COASTAL CITIES AT RISK IN THE PHILIPPINES
Investing in Climate and Disaster Resilience

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CREST

City Resilience Toolkit:

A Compendium of Systems Thinking Activities for Resilience Planning

Pilot Version

Imprint

City Resilience Toolkit (CResT):
A Compendium of Activities for Resilience Planning
Pilot Version

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Contents

Introduction

What is systems thinking?

A system comprises components or parts that relate to each other in specific ways to achieve a goal, perform a function or fulfill a purpose or goal. For example, machinery parts in a junkyard are just a "bunch of stuff"; but, if you have specific parts – e.g. a compressor, evaporator coil, fan – that assemble in certain ways to function as a thermal regulating unit, then you have an air conditioning system. In the case of a city as a system, we can think of how the different people and resources (components), connect and interact with each other (relationships) in order to develop the city and promote a certain quality of life (goal).

Identifying these three aspects of a system is important for resilience planning. We need to articulate what we are planning for (the purpose/goal), who or what will be involved in the planning (stakeholders, infrastructures, etc. - the components), and what their roles and interactions are (relationships).

The practice of systems thinking therefore involves careful delineation and reflection on systems and their boundaries, and how the specific structure of these systems leads to trends or behaviors over time. It is "big picture" thinking, which considers feedbacks and interconnections arising from the parts of the system, and which recognizes that rarely are these relationships and causalities purely linear in nature. For example , during the Covid-19 pandemic, we witnessed how the virus was not only a health system issue. Decisions on community quarantines and how to implement them required coordination with transportation/mobility systems and cooperation of the private sector. The lockdowns had far-reaching impacts on the socio-economic and governance systems. The prolonged lockdown took an economic toll, which contributed to the push for quarantine restrictions to relax and some businesses to re-open. Without adequate health system structures in place (e.g. contact tracing), opening up led to resurgence of cases. This is an example of a feedback. In another example, poverty often leads to families settling in hazardous areas and in sub-standard housing. When hazards hit, they suffer damages and losses that push them even further into poverty. This downward spiral is also an example of feedback. Systems thinking involves recognizing when and how these feedbacks occur, so we can mitigate adverse ones and take advantage of beneficial ones when implementing plans and projects.

Systems Thinking is also "deep thinking" that considers the underlying worldviews that determine how structures are formed, which in turn, drive patterns of behaviors and events. By doing so, systems thinking encourages the development of proactive solutions that address root causes rather than initiatives that simply react to symptoms. For example, consider a low-lying city that is often flooded. Every rainy season, families evacuate several times over a few months. This is a pattern. Why is this happening? Do the plans and funding for dealing with flooding favor disaster response and relief initiatives over prevention and mitigation? Are there deeper

cultural aspects, such as a belief that evacuation is a "way of life" that people have grown accustomed to, and that is "just how things are; nobody dies from flooding anyway"? A systems thinking approach to promoting resilience will attempt to uncover these layers.

To learn more, a good primer on systems thinking can be found here:

> "Systems Thinking: What, Why, When, Where, and How?" by Michael Goodman (The Systems Thinker Website, 2018), https://thesystemsthinker.com/systems-thinking-what-why-when-where-and-how/

Systems thinking is not one skill but a set of skills. Richmond (2018) summarizes key skills as the following:

1. "10,000-meter" thinking – seeing the big picture
2. system-as-cause thinking – discerning the properties of the system that drive is behavior
3. dynamic thinking – discerning patterns, e.g. behaviors and trends in time
4. operational thinking – learning and "speaking" the language of stocks and flows
5. closed-loop thinking – recognizing feedbacks (vs. one-way thinking)
6. scientific thinking – applying rigorous simulation practices in studying systems
7. empathic thinking – listening and sharing, e.g. perspectives and mental models
8. generic thinking – discerning common or "generic" structures across different systems

Read more on the eight skills in this primer:

> "The Thinking in Systems Thinking: Eight Critical Skills" by Barry Richmond (The Systems Thinker Website, 2018), https://thesystemsthinker.com/%EF%BB%BFthe-thinking-in-systems-thinking-eight-critical-skills/

The Waters Foundation has another version synthesizing systems thinking skills into these "Habits of a Systems Thinker:"

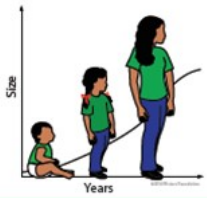
> Image next page is from the Second Edition ©2014, 2010 Systems Thinking in Schools by Waters Foundation (www.watersfoundation.org)

Likewise, systems thinking can be applied using a spectrum of tools, from activities that help clarify conceptual models (i.e. underlying perspectives and paradigms of systems) and promote discussion among stakeholders, to more quantitative system dynamics modeling activities. A summary of the spectrum of systems thinking tools can be found here:

> A Palette of Systems Thinking Tools by Daniel Kim (The Systems Thinker Website, 2018)
> https://thesystemsthinker.com/a-palette-of-systems-thinking-tools/

Seeks to understand the big picture

Observes how elements within systems change over time, generating patterns and trends

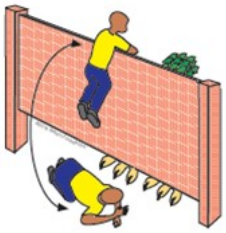


Recognizes that a system's structure generates its behavior

Identifies the circular nature of complex cause and effect relationships

Makes meaningful connections within and between systems

Changes perspectives to increase understanding



Surfaces and tests assumptions

Habits of a Systems Thinker

Considers an issue fully and resists the urge to come to a quick conclusion

Considers how mental models affect current reality and the future

Uses understanding of system structure to identify possible leverage actions

Considers short-term, long-term and unintended consequences of actions

Pays attention to accumulations and their rates of change

Recognizes the impact of time delays when exploring cause and effect relationships

Checks results and changes actions if needed: "successive approximation"

Second Edition ©2014, 2010 Systems Thinking in Schools, Waters Foundation, www.watersfoundation.org

How is systems thinking embodied in this book for resilience planning?

Resilience of systems can be defined as the ability of the system to "persist and survive amidst a variable environment (Meadows 2008, p. 76)." In the context of cities, we can interpret resilience to refer to the ability of the city to adjust, sustain or even improve on operations that promote quality of life for its stakeholders amidst disturbances or hazards. Resilience does not necessarily mean that the city is able to "bounce back" to some pre-hazard state, particularly if that baseline state was sub-optimal to begin with. Rather, it means that the city is able to adapt to changing conditions in order to function optimally.

Changing conditions can come in the form of slow or gradual pressures (e.g. growing populations and demands for resources due to urbanization; sea-level rise due to climate change), or in the form of discrete natural, socio-natural and human-induced hazards (e.g. typhoons and flooding events; earthquakes; biological hazards). Though we often associate the occurrence of "disasters" with the discrete and/or extreme events, both categories of hazards can actually trigger a disaster if exposed people and assets are vulnerable and resilience is lacking. Disasters are defined by the United Nations Office for Disaster Risk Reduction (UNDRR; formerly the United Nations International Strategy for Disaster Reduction) defined "disaster" as:

> *"A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts (UNDRR 2020)."*

The function of a system is one of its core components; and so, the loss of that functionality in a sense implies that the system is not able to "persist and survive." The ability of the system to persist depends greatly on its ability to anticipate possible future scenarios and integrate feedback structures that would allow it to adjust as needed. Thus, actions to develop resilience can and should be proactive as well as reactive. Such proactive transformation requires careful and deliberate planning.

The activities in this book were developed from systems thinking frameworks or adapted/enhanced from existing activities to better suit the purpose of applying systems thinking frameworks to resilience planning in three phases: Problem Diagnosis, Stakeholder Engagement, and Action Planning.

Problem diagnosis

The Problem Diagnosis section employs the "iceberg framework" for a deeper understanding of issues (Kim, 2000). This involves going beyond individual events into discerning patterns, the underlying structures that perpetuate them, and the

foundational paradigms or "mental models" on which these structures are built (Senge, 1990). A systems approach involves identifying the root of the problem, not just its symptoms (Kim, 2000), so that more effective interventions can be planned and implemented. In the case of building city resilience, this means investigating the roots of inefficiencies and gaps in city operations that erode resilience. Some of the issues or problems experienced may actually not be separate problems to be dealt with by separate offices, but could be an interrelated network of issues to be addressed be offices in collaboration with each other. Thus, an exercise like issue mapping can help identify connections and leverage points where efforts and resources can be concentrated to produce maximum effect. A variety of issues and systems exist, but there are actually common structures. Learning about these archetypal structures and discerning where they may prevail can help facilitate problem diagnosis and identification of interventions.

Stakeholder Engagement

Dialogue and discussion are important in resilience planning because, as the Myopia Principle states, no one person can see the entire system and its complexity (Cabrera and Cabrera, 2019). Collaboration is needed to see the bigger picture (Senge, 1990), and certain protocols such as Collaborative Conceptual Modeling (CCM) (Newell and Proust, 2012) can be adapted from systems thinking exercises towards resilience planning. Meaningful stakeholder engagement is easier said than done, however, since stakeholders may have different and even conflicting perspectives or "mental models" about the issues at hand. Thus, it would be helpful to map stakeholders'/ institutions' relationships to each other as components of the system (United Nations Evaluation Group, 2017; Department of Interior and Local Government, 2015), take time to share perspectives and needs, and learn to constructively "negotiate" towards a shared mental model.

Action Planning

The purpose or goal of a system is an important component, and in the case of cities or organizations, it would be crucial to articulate this desired goal through vision-setting (Senge, 1990). Ideally, this vision, shared among the stakeholders, will serve as the foundational mental model upon which system structures will be built. The implementation of these interventions will take time, however, especially in the case of building city resilience. Actions will need to be plotted in terms of short-term and long-term pathways with clear indicators for measuring and evaluating impacts and trends dynamically. Mapping interconnections of system components and feedbacks to identify leverage points can help transition towards desired state (Senge, 1990).

Why should we use this book?

There are many existing guidebooks for planning – why use this one?

This book is intended as a resource for those who are looking for ways to get started with incorporating systems thinking into planning for resilience. (This is *not* to say that other guidebooks *don't* use systems thinking – some of them probably do, though maybe not explicitly stated!) This compendium is a means of bringing systems thinking to the fore, by giving examples of what sorts of activities can inject planning with systems thinking, so that you can also learn to recognize systems thinking principles in other planning tools and highlight them in a more deliberate way. Thus, the practicability of this compendium is in its (1) explicit linking of system thinking to the resilience issues and challenges we need to be planning for and acting on; (2) its flexible format which can be adapted for different contexts.

If you have further interest in systems planning activities and "games" that can be incorporated into different workshops / training sessions / capacity-building programs, excellent resources to draw from include:

> Sweeney, L. B., & Meadows, D. (2010). *The systems thinking playbook: Exercises to stretch and build learning and systems thinking capabilities*. Chelsea Green Publishing.
>
> Meadows, D., Sweeney, L. B., & Mehers, G. M. (2016). *The climate change playbook: 22 systems thinking games for more effective communication about climate change*. Chelsea Green Publishing.

What this book is NOT

This book is not intended as a replacement for any strategic planning processes your institution, organization or community is required or encouraged to use. While we have endeavored to develop the activities as clearly as possible, this book is not a manual on the basics of planning. It might thus benefit the facilitator/trainer to have the latter on hand to provide more guidelines and examples of how to write a vision statement, how to develop indicators, how to synthesize or process activities, etc.

While we have also given a brief introduction to the concept of resilience in the context of systems, this book is not intended as an introductory text on disaster resilience or disaster science. Disaster resilience is the main form of resilience addressed in the examples provided throughout the book, but we do not limit the potential applications of these activities to disasters. Many of these activities can also be used to tackle matters pertaining to organizational resilience, for example.

For those who are not yet familiar with disaster terminologies, the UNDRR provides a handy online glossary:

> United Nations Office for Disaster Risk Reduction: Terminology
> https://www.undrr.org/terminology

There are also several resources available to get started in disaster science, specifically, on the basics of the concepts of resilience, risk, hazard, exposure and vulnerability. Key documents include:

> IPCC. (2012) Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker,D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen,M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp. https://www.ipcc.ch/site/assets/uploads/2018/03/SREX_Full_Report-1.pdf
>
> United Nations Development Programme. Bureau for Crisis Prevention. (2004). Reducing Disaster Risk: A Challenge for Development-a Global Report. United Nations. https://www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/reducing-disaster-risk--a-challenge-for-development.html

Collections of publications (including the Sendai Framework for Disaster Risk Reduction 2015-2030, the Global Assessment Report on Disaster Risk Reduction 2019, and documents and tools for measuring resilience) can be found at:

> UNDRR Publications: https://www.undrr.org/publications
>
> PreventionWeb Collection on Measuring Resilience: https://www.preventionweb.net/collections/measureresilience

How do we use this book?

The activities in this compendium are written in a "train the trainers" style with instructions for setting up, implementing and debriefing each activity. Running examples – the management of flooding hazards at the local government level, and aspects of the COVID-19 pandemic – are also provided to illustrate potential responses.

While this toolkit was developed primarily with city resilience planning in mind, the activities are meant to be flexible in terms of the organization or community involved and their resilience issues and planning goals. Thus, the activities may be adapted according to users' needs, as long as the core systems thinking principles are observed. They are also designed to be relatively tractable to implement even by those who do not yet have comprehensive prior experience in systems thinking. While systems thinking is in itself a rigorous field of study and practice, there need not be a steep learning curve to start practicing some basic principles!

The only systems thinking tool employed in some (not all) activities here that requires prior study and practice on the part of the participants is that of developing Causal Loop Diagrams (see next section). The facilitator should be knowledgeable about archetypes if the "Scoping with System Archetypes" activity will be used.

Activity Sections

Each activity is broken down into the following sections:

- ***Challenges to be addressed***: Describes the planning concerns or challenges that the activity can help address or overcome using a systems perspective.
- ***Purpose of the activity***: Articulates the objectives or goals of the activity, what it hopes to achieve from a systems thinking standpoint.
- ***Resilience Link***: Explains how the specific systems thinking habit or skill used in the activity can help with integrating resilience into the planning process.
- ***Learning Outcomes***: Describes that the participants in the activity should be able to learn or do after performing the activity
- ***Setup***: Describes the people, space, time, materials and equipment needed for the activity
- ***Instructions***: Presents the activity step-by-step and with examples
- ***Debrief***: Suggests follow-up questions to review the activity, discuss and synthesize learnings and reflect on insights for the planning process. (Note: experiences will differ depending on the specific group of participants and the issues to which the activities are applied. The contents of the Debrief sections are a guide for post-processing rather than a prescribed script.)

Combining Activities

The activities in the compendium are not all intended to be implemented in sequence. Except for the "Developing Indicators" activity which should follow from "Vision-setting and Pathways planning," the workshop facilitators/designers can select those which are most relevant for their needs or context. For example, if the group needs to diagnose why certain interventions have failed to produce desired results, then problem diagnosis could begin with the Iceberg Activity to probe the underlying structures and perspectives that may be "foiling" their plans. If the participants are diverse and need to better visualize how they connect with each across a given concern, then Issue Mapping may be a place to start. The "Challenges Addressed" section of each activity could give workshop designers/facilitators an indication of whether that activity could be useful towards achieving the particular goals of their planning session.

A sample combination for a strategic planning workshop could:

- Start with the Iceberg Activity in combination with Behavior-Over-Time graphs to aid in trend/pattern recognition.
- Insert a short tutorial for participants to learn about causal loop diagramming and follow-up with Stakeholder Dialogue/Perspective Sharing to delve deeper into the structures and mental models across different stakeholders as discussed in the Iceberg Activity.

- Bring stakeholders together with Vision-Setting, Pathways Planning and Scenario-Building.

For a group that has had more experience with diagramming, the combination of activities could include:

- Issue Mapping that transitions into System Archetypes (i.e. do the diagrams and storylines generated in Issue Mapping align with any of the archetypes?).
- Stakeholder Dialogue/Perspective Sharing, Participatory Learning or Negotiating Terms of Agreement (choose one)
- Vision-Setting, Pathways Planning and Scenario-Building combined with Developing Indicators.

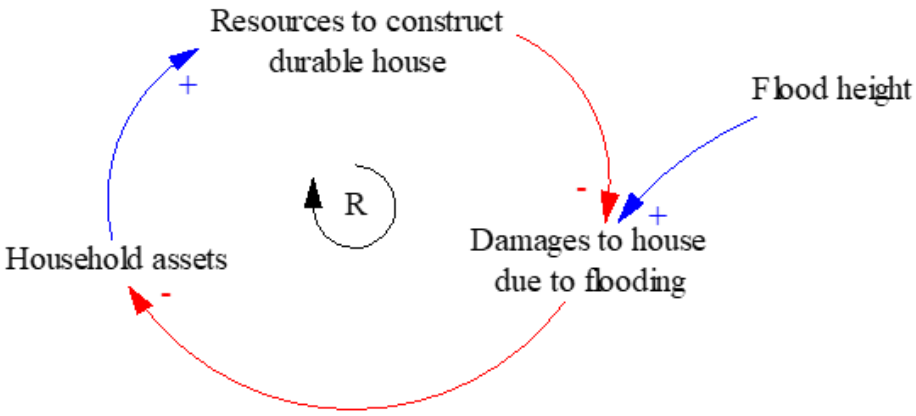
For a group with no experience in influence diagramming or causal loop diagramming, and not enough time to go through a tutorial, activities could include:

- Iceberg Activity in combination with Behavior-Over-Time graphs for the Patterns level and/or Double-Q Diagramming for the Structures level
- Participatory Learning
- Vision-Setting, Pathways Planning and Scenario-Building combined with Developing Indicators.

For a group that is relatively homogenous (i.e. all from the same organization or sector with similar perspectives), the Network Mapping activity would be useful to identify other groups who should perhaps be brought to the table to share their perspectives.

How do we construct causal loop diagrams?

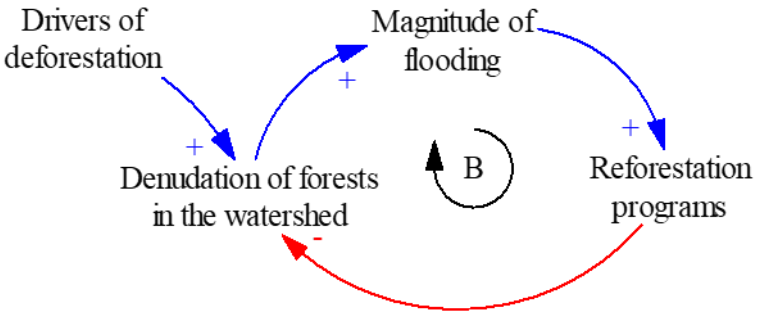
Causal loop diagrams are a visual means of representing our understanding of causal relationships . Here is an example:



An arrow that links one variable to another means that the first variable leads to or causes the second. The "+" sign on the arrow indicates that the variables vary in the same direction – either an increase in the first variables leads to an increase in the

second, or a decrease in the first leads to a decrease in the second. For example, having more assets means having resources to build a durable house; however, in the case of poverty (low asset base), the household may not have enough resources for adequate housing. When variables "move" in the same direction, this is called a positive link. When there are more resources for housing, then that reduces the damages due to flooding (assuming that those resources were channeled towards housing construction and flood preparation). This is a negative link denoted by the "-" sign. The sign indicates that the variables move in the opposite direction. Note that the terms "positive" and "negative" in this case are not value judgements; they merely indicate the direction of change between two variables (same or opposite, respectively).

The "R" in the center indicates that the loop, overall, tells the story of a reinforcing feedback. This means that the events in the loop act towards amplifying the original stimulus or exacerbating the original condition. In this case, poverty (i.e. the lack of household assets) is exacerbated. Another type of overall feedback is the balancing loop. In this case, the events in the loop act so as to counter the original stimulus. For example:

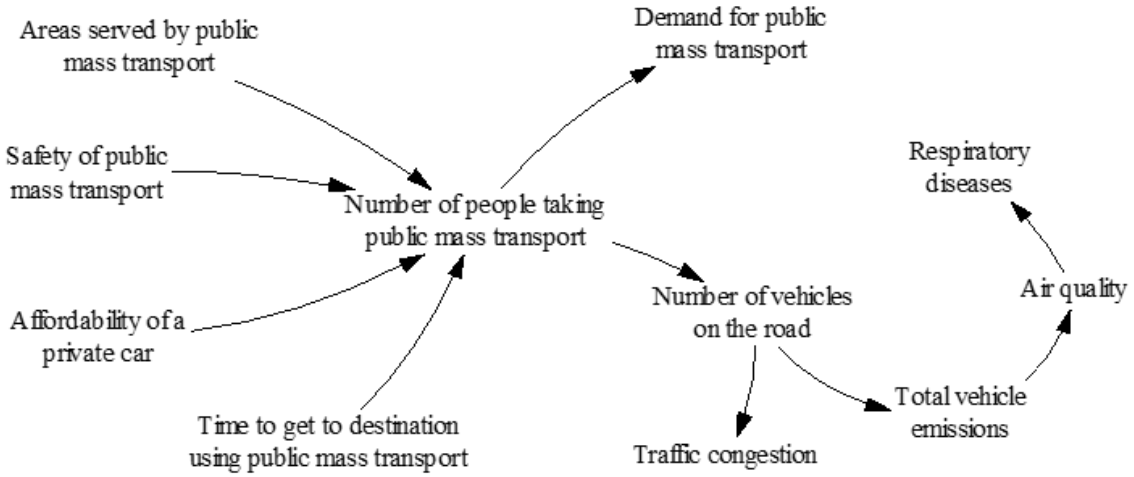


In this example, denudation of forests leads to more flooding in the low-lying areas of the watershed. Assuming that people are able to identify deforestation as a contributor, they embark on reforestation initiatives which reduce the denudation and hence reduce the amount of flooding – this is the counter-balancing effect. Eventually, the need for reforestation programs may ease; however, if the original drivers of deforestation were not addressed, then it may be possible for denudation to recur.

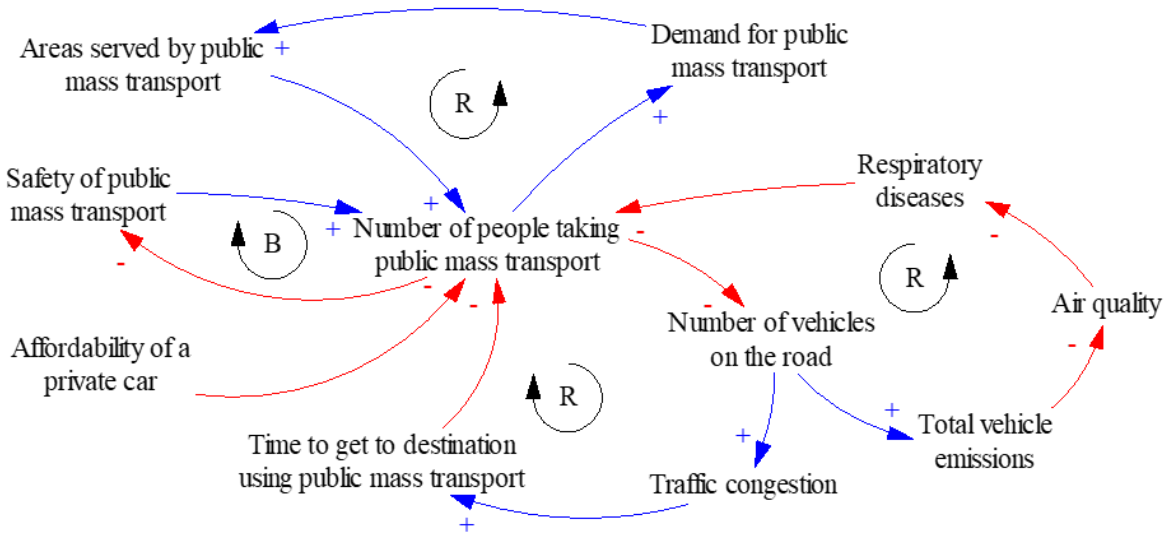
Such diagrams can be used as tools to illustrate our understanding or perception of the interconnections in a system. One can start by defining a focus variable: What is it that we are interested to investigate? Identify "drivers" of the focus variables. These are the factors that lead to or cause the focus variable. Then identify "impacts". These are the things that happen because of the focus variable. Then discern: Are there things on the "impacts" side that actually lead back to the "drivers" side? If so, then you can close the loop!

Let us take this example of the everyday experience of commuting. What makes people decide to use public mass transportation? The "number of people using public mass transport" is the focus variable here. Brainstorming on the causes or drivers may lead to several reasons – whether the area is served by public transport options, the time it will take to arrive at the destination using public transport

options, and the safety of these options, vs. the affordability or convenience of using a private car. The number of people using public mass transport will influence the demand for more public transportation infrastructure as well as the number of private cars of the road. The latter will further affect traffic congestion, and vehicle emissions and air quality.



Are there factors on the right-hand side that might feed back to the left-hand side? For one, the demand for mass transport might lead to an increase in the areas served. The traffic will affect the time it takes to reach one's destination. Air quality will have implications on respiratory diseases, which will influence whether a person is fit enough to commute by public transport. One might also argue that the sheer volume of people taking mass transport might lead to the system becoming crowded and over-burdened, and hence, unsafe. Unless these issues are addressed, then people who have options for private vehicle use may be discouraged from taking public mass transportation. So, in this simple example, we have constructed multiple feedback loops. Just add the polarities (+/-) to the individual arrows and identify whether the effect of the loop overall is balancing or reinforcing.



Note that the above is not the only diagram one can construct with "number of people taking public mass transport" as a focus variable – there can be many variations. Having people to dialogue with usually results in more ideas. Thus, there is

no one “right answer”; however, there are guidelines to making good causal loop diagrams. A general tip is to name variables in a way that it becomes clear what it means for that variable to increase or decrease. However, do not put “increase” or “decrease” in the variable name. For example, “amount of rice eaten” would be a good variable name, but “diet” would be unclear. What does it mean for “diet” to increase or decrease? Similarly, “flood height” or “flood duration” would be good variables, but not “flood status”. “Soft” variables can be used – for example, we can understand what is means for “happiness” or “trust” or “stress” to increase or decrease. In constructing your diagrams, add as many variables as needed to make the logic of your thinking clear, but try not to put too much in that the diagram becomes difficult to read.

There are many tutorials on this available online, some of which include:

Videos

- **How to construct causal loop diagrams:**
  Introduction to Causal Diagrams by the Climate Leader via the Climate Interactive YouTube channel, https://youtu.be/UgZTXf5PDis
- **Introduction to reinforcing loops:**
  Introduction to Reinforcing Feedback by the Climate Leader via the Climate Interactive channel, https://youtu.be/y-WAEW06J00
- **Introduction to balancing loops:**
  Balancing Loops by the Climate Leader via the Climate Interactive channel, https://youtu.be/vmcunCwX6Fc

Articles

- **Basics of constructing CLDs (e.g. drawing links among variables and labeling loops):**
  "Causal Loop Construction: The Basics" by Colleen Lannon (The Systems Thinker website, 2018), https://thesystemsthinker.com/causal-loop-construction-the-basics/
- **Guidelines on making CLDs (e.g. naming variables, determining balancing and reinforcing loops, etc):**
  "Guidelines for Drawing Causal Loop Diagrams" by Daniel Kim (The Systems Thinker website, 2018), https://thesystemsthinker.com/guidelines-for-drawing-causal-loop-diagrams-2/

Software for constructing causal loop diagrams

- Vensim PLE Free Download: https://vensim.com/free-download/
  Please open the link, click "Download Software", and install after download is completed.

- This video provides a tutorial for how to create causal loop diagrams using Vensim: https://vensim.com/vensim-causal-loop-diagramming/

Alternative to CLD

A simpler alternative to the CLD is an **influence diagram**. Like the CLD, it is intended to visually represent causal relationships (i.e. A-->B indicates that A results in B) but without adding the polarities (+/-) to the individual arrows.

Where can we find more resources?

Below are more resources you could use to learn more about systems thinking:

- The Systems Thinking Playbook by Linda Sweeney and Dennis Meadows (Chelsea Green Publishing, 2010) – contains exercises on systems thinking
- The Systems Thinker website (https://thesystemsthinker.com/) – repository of the concepts, skills, and tools in systems thinking
- System Dynamics Society (via the Facebook page https://www.facebook.com/systemdynamics/)

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CONTACT US

We would love to hear about your experiences in implementing these activities! We welcome any comments and feedback to enhance and add to the activities in this compendium so it can improve and grow over time!

Please send your stories and suggestions to:

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PROBLEM DIAGNOSIS

This section contains activities that will help you and your team identify issues and problems using systems thinking tools like the Iceberg Model, Issue Mapping, and System Archetypes.

The Iceberg Activity

CHALLENGES TO BE ADDRESSED

Creating solutions is difficult if there is inadequate understanding of the problem. Solutions that do not address root causes or that tackle only particular parts of its system could lead to ineffective actions. These actions might only temporarily resolve issues, or, worse, aggravate the situation in the long run. In order to prevent symptoms of the problem from continuously manifesting, a proper diagnosis of the issue and its concurrent system must take place in order to ensure that all important facets of the problem are taken into consideration.

PURPOSE OF THE ACTIVITY

The rationale of the activity is to provide a framework for understanding different situations from a systems-oriented perspective. The activity aims to provide an examination of issues or problems by targeting the root causes – examine patterns and trends; identify the norms rules, and structures that influence the issues in a system; and tease out the assumptions, beliefs, and values about the system. Through the activity, the participants would be able to identify increased leverage for intervening an issue. While the activity on its own is not sufficient to encompass all the facets of systems thinking, it provides a good foundation for analyzing a system.

The Resilience Link

When faced with various issues relating to resilience such as disasters (as a confluence of natural and human-induced hazards, exposure and vulnerability), it can be difficult to identify necessary points of intervention that would address the situations. Reacting to only short-term effects of events would not take into consideration structures that perpetuate these vulnerabilities within communities. The systems approach encourages "deep thinking" – it allows for the identification of these deeper structures so that more long-term and holistic solutions can be implemented.

SET UP

WHO

This activity requires no specific type of participant.

NUMBER OF PEOPLE

A small number of people, typically 3-5. If there are more than 5 people, the participants can divide themselves into groups of 3-5 members.

SPACE

There should be enough space for participants to sit, group together and discuss, comfortably.

TIME

This activity could take 1-2 hours depending on your discussion: 1 hour for the activity proper, and 30min to 1 hour for discussion and debriefing.

MATERIALS & EQUIPMENT

- A whiteboard, blackboard or manila paper
- Markers (whiteboard marker if using whiteboard or chalk if blackboard)
- Scotch tape/masking tape
- Alternatively: Or laptops with software with tables/ spreadsheets, and LCD projectors

LEARNING OUTCOMES

- Explain the concepts of the iceberg model (Kim,2000) and relate it to its corresponding action modes and time orientations.
- Identify the various levels of analysis to understand a resilience issue more deeply.
- Apply the levels of analysis in their specific contexts in order to better assess the situation.

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Start by having all the participants agree on a certain situation/ issue related to resilience that they have experienced (E.g. Flooding, Earthquakes, Tropical Cyclones etc.). Afterwards, decide on the point of view you would want to represent (E.g. Citizen, Barangay Office, Government Officials etc.). This point of view can be that of the sector or group represented by the participants, or they may opt to include other perspectives.

    - If there are multiple groups/stakeholders represented among the participants, it would be good to have multiple perspectives.

3. Ask the group to draw on a piece of a paper/whiteboard a table with four columns and following labels:

Level of Analysis	Description	Actions Done	Ideal Scenario

    - The table visualization can be subject to change depending on participants.
    - Alternatively, the table can be prepared on a laptop using a word processing or spreadsheet software, and projected for all participants to view.

4. Ask the participants to describe what happened during the most recent instance of that issue. For example, if the issue being analyzed is that of flooding, then they can refer to a recent or salient flooding event. Have them write down their answers on the first row in the second column of the table. Once accomplished say: "This is described as an 'event', it is the problem that is observed and experienced by people directly." Write down this 'Event' on the first column beside it.

Example 1A – Flooding

Flooding example during LGU planning and evaluation:

Potential question prompts include:

- *What happened during Typhoon X?*
- *Was there massive flooding?*
- *What were the impacts of this flooding? Were there cascading impacts on health, security, etc.?*

1 Level of Analysis	2 Description	Actions Done	Ideal Scenario
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*		

5. Ask the participants what actions were done in relation to the "event" in order to address it. Have them write down their answers on the first row in the third column of the table. Once accomplished say: "These were the 'actions' done for the experienced 'event'."
    - If the participants represent a mix of stakeholders, it might be particularly useful to also ask them to identify WHO did which actions and include this in the "Actions Done" column.

Example 1A – Flooding

Flooding Example during LGU planning and evaluation:
Potential question prompts include:

- *What actions were implemented by the LGU before the typhoon came, when the rainfall warning was received from PAGASA?*
- *What actions were implemented by the LGU during the flooding event?*
- *What actions were implemented by the LGU after the flooding event?*

Level of Analysis	*Description*	3 *Actions Done*	*Ideal Scenario*
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*	*BEFORE:* • *Families in the flood plain were evacuated (but many did not want to leave their houses)* • *LGU stocked up on rubber boats and rescue equipment, leptospirosis meds, relief goods* *DURING:* • *Boats were used by barangay officials to rescue civilians.* • *Regular situation reports were released by the LGU* *AFTER:* • *Relief packs were distributed for 2 weeks following the flooding; but some families could not be reached due to unpassable roads* • *Cash for work program was implemented for clean-up operations*	

6. Given the actions done, ask participants to reflect on what would have been the ideal scenario. Have them write down their answer on the first row in the fourth column of the table.
    - Additional guide questions include: Was there a gap between the ideal and the actual circumstances and actions? Would certain actions have been taken or done differently had circumstances been ideal?
    - If the participants represent a mix of stakeholders, it might be

Example 1A – Flooding

Flooding Example during LGU planning and evaluation:
Potential question prompts include:

- *Which actions were effective in mitigating the damages due to flooding?*
- *What could have been done better, whether before, during or after the flooding? Were there "less-than-ideal" circumstances that hampered proper actions from being implemented?*
- *Were there adverse flooding impacts that were avoidable had other actions been taken, or had the situation been ideal?*
- *Who would have been responsible for the ideal actions or the ideal scenario?*

Level of Analysis	Description	Actions Done	4 Ideal Scenario
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*	*BEFORE:* • *Families in the flood plain were evacuated (but many did not want to leave their houses)* • *LGU stocked up on rubber boats and rescue equipment, leptospirosis meds, relief goods* *DURING:* • *Boats were used by barangay officials to rescue civilians.* • *Regular situation reports were released by the LGU* *AFTER:* • *Relief packs were distributed for 2 weeks following the flooding; but some families could not be reached due to unpassable roads* • *Cash for work program was implemented for clean-up operations*	*BEFORE:* *The evacuation was done well enough beforehand; but in the first place, there shouldn't be so many families in the hazardous area needing to be evacuated* *DURING:* *Regular situation reports were useful; stockpile of boats were utilized; there were enough trained first responders* *AFTER:* *Lack of alternate transport routes hampered relief operations; Needed better mobility planning and supply chain management, including better placement of storehouses;* *Cash for work helped families in the short-term but could not be sustained*

particularly useful to also ask them to identify WHO should have implemented any ideal actions identified and include this in the "Ideal Scenario" column.

7. Ask the following questions: "How often does the 'event' occur? Is it getting better or worse? What is the pattern?" Write down your answers on the second row in the second column of the table. Once accomplished say: "This is described as a 'pattern or trend', it is what is observed when problems are recurring." Write this down 'Pattern or Trend' on the first column beside it.
    - You can also ask them to create Behavior Over Time Graphs (See Other Scoping Tools, page 57) at this point in order to check if the pattern is based on perception or if it actually exists. If there is a difference, this can be further processed during the discussion.

Example 1A – Flooding

Flooding Example during LGU planning and evaluation:
Potential question prompts include:

- *Does flooding happen often in this area?*
- *If so, are the same impacts experienced every flooding event? Are the casualties and damages due to flooding increasing over time, with every event? Or are they decreasing?*
- *How has the LGU responded to the pattern of flooding?*

** Highlighted in blue are the input examples.*

Level of Analysis	*Description*	*Actions Done*	*Ideal Scenario*
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*	*BEFORE:* • *Families in the flood plain were evacuated (but many did not want to leave their houses)* • *LGU stocked up on rubber boats and rescue equipment, leptospirosis meds, relief goods* *DURING:* • *Boats were used by barangay officials to rescue civilians.* • *Regular situation reports were released by the LGU* *AFTER:* • *Relief packs were distributed for 2 weeks following the flooding; but some families could not be reached due to unpassable roads* • *Cash for work program was implemented for clean-up operations*	*BEFORE:* *The evacuation was done well enough beforehand; but in the first place, there shouldn't be so many families in the hazardous area needing to be evacuated* *DURING:* *Regular sit reps were useful; stockpile of boats were utilized; there were enough trained first responders* *AFTER:* *Lack of alternate transport routes hampered relief operations; Needed better mobility planning and supply chain management, including better placement of storehouses; Cash for work helped families in the short-term but could not be sustained*

Pattern/ Trend: Repeated flooding events in the city 5	*The city experiences repeated flooding events, mostly small-medium scale floods with 1-2 severe flooding events every rainy season for the past 10 years.* 6 *There is an increasing number of families settling in the flood plain, near the river and in other hazardous areas as the population density of the city increases.*	*The city has invested in flood pumps and emergency response measures but still hasn't reached zero casualty.* 7 *The city is spending more for relief and recovery operations every year.*	

8. Ask them to fill out the corresponding 'actions done' and 'ideal scenario' for 'Patterns or Trends' row.

Example 1A – Flooding

Flooding Example during LGU planning and evaluation:
Potential question prompts include:

- *What actions have proved to be effective as they are implemented from one event to the next? What has not been effective?*
- *Are there gaps in the LGU response to these trends?*
- *How can we be more strategic with our resources?*

Level of Analysis	Description	Actions Done	Ideal Scenario
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*	*BEFORE:* • *Families in the flood plain were evacuated (but many did not want to leave their houses)* • *LGU stocked up on rubber boats and rescue equipment, leptospirosis meds, relief goods* *DURING:* • *Boats were used by barangay officials to rescue civilians.* • *Regular situation reports were released by the LGU* *AFTER:* • *Relief packs were distributed for 2 weeks following the flooding; but some families could not be reached due to unpassable roads* • *Cash for work program was implemented for clean-up operations*	*BEFORE:* *The evacuation was done well enough beforehand; but in the first place, there shouldn't be so many families in the hazardous area needing to be evacuated, and houses should follow the building codes.* *DURING:* *Regular situation reports were useful; stockpile of boats were utilized; there were enough trained first responders* *AFTER:* *Lack of alternate transport routes hampered relief operations; Needed better mobility planning and supply chain management, including better placement of storehouses;* *Cash for work helped families in the short-term but could not be sustained*

Pattern/Trend: Repeated flooding events in the city	*The city experiences repeated flooding events, mostly small-medium scale floods with 1-2 severe flooding events every rainy season for the past 10 years.* *There is an increasing number of families settling in the flood plain, near the river and in other hazardous areas as the population density of the city increases.*	*The city has invested in flood pumps and emergency response measures but still hasn't reached zero casualty.* *The city is spending more for relief and recovery operations every year.*	*The emergency response training has helped streamline operations; however, the city needs to regulate the exposure of vulnerable people to flooding, i.e. the families in hazardous areas. The fewer families affected, the less the need for relief measures. This will require more prevention and mitigation strategies that will either reduce exposure (areas that flood should be no-build or restricted building zones) or vulnerability if people cannot be relocated (consider different housing design; review soft and hard infrastructure).* 8

9. Ask the following questions: "What are the structures that perpetuate these patterns? Why does this pattern or trend occur?" Write down your answer on the third row in the second column of the table. Once accomplished say: "This is described as an 'underlying structure', it is the structure that influences the patterns observed." Write down 'Underlying Structure' on the first column beside it.
    - It is important to point out here that the structure need not be physical institutions and can also be mental structures or behaviors.
    - At this point you can conduct a Double-Q (QQ) Diagramming Activity (See Other Scoping Tools, p. 57) in order better guide participants in the processing of going from one level of understanding to the next.

10. Ask them to fill out the corresponding 'actions done' and 'ideal scenario' for 'Underlying Structure' row.

Example 1A – Flooding

Flooding Example during LGU planning and evaluation:

Potential question prompts include:

- *Are these the typical strategies for addressing floods? Are there novel or innovative strategies?*
- *Why were these actions selected in response to the flooding trends? Are there policies or mechanisms or even budgetary considerations that facilitate (or hinder) certain approaches over others? (Underlying Structures)*
- *What has been done at a higher level to address repeated patterns of flooding? Have existing laws, policies, organizations/agencies, processes, or other structures been adjusted? If so, how? If not, why not?*

Level of Analysis	Description	Actions Done	Ideal Scenario
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*	*BEFORE:* • *Families in the flood plain were evacuated (but many did not want to leave their houses)* • *LGU stocked up on rubber boats and rescue equipment, leptospirosis meds, relief goods* *DURING:* • *Boats were used by barangay officials to rescue civilians.* • *Regular situation reports were released by the LGU* *AFTER:* • *Relief packs were distributed for 2 weeks following the flooding; but some families could not be reached due to unpassable roads* • *Cash for work program was implemented for clean-up operations*	*BEFORE:* *The evacuation was done well enough beforehand; but in the first place, there shouldn't be so many families in the hazardous area needing to be evacuated* *DURING:* *Regular situation reports were useful; stockpile of boats were utilized; there were enough trained first responders* *AFTER:* *Lack of alternate transport routes hampered relief operations; Needed better mobility planning and supply chain management, including better placement of storehouses;* *Cash for work helped families in the short-term but could not be sustained*
Pattern/Trend: Repeated flooding events in the city	*The city experiences repeated flooding events, mostly small-medium scale floods with 1-2 severe flooding events every rainy season for the past 10 years.* *There is an increasing number of families settling in the flood plain, near the river and in other hazardous areas as the population density of the city increases.*	*The city has invested in flood pumps and emergency response measures but still hasn't reached zero casualty* *The city is spending more for relief and recovery operations every year.*	*The emergency response training has helped streamline operations; however, the city needs to regulate the exposure of vulnerable people to flooding, i.e. the families in hazardous areas. The fewer families affected, the less the need for relief measures. This will require more prevention and mitigation strategies that will either reduce exposure (areas that flood should be no-build or restricted building zones) or vulnerability if people cannot be relocated (consider different housing design; review soft and hard infrastructure).*

Underlying Structures: Rationale behind flooding response 9	*Most actions taken fall under disaster preparedness measures (e.g. rescue drills, stockpiling) and emergency response/relief measures. These were the actions highlighted in PD 1566 which was in effect prior to RA10121.* 10 *The new law allows for not less than 5% of local government revenue to be used for DRRM expenses; but it is not clear sometimes what can be justified as DRRM expenditure. Purchase of equipment like boats and hard structural measure like flood pumps and dikes are clear, but what about urban planning initiatives like relocating people outside of hazardous areas?*	*RA10121 was enacted in 2010 and it expanded the spectrum of DRRM.* 11	*RA10121 is seen as a good approach but the spectrum of DRRM needs to be better implemented on the ground.* 12 *Allowable expenditures also need to be clarified.*

11. Ask the following question: "What assumptions, beliefs or values keeps this structure in its place? Why is the structure here?" Write down your answer on the fourth row in the second column of the table. Once accomplished say: "This is described as a 'mental model' or 'paradigm', it is the assumption or set of values that generates a structure and keeps it in place." Write down 'Mental Model' on the first column beside it.
    - Note that the use of "model" here does not refer to a mathematical or computer-based model; rather, it refers to our way of "seeing the world", our way of interpreting the societal system that also dictates how we act within it.
    - The description of the prevailing mental model is already what is currently in practice so participants may skip the "actions done" column. However, it might still be helpful to fill up the "ideal scenario" column to describe how we think we should adjust perspectives, if a paradigm shift is deemed necessary.
    - At this point, the entire table should be filled out completely.

Example 1A – Flooding

Flooding Example during LGU planning and evaluation:
Potential question prompts include:

- *Why have our policies and institutions been approaching flooding disasters in this way?*
- *Is there a cultural aspect (beliefs, way of life, perceptions) to how we see flooding events that affects how we manage them?*
- *How do we understand disasters, and what makes a disaster? Could this be influencing how we manage flooding events?*

Level of Analysis	Description	Actions Done	Ideal Scenario
Event: Flooding triggered by Typhoon X	*Typhoon X brought massive flooding to the city* • *100 casualties* • *8000 families were affected; evacuation centers set up in schools were overcrowded.* • *Infrastructure damage is estimated at Php200M* • *Houses in the flood plain were either completely destroyed or severely damaged leaving many families homeless* • *Insufficient supply of potable water* • *Leptospirosis and acute gastro-enteritis cases spiked; these, together with injuries, overwhelmed the barangay health centers*	*BEFORE:* • *Families in the flood plain were evacuated (but many did not want to leave their houses)* • *LGU stocked up on rubber boats and rescue equipment, leptospirosis meds, relief goods* *DURING:* • *Boats were used by barangay officials to rescue civilians.* • *Regular situation reports were released by the LGU* *AFTER:* • *Relief packs were distributed for 2 weeks following the flooding; but some families could not be reached due to unpassable roads* • *Cash for work program was implemented for clean-up operations*	*BEFORE:* *The evacuation was done well enough beforehand; but in the first place, there shouldn't be so many families in the hazardous area needing to be evacuated* *DURING:* *Regular situation reports were useful; stockpile of boats were utilized; there were enough trained first responders* *AFTER:* *Lack of alternate transport routes hampered relief operations; Needed better mobility planning and supply chain management, including better placement of storehouses;* *Cash for work helped families in the short-term but could not be sustained*
Pattern/Trend: Repeated flooding events in the city	*The city experiences repeated flooding events, mostly small-medium scale floods with 1-2 severe flooding events every rainy season for the past 10 years.* *There is an increasing number of families settling in the flood plain, near the river and in other hazardous areas as the population density of the city increases.*	*The city has invested in flood pumps and emergency response measures but still hasn't reached zero casualty* *The city is spending more for relief and recovery operations every year.*	*The emergency response training has helped streamline operations; however, the city needs to regulate the exposure of vulnerable people to flooding, i.e. the families in hazardous areas. The fewer families affected, the less the need for relief measures. This will require more prevention and mitigation strategies that will either reduce exposure (areas that flood should be no-build or restricted building zones) or vulnerability if people cannot be relocated (consider different housing design; review soft and hard infrastructure).*

Underlying Structures: Rationale behind flooding response	*Most actions taken fall under disaster preparedness measures (e.g. rescue drills, stockpiling) and emergency response/relief measures. These were the actions highlighted in PD 1566 which was in effect prior to RA10121.* *The new law allows for not less than 5% of local government revenue to be used for DRRM expenses; but it is not clear sometimes what can be justified as DRRM expenditure. Purchase of equipment like boats and hard structural measure like flood pumps and dikes are clear, but what about urban planning initiatives like relocating people outside of hazardous areas?*	*RA10121 was enacted in 2010 and it expanded the spectrum of DRRM.*	*RA10121 is seen as a good approach but the spectrum of DRRM needs to be better implemented on the ground.* *Allowable expenditures also need to be clarified.*
Mental model or paradigm: How we regard flooding in our culture 13	*Flooding is seen as a regular occurrence and is part of the Filipino way of life – people say that they are used to evacuating and accept that this happens. Some people say that "walang namamatay sa baha." We even like to affirm that the Filipino spirit is "waterproof".* 14 *Flooding is seen as a "natural disaster", meaning, caused by nature so we can't do much about it other then preparedness and response measures.*		*Flooding should be seen as a hazard (rather than a disaster), and as a socio-natural one (rather than a purely natural hazard one).* 15 *A flooding hazard becomes a disaster when vulnerable people and assets are exposed, and the impacts are beyond what the community can bear. It is socio-natural because while the occurrence of monsoonal rains and typhoons in our region might be natural, floods can be aggravated by urban issues (e.g. too much built-up area, lack of proper drainage, improper solid waste management that also leads to health issues, etc.)* *Thus, we can prevent flooding events from becoming disasters if we adopt more proactive means.*

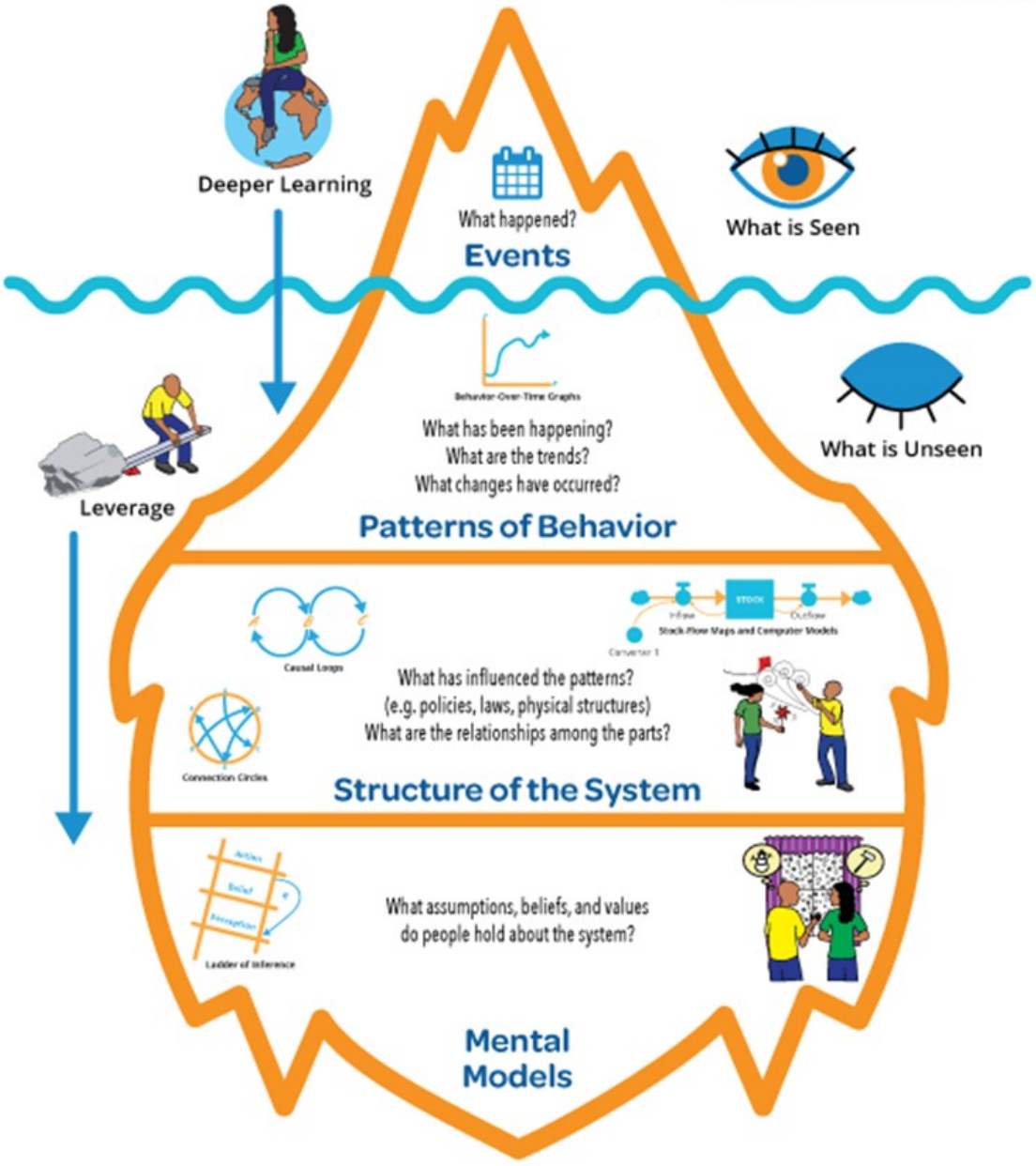
DEBRIEF

- Recap: During the activity, you were first asked to describe a single event, and from there, discern whether there are patterns or trends with events of the same nature. You then probed into deeper levels of understanding by identifying the structures that contribute to the observed patterns, and the underlying worldviews or perspectives supporting those structures. What was going through your mind while describing the different levels of understanding for your specific issue?
- Are there differences between the actions done and the 'ideal actions or scenario at each level? Why / why not? (Gap analysis)
- What would happen if only one level of understanding was acted upon? Say, only the initial 'event'? (Could that event happen again in the future, with the same impacts?)
- What do you notice about the actions that need to be done at each level of understanding? How and why do they differ at each level of understanding though they all address the same event?
- How would you compare the time horizon for the interventions at the level of discrete Events vs. Patterns vs. Underlying Structures vs. Mental Models/Paradigms? (i.e. longer planning horizons are required for interventions targeting the deeper levels)
- Is the current dominant mental model or shared vision the vision you would like to have for your organization or for yourself?
- Now that we have probed into the deeper levels of understanding, how do the insights generated help with problem diagnosis? How can these be useful for your specific position/ occupation?
- This activity is based on the Iceberg Framework. In this framework, deeper learning can be achieved by investigating the "unseen". More powerful and long-term points for intervention ("leverage points") can be found by articulating the structures and mental models that underpin patterns of behavior. The former are the "roots" of the issue while the latter are the "symptoms."

Waters Center
For Systems Thinking

SYSTEMS THINKING RESOURCES

Iceberg: Seeing What's Below the Surface



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ANOTHER EXAMPLE

Here is another example, with sample answers in the table, of how the Iceberg Activity can be used to dissect the COVID-19 pandemic. The objective is to analyze the protest actions that are taking place amidst the community quarantine. Note, however, that this is a sample answer – there are no "right" answers as participants may have different mental models underpinning their interpretation of the situation. The facilitator should be open to receiving potentially diverse answers and process how the inputs for the actions and ideals are influenced by the underlying assumptions and perspectives.

Example 1A - Pandemic

Potential question prompts:

Event:

- *Last April 1, Quezon City residents staged a protest amidst quarantine conditions and were arrested. What happened? Who were they and what were they demanding? What were the circumstances of their arrest?*

Patterns:

- *Have there been more similar incidents? Describe the persons involved, the issues raised and what happened. Were they arrested? If so, why?*

Underlying Structure:

- *Why have there been repeated instances of these protest actions, despite the lockdown conditions, the threat of arrest, and the risk of COVID-19 infection? What factors are driving these movements?*
- *Who holds the power in developing and implementing solutions to the COVID-19 pandemic?*

Mental Model / Shared Vision:

- *What is the prevailing paradigm for the management of the COVID-19 pandemic that could be contributing or giving rise to protest actions?*

Level of Analysis	*Description*	*Actions Done*	*Ideal Scenario*
Event: April 1 protest of QC residents	*Sitio San Roque residents staged a protest along EDSA to demand government help for food and support. Most could not work during ECQ conditions. They were arrested for protesting without a permit, according to a news article in Rappler (Talabong, 2020)*	*Protesters were arrested.*	*QC protesters should have been given aid in the form of food and financial assistance.*

Patterns: Other protest actions	*Other protest actions have arisen leading to more arrests. Six jeepney drivers were also arrested rallying to ask for permission to resume jeepney operations and request government aid (Aspinwall, 2020). Similarly, 20 protesters during the Global Pride march were arrested for rallying to demand from the government aid for poor workers and drivers displaced by the pandemic (The Associated Press, 2020). Even groups conducting relief work were arrested.* *Common issues: lack of food and livelihood*	*Increased government crackdown on ECQ violators, with orders of immediate arrests without warning*	*Enforcement of quarantine rules needed to be balanced with social amelioration programs and other forms of assistance to those without resources and livelihoods to avoid protest actions*
Underlying Structure:	*Law enforcement agencies seem to be given more power/ authority, and leeway.*	*Reliance on military solutions and agencies to enforce quarantine rules as a solution to the COVID-19 pandemic*	*Balanced "systems" solution that also capacitates the public health sector and social sectors more*
Mental model / paradigm:	*Approach to containing the pandemic is a top-down, command-and-control type militaristic approach – i.e. citizens should follow what authorities say without question.*		*Approach to managing the epidemic should be a more well-rounded systems-based approach that considers how the public health sector also engages the social sectors*

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Issue Mapping

CHALLENGES TO BE ADDRESSED

Most socio-economic problems are complex, and they persist because strategies to manage them fail to recognize their complexity. Traditionally, they have been addressed in a fragmented fashion and in shorter timescales that are either incommensurate with the scale of the problem, or make the problem worse in the long-run.

Identifying the critical issues, their causes, and their impacts have often been left to experts and decision-makers. While useful, it is inherently incomplete. Increasing the participation of different stakeholders at this stage will not only provide a more complete picture of the issue but will also foster consensus, learning, and legitimacy.

PURPOSE OF THE ACTIVITY

This activity aims to bring different stakeholders together to identify critical issues and map their root causes, impacts, and links with other issues. It likewise aims to bring the mental models of different stakeholders of the issues to the fore to examine and understand the issues more completely, better anticipate consequences, and manage them more effectively.

RESILIENCE LINK

Strategic solutions need to recognize the complexity of issues in order to anticipate and plan for the spectrum of potential consequences. A resilient community or organization is one that can implement multi-faceted and multi -stakeholder actions to adapt to changing conditions as they affect different sectors.

LEARNING OUTCOMES

- Identify and map priority issues.
- Determine root causes, impacts, linkages, patterns, and feedback structures.
- Deliberate on mental models to find a common understanding of the issues.

SET UP

WHO

This requires a diverse mix of participants with different backgrounds to provide different perspectives on the issues. Knowledge of influence diagrams is advantageous, but facilitator can guide the group through the process.

NUMBER OF PEOPLE

Ideal size is 10 to 20 people that will be divided into groups of 3 to 5.

SPACE

There should be enough space for participants to sit comfortably and break out into 3 to 5 groups.

TIME

This activity will take 60 to 90 minutes to finish.

MATERIALS & EQUIPMENT

- Sticky notes
- Markers
- Whiteboard or Manila paper
- Optional but very useful material – Laptops and software for constructing causal loop diagrams: Vensim PLE (see "How do we use this book", page 7)
- LCD projector (if laptops and software will be used)

INSTRUCTIONS

Part 1: Identifying important issues

1. Divide the participants into groups of 3 to 5 people. Ensure that the composition of participants per group is diverse.

2. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

3. Articulate the overarching theme/concern related to resilience that will be the topic of the activity (e.g. disasters due to flooding, the Covid-19 pandemic, poverty incidence, as examples for community resilience; supply chain disruptions due to climate change or business continuity in the midst of hazards, manpower or technical capacity needs, as examples for organizational resilience).

4. Ask each of the participants to identify 3 issues related to the overarching theme that they deem important and need to be addressed. They need to write these issues down in a sticky note, 1 issue per note. Issues may be multi-faceted – i.e. they may be hazard, exposure, or vulnerability issues, resource issues, management issues, etc.

5. Ask the participants to place their sticky notes on the board assigned to their group.

6. Have the participants cluster similar issues.

7. Have the participants discuss and determine their 3 most pressing issues for their groups.

Part 2: Assessing the evolution of issues /trends over time

1. Give participants time to reflect on their experiences per issue, particularly on how they experienced them in the past in terms of magnitude, frequency, and extent of impacts, and whether these changed over time.
    - Give participants time to reflect on their experiences per issue. Guide questions may include (if applicable):
    - Describe your experience of this issue in the past (e.g. in terms of magnitude, frequency, and extent). How strong or how

intense has it been? How frequent? How widespread?
- Based on your experience and perception, has this issue changed over time? For example, has it become more severe or more frequent? Are more people, things or areas affected?

2. Encourage participants to look far back enough to see patterns on how the issue has changed over time, if it has. The timescale will vary depending on the issue. Some trends can be observed in a matter of hours and days (e.g. spread of the disease, issues going viral on social media) while others take decades, or longer (e.g. land use change, shifts in organizational culture). They should specify this timescale during the group discussion.

3. The Behavior-Over-Time Graphs (see page 58) can be useful here to assess trends if data are available.

4. Ask the participants to discuss among their groups their reflections and make them fill in the table below. Inform them that they can differ in their assessments.

Example 1B – Flooding

Issue	*Timeframe*	*Changes observed*		
		Magnitude	*Frequency*	*Impacts*
Seasonal flooding	*Past (10–20 years ago)*	*Ankle-deep*	*About 10 times during the rainy seasons, particularly during heavy downpours. Floodwater usually subsides shortly after the downpour*	*Traffic congestion due to street-level flooding*
	Present	*Knee to waist-deep*	*Flood frequency did not change markedly. However, moderate rains can now trigger floods that take hours to subside.*	*– Traffic congestion that lasts until late in the evening* *– Cancellation of classes and interruption of business activities* *– Increase in flood-related diseases* *– Damage to infrastructure and other assets*

Issue	Timeframe	Changes observed		
		Magnitude	Frequency	Impacts
Loss of green spaces and expansion of built-up areas	Past (10-30 years ago)	Green spaces accounted for more than half of the land cover	The clearing of green spaces to make way for human settlements has been occurring for a long time but has accelerated in the past decade	– Reduction in 'natural' recreational areas – Deterioration of air quality – Erosion and siltation of waterways – Reduced infiltration capacity
	Present	Extent of green spaces shrank significantly to about only 10% of the land cover and replaced with residential and commercial areas	The clearing of green spaces is still continuing. More buildings and houses are also erected in existing built-up spaces.	– Further reduction in infiltration capacity – Waterways are heavily silted which overflows during heavy downpours – Loss in amenity value due to poor air quality, flooding, and congestion
Inadequate solid waste management	Past (10-20 years ago)	Only a quarter of solid waste generated is properly managed About half a kilo of solid waste is generated per person per day	Less than half of the households and establishments are covered by the municipality's weekly waste collection service	– Loss in amenity value due to the stench of uncollected waste – Incidences of water -borne diseases during flooding
	Present	Solid waste management capacity increased but it still has not kept -up with the demand. About half of the solid waste generated is improperly managed Waste generation rate increased to 1 kilo per person per day	Half of the households and establishments have their waste collected twice per week Others improperly dispose their waste	– Increased incidences of water -borne diseases during flooding – Reduced conveyance capacity of drains and waterways due to improperly disposed solid waste – More piles of uncollected garbage and the consequent reduction in amenity values and proliferation of disease vectors

Part 3: Understanding interconnections

1. For this section, participants should work on 1 issue at a time. Provide the participants with Manila paper and markers. Alternatively, they can use diagramming software like Vensim PLE.

2. Have the participants brainstorm and write down the proximate causes of the issue that influenced how it has changed over time (free and unencumbered brainstorming would be ideal but if time is limited, the facilitator may limit the identified causes to 10-15). Ask them to draw arrows indicating the chains of causality with arrows flowing from causes to effects.

3. Ask them to complete the chains of causes by adding secondary and tertiary causes.

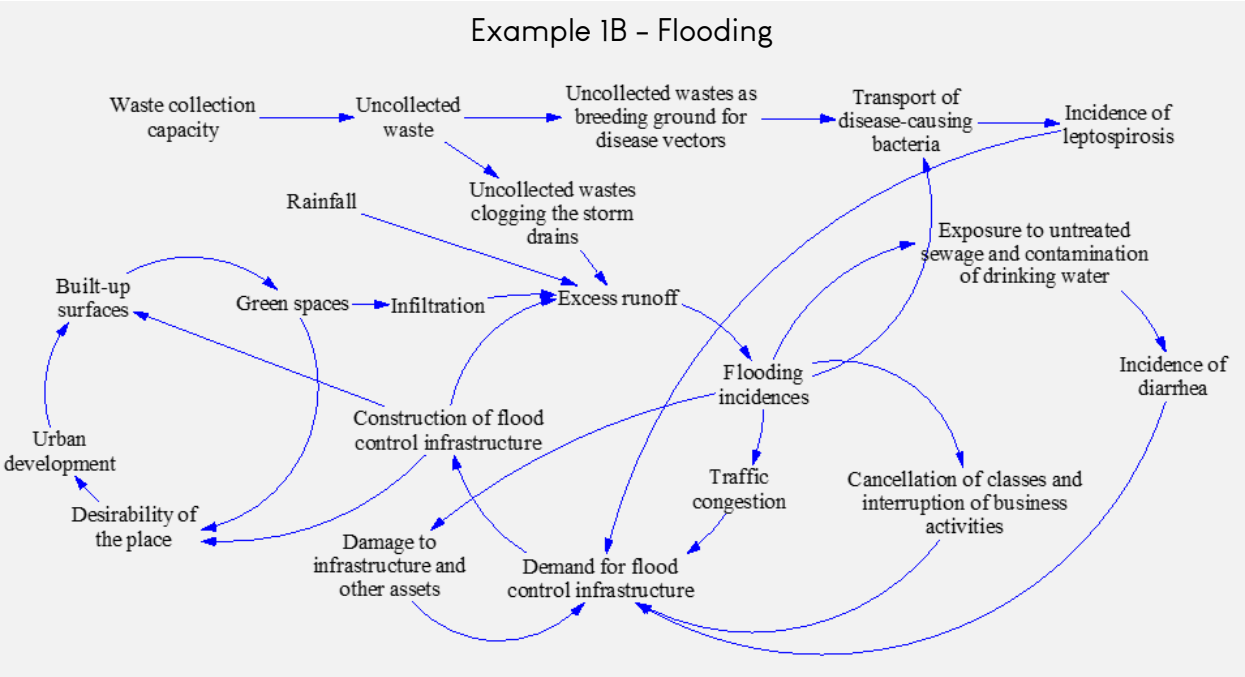
4. Ask the participants to identify linkages across causes.

5. Do the same for the second and third issues.

6. Check if the chains of causality can be combined – how do the 3 issues, their causes and effects connect to one another? Can one overall influence diagram be developed?

7. Have them review their influence diagrams to simplify and check for consistency and completeness. They may revise, add, and remove information as they deem fit.

8. Ask each group to present their assessments and influence diagrams of the issues.



DEBRIEF

- What are the most important issues? Are they similar or different across groups? What could be the reasons why they are similar or different?
- Have your understanding and perception of the issue changed after the activity and how?
- Within your group, have there been differences in your assessments of the important issues, how they changed over time? What were they and how did you resolve them?
- This activity is intended to encourage "big picture" thinking – i.e. to discern the interconnections among issues. Were there connections that weren't obvious before but are not brought to light? What insights can we derive from them?
- Because of these interconnections, it may not be easy to immediately identify a "root" of the overarching theme, if there was one root historically; however, it the diagrams may make it easier to identify "leverage points." Leverage points are points where interventions can result in larger impacts given the ripple effects through the system. Based on your diagrams, what are possible leverage points for your overarching problem? Can a multi-prong plan be developed? (This question can help transition the session into Action Planning activities.)

ANOTHER EXAMPLE

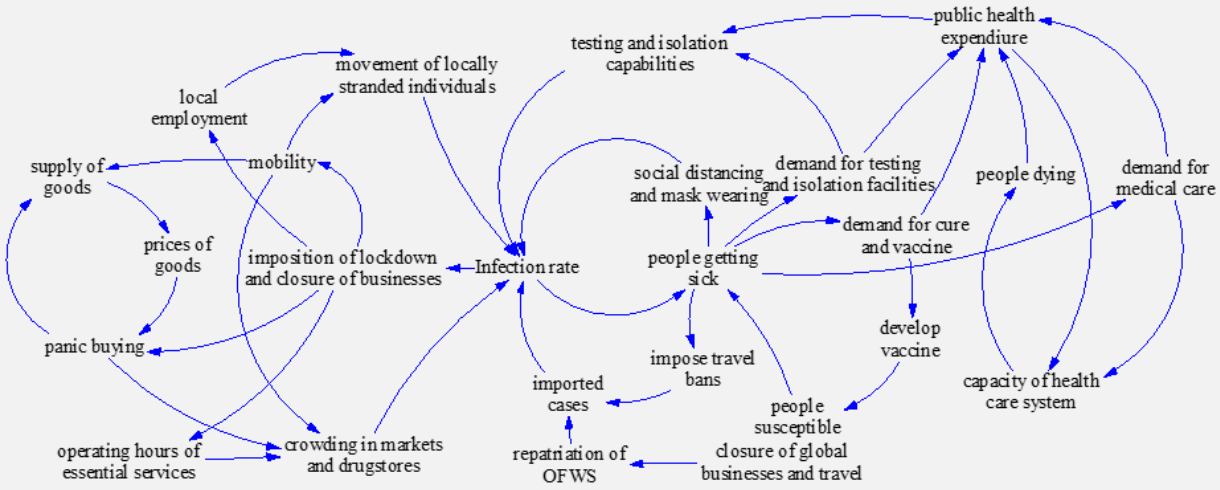
Below are examples of Issue Mapping table and figures as applied to a pandemic theme:

Example 1B – Pandemic

Issue	*Timeframe*	*Changes observed*		
		Magnitude	*Frequency*	*Impacts*
COVID-19 prevalence	*Past (few months ago, when the first few cases were reported)*	*Only a few cases were reported*	*Spread of the disease was initially undetected but accelerated a month after the first confirmed case*	– *A few deaths and hospitalizations* – *Minimal disruption in socio-economic activities*
	Present	*Hundreds of new cases are reported per day*	*Prior to the imposition of the enhanced community quarantine (ECQ), disease doubling time was about three days. Months into the ECQ, disease doubling time increased to about 7 days*	– *Socio-economic activities are severely hampered due to community lockdowns and closure of non-essential businesses* – *Hundreds have died and thousands are still in the hospitals*
Imposition of community quarantines to limit transmission of COVID-19	*Past (few months ago)*	*Initial form of community quarantines were strict (movement is limited to essential activities)*	*Community quarantines initially vacillated between strict and less strict, with the policy being evaluated every fortnight*	– *Lower number of COVID-19 cases* – *Closure of small businesses and job losses* – *High incidences of mental problems and domestic violence due to prolonged lockdowns* – *Increase in prices of goods due to difficulties in transport*
	Present	*Current community quarantines are less strict (non-essential activities are allowed)*	*Community quarantine policy does not change as often, looser community quarantine is imposed as a default until vaccines are developed or until the situation changes*	– *Slight increase in employment due to resumption of business activities and public transport* – *Increase in number of COVID-19 cases* – *Quarantine fatigue and perception that COVID-19 is no longer a threat*

Issue	Timeframe	Changes observed		
		Magnitude	Frequency	Impacts
Underfunded health care system	*Past (20 years ago up to few months prior to the pandemic)*	*Health expenditure in the country is low at 3-4% of its GDP compared to the regional average of 7% of GDP*	*Health care budget is allocated annually*	– *Migration of medical workers to countries with better pay* – *Persistent shortages in health care capacity vis-à-vis demand* – *Concentration of better equipped facilities in urban areas* – *Limited access to health care for the majority of the population*
	Present	*Despite the pandemic, health spending remains stagnant*	*Regular budgeting is still annual but supplementary funding is provided*	– *Shortages in health care capacity is magnified with the influx of COVID-19 patients* – *Increase in both non and COVID-19 deaths*

Example 1B – Pandemic



Scoping with System Archetypes

CHALLENGES TO BE ADDRESSED

Although there are diverse examples of systems, common structures or patterns have emerged. For example: A common problem is when unintended consequences occur as a result of well-meaning interventions. There are cases when interventions target only the symptoms of the problem, and problems recur after applying a seemingly effective solution. Fundamental solutions can get casted into the shadows due to the delays in perceiving the recurrence of the problem after the application of a symptomatic solution. In some cases, the harder we try to apply an intervention, the harder the system seems to push us back into failure. The challenge is to discern whether our actions within our systems are falling into these patterns and how we can use this understanding of the pattern to our advantage – i.e. to understand which aspects the interventions are targeting, the limits of the system, and how the different players of variables in a system relate to each other to balance or reinforce a vicious or virtuous cycle.

PURPOSE OF THE ACTIVITY

The activity will provide a framework for participants to think about problems in a system or intervention using system archetypes. System archetypes are generic, common patterns or systemic structures that are found to be recurring in many organizations (Senge, 1990; Braun, 2002). Understanding the system through the archetypes can provide various insights about why certain unfavorable events keep on occurring despite the efforts to improve the situation, and how these patterns can be broken

RESILIENCE LINK

A resilient community or organization is one that is able to adjust and adapt to changing conditions in order to still perform its function or achieve its goals. If a system is "trapped" in a dysfunctional state, it will not be able to adapt as needed and achieve its objectives. The study of archetypes can help identify common traps of systems and turn them into opportunities.

LEARNING OUTCOMES

- Diagnose a problem or issue in the organization in terms of a system archetype.
- Apply system archetypes to gain insights about potential interventions.

SET UP

WHO

This activity requires no specific type of participant but basic knowledge of how to make causal loop diagrams is required.

NUMBER OF PEOPLE

A small number of people, typically 3-5. If there are more than 5 people, the participants can divide themselves into pairs or groups of 3-5 members.

SPACE

There should be enough space for participants to sit, group together and discuss, comfortably.

TIME

This activity could take about 2.5-3 hours depending on your discussion: 30 minutes for initial causal loop diagramming; 1 hour for archetype discussion; 60-90 minutes for archetype diagramming, sharing, and debriefing.

MATERIALS & EQUIPMENT

- A whiteboard, blackboard or manila paper
- Markers (whiteboard marker if using whiteboard or chalk if blackboard)
- Scotch tape/masking tape
- Optional but very useful material – Laptops and software for constructing causal loop diagrams: Vensim PLE (see "How to do we use this book?", page 7)
- LCD projector (if laptops and software will be used)

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Start by asking the participants to agree on a resilience-related issue or problem in their organization or community and that will be the focus of this activity.

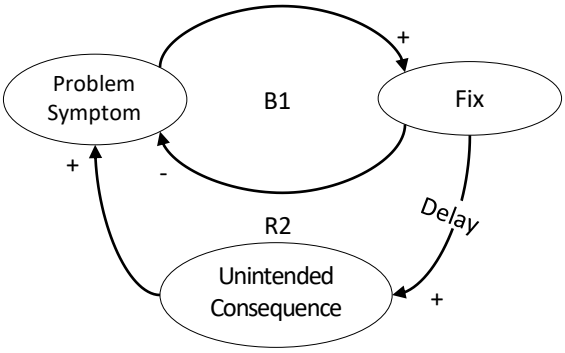
3. Have the participants develop an initial causal loop diagram (CLD) to explain the issue. In a small group this can be done individually. In larger groups, this can be done by pairs or in groups of 3-5 members. Alternatively, the activity in Module 2B. Stakeholder Dialogue / Perspective Sharing can be integrated here to generate the CLD. What is important is that at the end of this step, participants have a clear “storyline” explaining how they understand the problem.

4. Introduce the system archetypes to the participants. Present the description (or "storyline") of the 8 archetypes: Fixes that Fail, Shifting the Burden, Limits to Growth, Drifting Goals, Growth and Underinvestment, Success to the Successful, Escalation, and Tragedy of the Commons. Also present to them the CLDs and Behavior over Time (BOT) graphs of each archetype. See guide/script below.

Below is a suggested script to present the system archetypes. The details included here are derived from "System Archetype Basics, From Story to Structure" (Kim and Anderson, 2007), "The Fifth Discipline: The Art and Practice of The Learning Organization" (Senge, 1990) and "The System Archetypes" (Braun, 2002). It is recommended to present the description of each archetype while referring to the respective CLDs. You may choose to draw the CLDs, prepare diagrams of CLDs beforehand to post in the whiteboard or a blank wall, or prepare a Powerpoint Presentation containing the descriptions and CLDs to be projected on a screen.

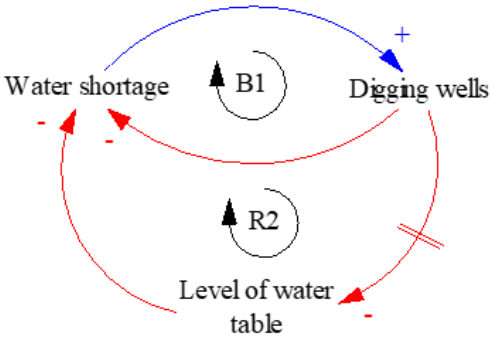
We're going to examine a resilience issue using system archetypes. System archetypes are generic, common patterns of systemic structures that are found to be recurring in many organizations. Today, I'm going to give you an overview of the eight system archetypes namely Fixes that Fail, Shifting the Burden, Limits to Growth, Drifting Goals, Growth and Underinvestment, Success to the Successful, Escalation, and Tragedy of the Commons. There are more archetypes, but we're going to cover only these eight during this session.

Fixes that Fail

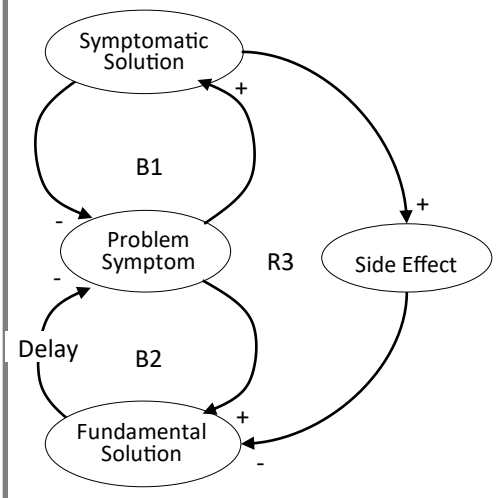


In a "Fixes that Fail" situation, a solution is quickly implemented to alleviate a problem. However, the effect only lasts in the short-term. In some cases, the "solution" only addresses the problem symptom rather than the root cause. Furthermore, it produces unintended consequences that later cause the original problem symptom to resurface or get worse.

An example of fixes that fail is digging more deep wells or digging existing wells deeper to address water shortage. This intervention generates water supply in the short-term but causes an unintended consequence of lowering the water table, which aggravates the water shortage in the long -term.



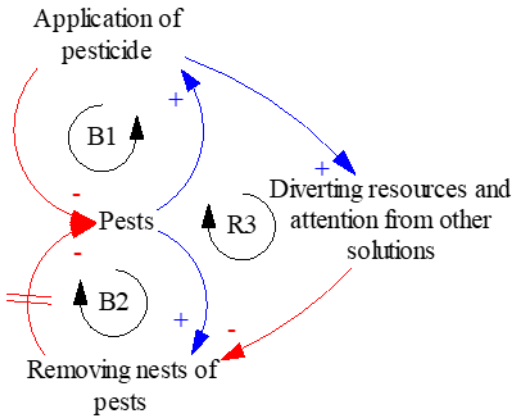
Shifting the Burden



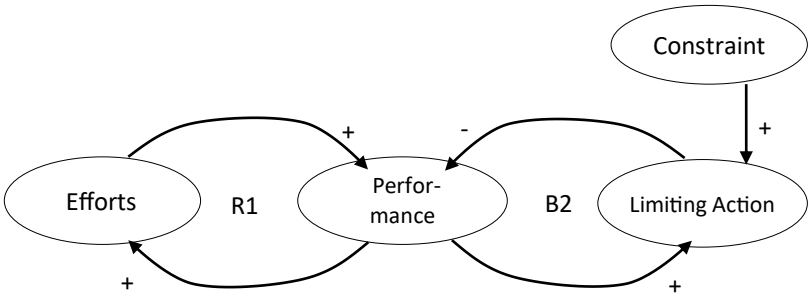
In a "Shifting the Burden" situation, a problem symptom is addressed by a short-term "symptomatic" solution which reduces or eliminates the problem, so there doesn't seem to be a need to implement any other action. Over time, the symptom resurfaces, and the short-term solution is repeated. The problem could have been better addressed by a fundamental solution but the short-term solution produces side effects that shift attention away from the fundamental solution.

An example is the use of pesticides as a symptomatic solution. The effect of the pesticide abates or the pests develop a tolerance. As pests return, more pesticide is applied. While resources and attention are focused on

repeated pesticide application, the fundamental solution of looking for the nest and cleaning it up, or using natural control mechanism gets neglected.

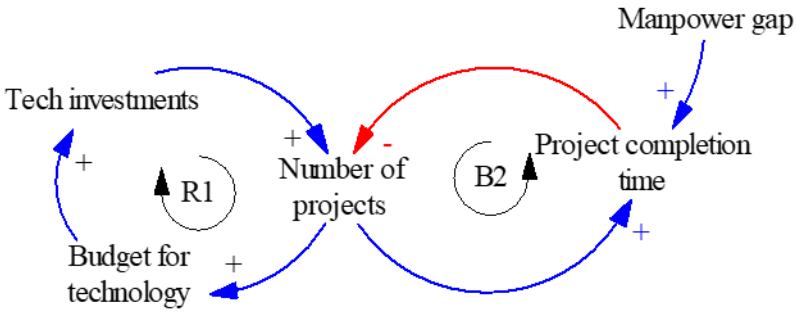


Limits to growth

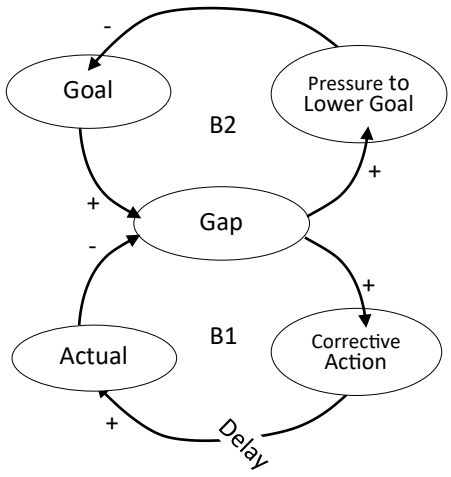


In "Limits to Growth," efforts or actions initially yield success or to lead to growth, which encourages us to do more of those efforts. However, over time, the growth slows down due to a limit or constraint triggered by that growth. The tendency is to apply the same efforts again and again, but performance will decline anyway if the constraint is not addressed. Moreover, the limiting factor is usually activated later, after a delay, and so it can be ignored or difficult to diagnose.

An example of Limits to Growth situation is when an office or company channels their resources towards technological investments that give them the edge over their competitors. This leads to taking on more challenging projects. However, they reach a point when the capacity to deliver is constrained because the manpower did not increase. The lack of manpower leads to longer project completion times, which would mean fewer projects can be handled by the company.

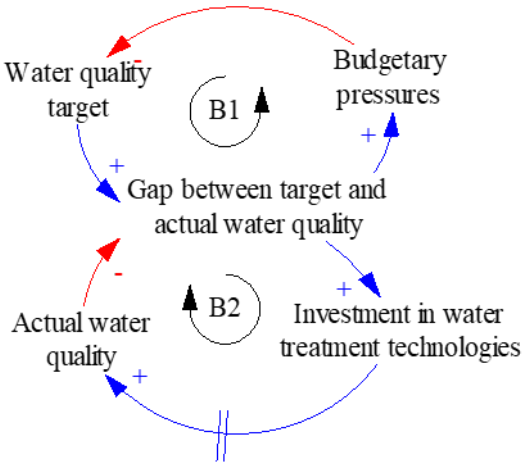


Drifting Goals

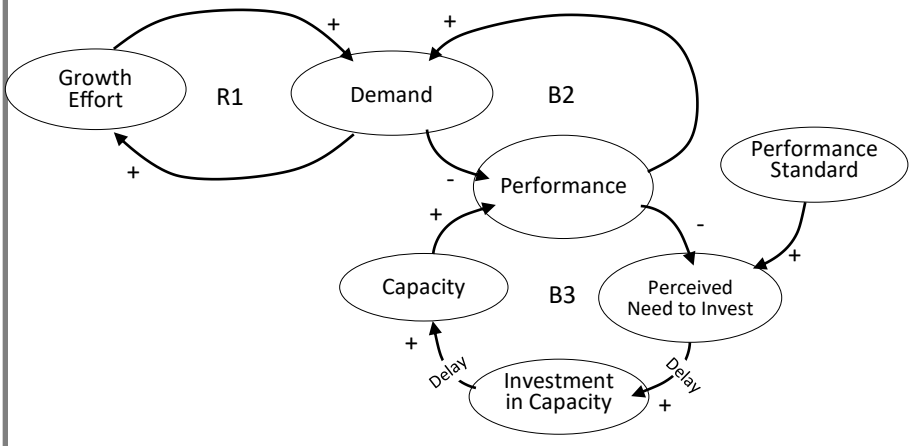


In "Drifting Goals," a gap between a goal and the actual performance is resolved either by taking corrective action to reach the goal or by lowering the goal. If the latter option is taken, then over time, the effect of a lower goal is for the performance level to decline as well. However, this may happen gradually and remain unnoticed.

An example of this archetype is reducing pollution targets because the costs of implementing pollution control are deemed too high. The corrective action to close this gap in the long run would be to invest in efforts to cleaner production or pollution control technologies.

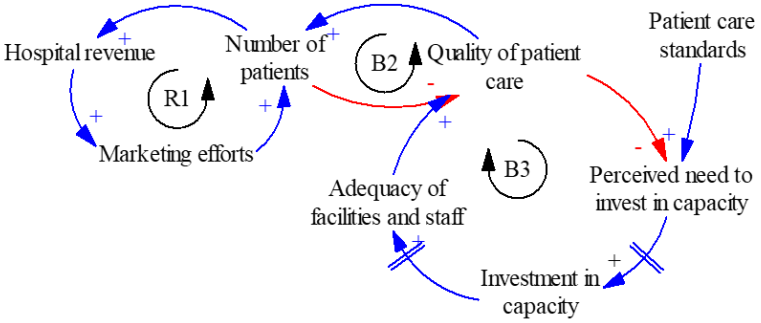


Growth and Underinvestment

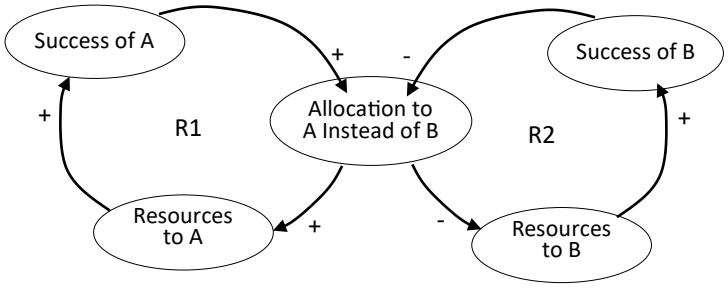


This archetype is an extension of "Limits to Growth." In "Growth and Underinvestment," growth reaches a limit that could be avoided if capacity investments were made. Reasons for not making such an investment may include basing the decision on past (declining) performance, or may be due to delays in the system which make it hard to see the impact of the investment on performance. This underinvestment limits further growth, and may even eventually result in worse performance.

An example of this archetype is when hospital gets more patients by marketing its services, but is eventually no longer able to render quality patient care because old facilities are not upgraded and the staff becomes increasingly overworked. Non-upgraded facilities and overworked staff further reduces the hospital's patient care, to the point that they no longer have enough patients so the hospital has even reduced revenue. This situation creates a "justification" not to push for marketing services anymore, and not to invest in more staff and facilities.

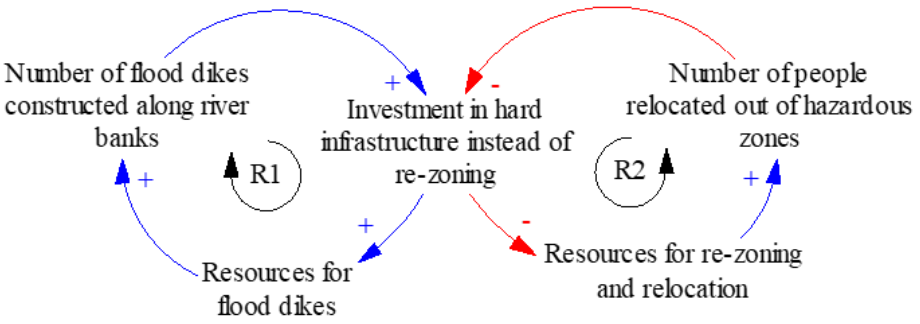


Success to the Successful



In "Success to the Successful," two or more individuals, groups, projects, interventions, etc. compete for the same finite resources. If one of them is initially more successful (or is perceived to be more successful) than the others, it tends to garner more resources, thereby increasing the likelihood of continued success. On the other hand, the others are not allocated the same resources or opportunities, which limits their potential to succeed, even if these are actually superior options.

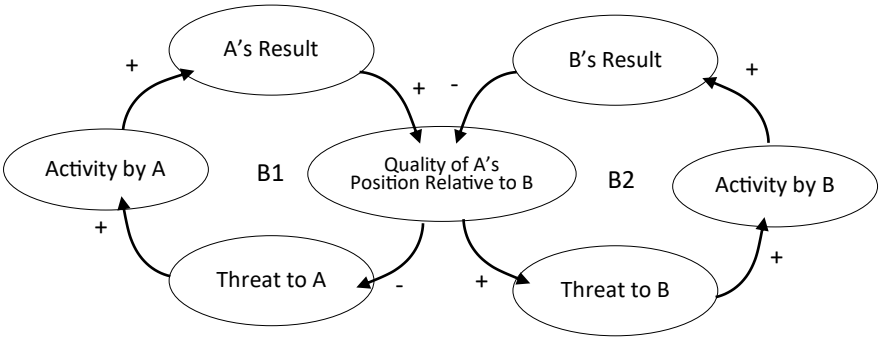
For example, there are two options being considered for reducing the number of people affected by a flood due to river overflow – investment in hard infrastructure like dikes or investment in relocation two flagship projects are being implemented by an office or company. The budget of the local government to implement these measures is limited. The infrastructure project successfully gains media traction, while the re-zoning and relocation project is poorly received despite being able to move people out of harm's



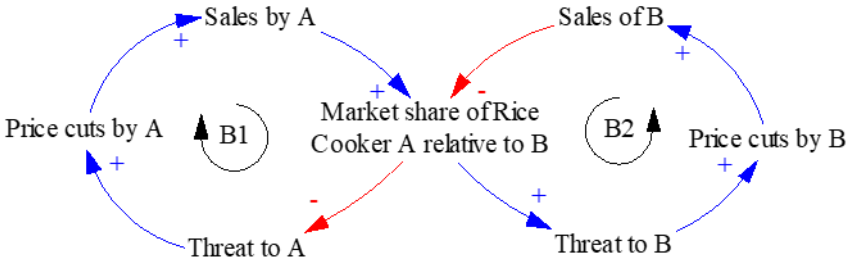
way in the long run. Because more people now have their eyes on the infrastructure project, more resources are allocated to improve this project. The other initiative, however, gets overshadowed and receives less and less resources when more and more resources are redirected to the project that is deemed more successful.

Escalation

In "Escalation," competing parties implement actions that threaten the other. Counteractions are taken in turn until the reinforcing process escalates tension on both sides, to the detriment of both sides.



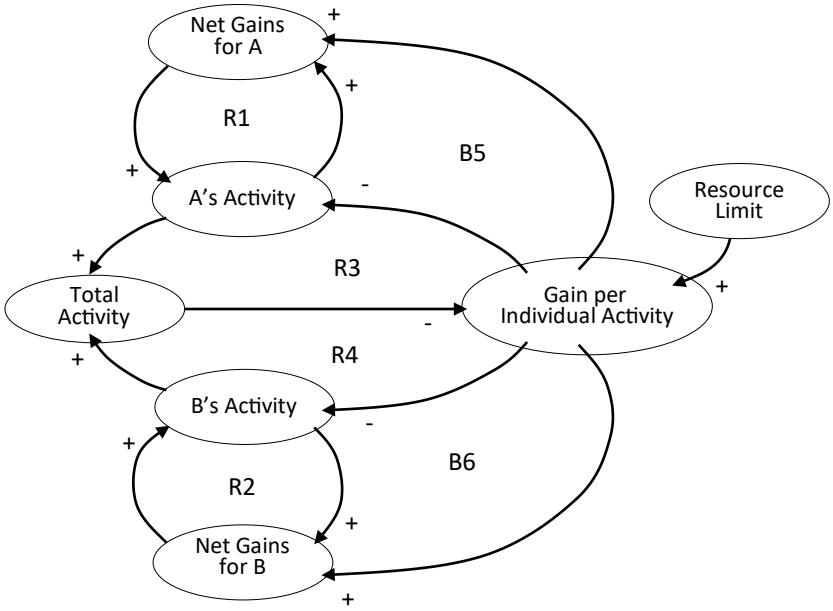
An example, Company A developed a new design for a rice cooker that automatically loads water depending on how much rice grain you put. This was an immediate hit. At the same time, a competitor Company B started selling the same product. Company A still had the majority share of the market since most buyers preferred Company A's product. To get more people to buy its product, Company B lowered their price. In response, Company A also lowered its price. Consequently in response, Company B also lowered its price further. Several years later, both companies were barely breaking even.



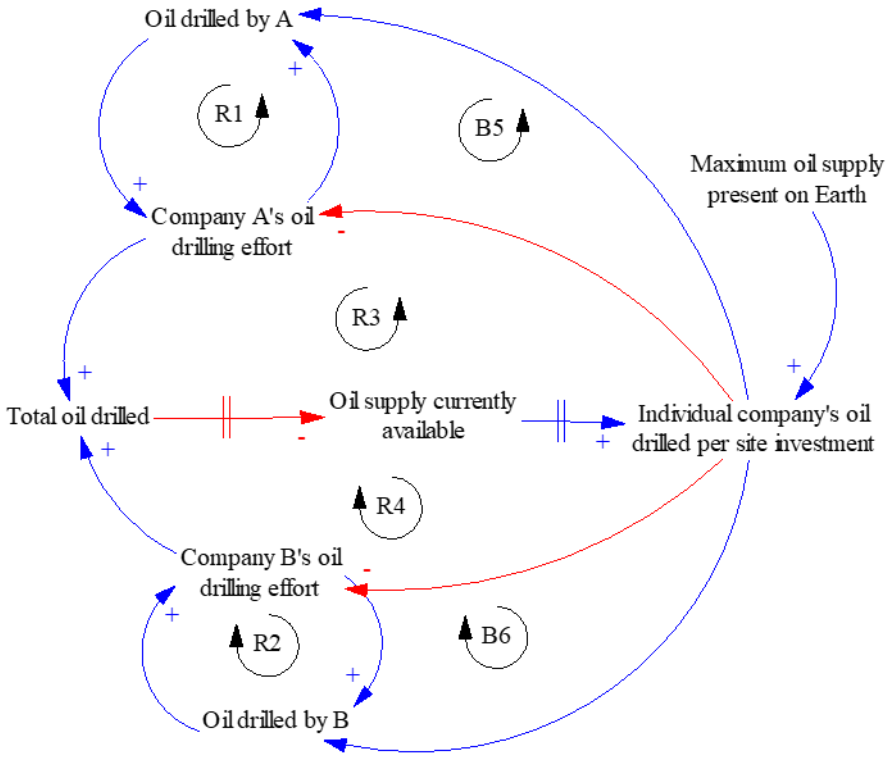
Tragedy of the Commons

In "Tragedy of the Commons," multiple parties enjoy the benefits of a common resource to which they all have (potentially unrestricted) access. At some point, the collective and often unregulated activity overwhelms the common resource. All parties experience diminishing benefits per unit of

effort the exert towards harvesting that resource. The common resource base gets depleted faster than it is replenished or renewed, may even collapse.



This archetype represents a typical situation in natural resource management. In the case of fossil fuels, for example: The more oil that petroleum companies drill for, the more income they earn, and the more they can explore and invest in drilling technology. This benefit applies to all companies. In time, the oil supply is depleted because it is being harvested at a rate much faster than replenishment – in this case, the time scales of fossil fuel replenishment are so long that we consider them as non-renewables resources. As the oil supplies are running low, companies have to exert more effort to explore for more sources and to harvest them. What will happen to these petroleum companies and the societies that depend on oil when the stock is depleted?



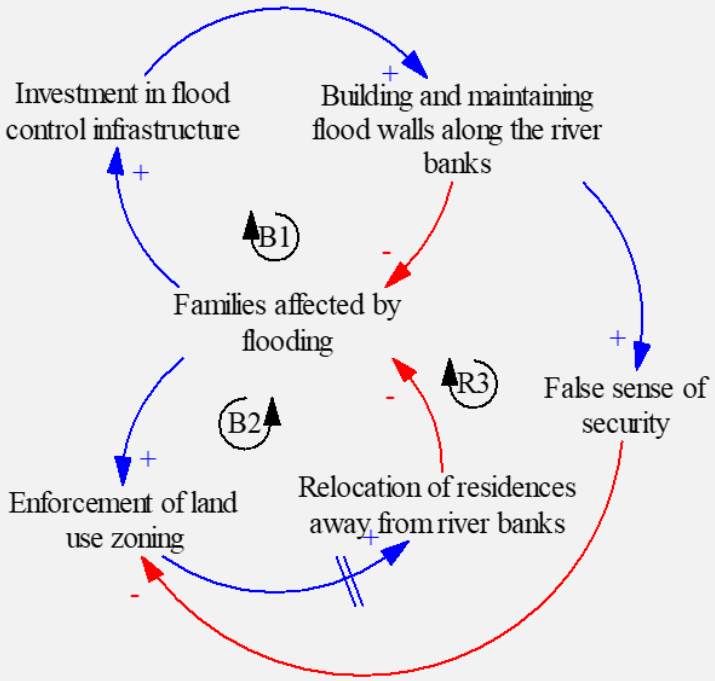
5. After reviewing the storylines of the archetypes, ask participants if any of these match or resonate the storylines of their CLD. If needed, have them redo their CLDs following the template of their chosen archetype.

6. After the participants complete their CLD, ask them to:

    - Show how or which part of their CLD exhibits the archetype.
    - Articulate the main variables that drives the system based on the archetype, and
    - Share insights they gained about the problem from examining the issue using the archetype.

Example 1C – Flooding

Here is an example of a CLD for flooding where the chosen system archetype is "Shifting the Burden".



In this CLD, the problem symptom is the number of families affected by flooding, with the symptomatic solution being investing in flood control infrastructure. As the flood control infrastructure in the form of flood walls along the river keeps flood waters from overflowing out of the river, the fundamental solution of targeting land use and zoning could be neglected. This false sense of security would be detrimental in the long run if the areas along the riverbanks become increasingly built-up. Should the hard infrastructure fail, more people and assets will be affected by the flooding.

An insight that can be gained from using this archetype to understand the problem would be that the fundamental solution is harder to implement and entails more resources and time. However, this solution should be more effective in the long run. From this insight, participants can try to come up with ways to address or further understand what hinders the implementation of the fundamental solution.

An insight that can be gained from using this archetype to understand the problem would be that the fundamental solution is harder to implement and entails more resources and time. However, this solution is should be more effective in the long run. From this insight, participants can try to come up with ways to address or further understand what hinders the implementation of the fundamental solution.

DEBRIEF

- How has this activity helped with the diagnosis of your problem/ issue? Has identifying the archetype of the problem led to insights on how to potentially address it?
- Do you think you could apply other system archetypes to the problem aside from those already mentioned? Which archetypes and what insights would you gain from looking at the problem through the lens of these archetypes?
- Were you able to identify potential interventions to the issue you selected, based on existing recommendations for the given archetype? What about the current interventions, based on your experience, do you appreciate after doing the activity?

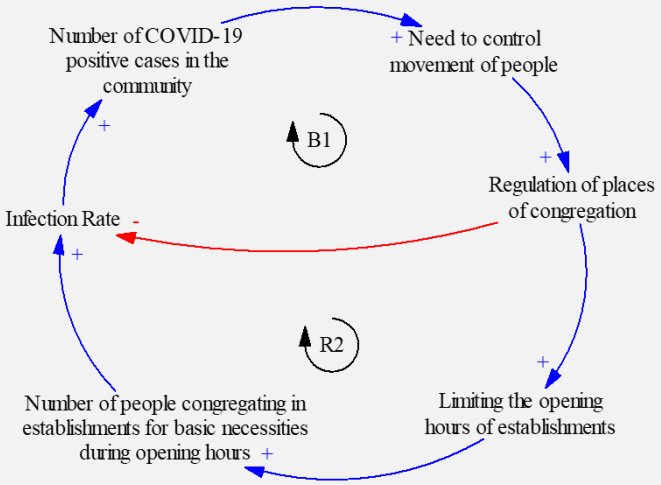
In your synthesis, guide the participants to realize that there is not necessarily one "right" archetype to describe the situation, and that identifying system archetypes can offer various insights into the problem. Mention as well that through system archetypes, the focus in problem diagnosis is about systemic structures more than individual persons or events. The exercise is intended to help them focus on the structural level, especially on the interrelationship of factors or variables. From here, Module 3 activities may follow for more in-depth development of interventions .

The references at the end of this section may be helpful to the facilitator to gain more insight into the opportunities presented by diagnosing archetypes.

ANOTHER EXAMPLE

Example 1C – Pandemic

Here is another example of a CLD for a pandemic situation where the applicable system archetype is "Fixes that Fail". The example below pertains to managing COVID cases through regulation of commercial establishments.



In this CLD, an immediate response to the rising number of COVID-19 cases in limiting the movement of people through quarantine-type measures that include closing or limiting the opening hours of establishments. In the short-term this decreases the number of cases. However, as quarantine conditions lengthen, people find that they need to replenish stocks of basic necessities. Here we see the unintended consequences of limited store hours. Since stores are open for only a few hours, there are more people congregating at these locations at a given time. If physical distancing measures are not properly implemented, then the infection rate may increase, leading to more COVID-19 cases.

An insight that can be gained from using this archetype to that the quick fix is usually a well-meaning measure – in this case, to reduce contact among people and prevent the spread of the virus. However, no matter how well meaning, we must acknowledge that this fix is not enough to solve the problem, and even unintentionally creates conditions that may worsen it.

REFERENCES

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Other Scoping Tools

There are other tools that promote systems thinking in problem diagnosis. These can be readily integrated into the Iceberg Activity and can complement the Scoping with System Archetypes Activity.

The Double-Q (QQ) Diagramming

Directed root cause analysis for specific situations can be used for articulating deeper levels of understanding to better illustrate patterns, underlying structures, and mental models. This activity can be used specifically when moving from the 'event' to the 'patterns and trends', from 'patterns and trends' towards 'underlying structures', and from 'underlying structures' into the 'mental models' in order to better nuance the transition from one level of understanding to the next while also providing more concrete qualitative and quantitative data for each level. To learn more, check:

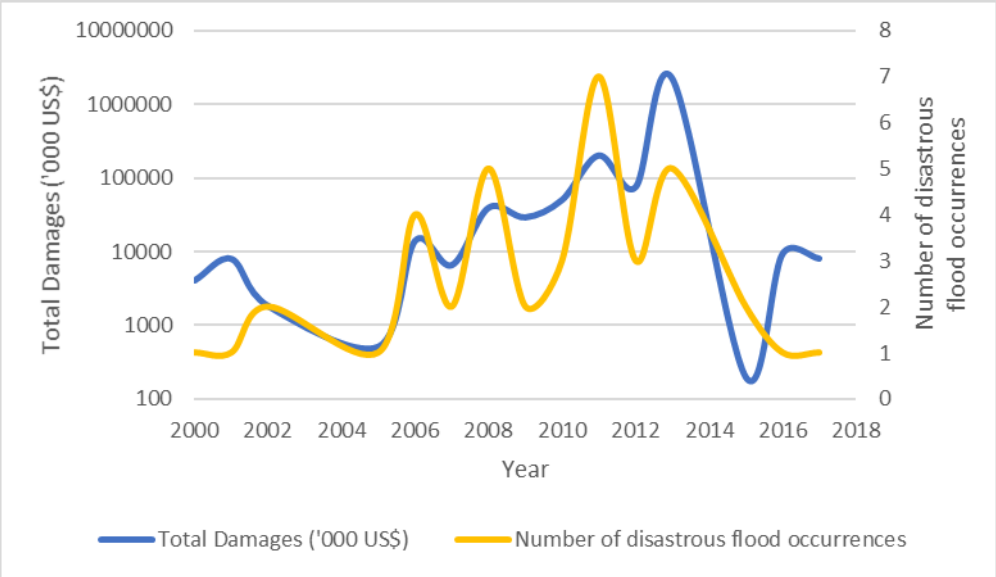
- Palette of Systems Thinking Tools by Daniel Kim. (The Systems Thinker Website, 2018), https://thesystemsthinker.com/a-palette-of-systems-thinking-tools/.
- How to Use the Fishbone Tool for Root Cause Analysis by the US Center for Medicare and Medicaid Services, https://www.cms.gov/medicare/provider-enrollment-and-certification/qapi/downloads/fishbonerevised.pdf
- Fishbone Diagram from the American Society for Quality website (2020), https://asq.org/quality-resources/fishbone.

Behavior Over Time Graphs (BOTGs)

BOTGs are a dynamic systems thinking tool that can be used in two ways for this activity. The first use is to better articulate the dynamic understanding of a certain event over time. In the case of a flood, how has the frequency or severity occur in the municipality changed over time etc. The second use of this tool is for validation of your perception of the system. You can put your expected trend of behavior beside the actual trend based on available data and it could reveal a possible gap in information available. Refer to Boxes 1 and 2 for examples.

More about BOTGs in Palette of Systems Thinking Tools by Daniel Kim. (The Systems Thinker Website, 2018), https://thesystemsthinker.com/a-palette-of-systems-thinking-tools/.

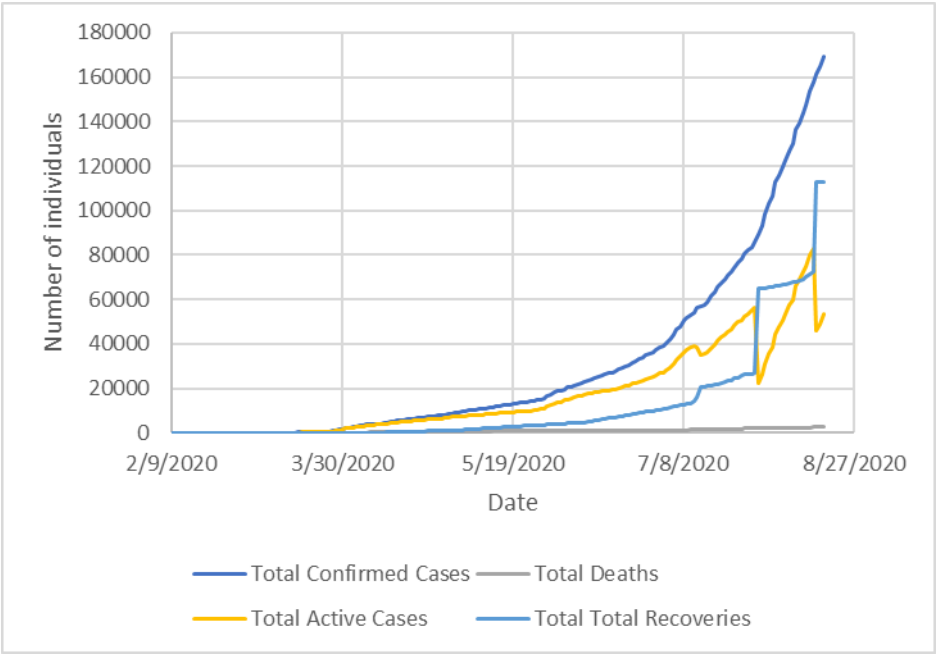
BOX 1. Total of damages due to floods and number of disastrous floods in 2000-2017.



Data source: EM-DAT, CRED (www.emdat.be)

The BOTG above shows the trends in total damages and the number of disastrous floods in the Philippines from 2000 to 2017. Why are total damages increasing despite advances in the field of science and technology?

BOX 2. Data on COVID cases, deaths, and recoveries in the Philippines from February to August 18, 2020.



Data source: DOH COVID-19 Tracker

Is the situation in the Philippines improving? Had we flattened the curve prior to the relaxing of quarantine rules?

STAKEHOLDER ENGAGEMENTENT

This section contains activities that could help you and your team strategize about engaging stakeholders in addressing resilience issues.

Network Mapping

CHALLENGES TO BE ADDRESSED

Miscommunication and unclear roles among stakeholders could result in different parties carrying out the same tasks, or none of the parties carrying out a certain task, assuming that others are already doing it. In such cases, the responsibilities of and the relationships among the "components" of the system are not well-articulated, leading to inefficiencies in achieving the system purpose. When objectives are not met, there is also a tendency to place the blame on someone else. The challenge is to clarify the roles, better coordinate with each other, and get past working in silos.

PURPOSE OF THE ACTIVITY

The activity will help participants understand the roles of stakeholders involved in an issue, the level with which they influence you or your office, how they influence other stakeholders, which stakeholder to approach for a specific concern, and how best to approach the different stakeholders given their roles and influences. The activity was adapted from the DILG Strategic Communications Toolkit (DILG, 2015).

RESILIENCE LINK

Stakeholders across different sectors need to work together as "components" of the system when adjustments and adaptations need to be made in the face of hazards or other changing conditions. Articulating the relationships in the stakeholder network will help clarify expectations, roles and responsibilities to more efficiently implement plans and programs.

LEARNING OUTCOMES

- Map different stakeholders.
- Develop strategies to approach various stakeholders.

SET UP

WHO

This activity requires no specific type of participant, but preferably those who are knowledgeable about the different stakeholders that could influence the chosen office (e.g. DRRMO).

NUMBER OF PEOPLE

A small number of people, typically 3-10. If there are more than 10 people, the participants can divide themselves into groups of 3-5 members.

SPACE

There should be enough space for participants to sit comfortably.

TIME

This activity could take 45 minutes to 1 hour depending on your discussion.

MATERIALS & EQUIPMENT

- A whiteboard, blackboard or manila paper
- Markers (whiteboard marker if using whiteboard or chalk if blackboard)
- Pieces of paper
- Metacards
- A pen or pencil
- Scotch tape/masking tape
- Alternatively, laptops with LCD projectors may also be used

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Start by agreeing upon a situation related to flooding:

   - What office will the group select as the point of the view for the activity?
   - After you have selected the office, assume that you are all members of that office.
   - What specific issue about flooding does your office want to address?

Example 2A—Flooding
Office selected: City Disaster Risk Reduction and Management Office
Issue selected: Reducing flooding due to heavy rains and clogged drainage

3. Ask the question: “Who or what office, company, institution, or individuals have an influence over the decisions/actions of our office concerning the selected issue?” List all of them down on a piece of paper. These are the “Influencing” stakeholders.

4. Also ask the question: “Who or what office, company, institution, or individuals are impacted by the decision of your office given the selected resilience issue?". List all of them down on a piece of paper. These are the “Impacted” stakeholders.

5. See if there are stakeholders who fall under both the “Influencing Stakeholders” and “Impacted Stakeholders”. If there are, draw a star next to their names.

Example 2A—Flooding

Influencing Stakeholders	Impacted Stakeholders
– Provincial Disaster Risk Reduction and Management Council – Regional Disaster Risk Reduction and Management Council – National Disaster Risk Reduction and Management Council – City Mayor ★ – City Planning and Development Office (CPDO) ★ – General Services Office – City Council – Budget Office – City Administrator – Office of Management Information Systems (OMIS) – General Citizens ★	– City Mayor ★ – City Planning and Development Office (CPDO) ★ – Management Information Systems Office – City Engineer's Office – City Environment and Natural Resources Office (CENRO) – City Health Office – Solid Waste Management Office – Barangay Captains – General Citizens★ – Urban Poor Affairs Office

Stakeholders

Stakeholders are individuals or groups who can influence or be affected by your company or organization's decisions and actions (Greene, 2005). They may:

- *Have decision authority over an initiative or activity;*
- *Have official mandate to carry out actions or decisions related to the initiative or challenge;*
- *Benefit from the decision or initiative; and/or*
- *Be disadvantaged by the decision or initiative.*

Influence

Influence is the power a stakeholder has to push forward or to impede the development of a project or achievement of a goal regarding a certain issue. It is the extent to which a stakeholder can "persuade" or "coerce" other stakeholders in the decision-making process.

The influence of a stakeholder could be based on the following (Greene and Elfrers, 1999 cited by Bourne and Walker, 2005):

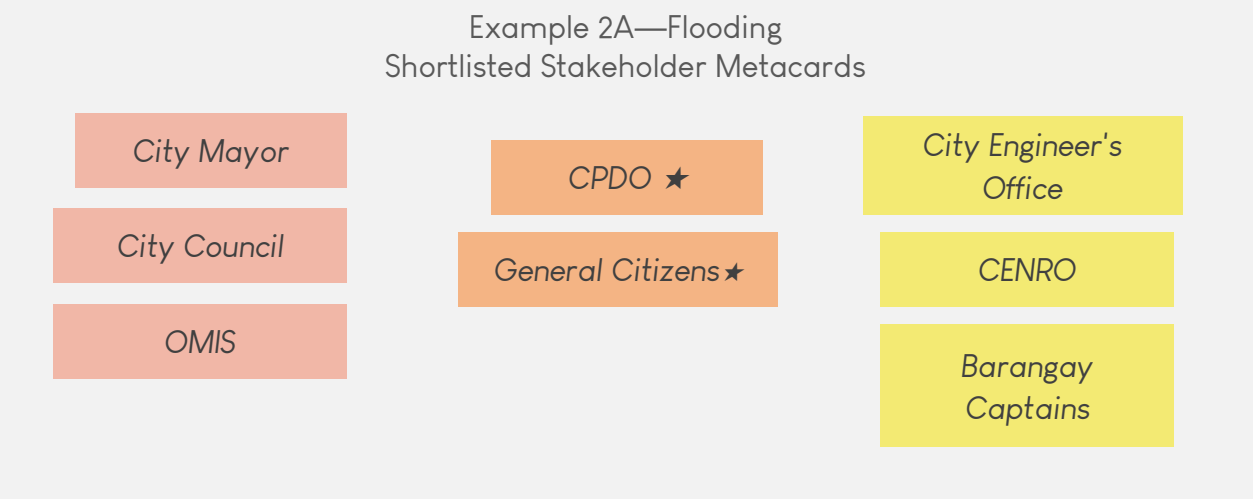
- *Position – formal authority based on their organization or hierarchical position*
- *Coercive – based on fear (failure to comply would mean punishment)*
- *Connection – based on connections to networks or people with*

influence or power
- *Rewards – based on ability to provide incentives for compliance*
- *Referent – based on charisma, being likeable or admired*
- *Information – based on possession or access to valuable information*
- *Expert – based on knowledge and skills they posses that are valuable to the project/objective*
- *Financial – based on the ability to provide budget/monetary support to the project*

Impact
- *Impact is the level at which a stakeholder is positively or negatively affected by the issue or decisions about the issue.*
- *Stakeholders may be affected positively or negatively in any of, but not limited to, the following aspects: Livelihood, income generation, physical location, financial resources, human resources, and organizational operation, delivery of goods and services, and accountability.*

6. If the group has a long list of stakeholders, ask the groups to shortlist stakeholders they think are most important. The shortlist could comprise 3-5 stakeholders per category ("Influencing" and "Impacted" stakeholders)

7. Write the names of the stakeholders in one metacard each. For stakeholders who fall under both "Influencing" and "Impacted", draw a star next to their names on the metacard (do not duplicate the metacard for these stakeholders). Draw the graph below on the Manila paper/whiteboard/blackboard and plot your stakeholders according to the values in your table.



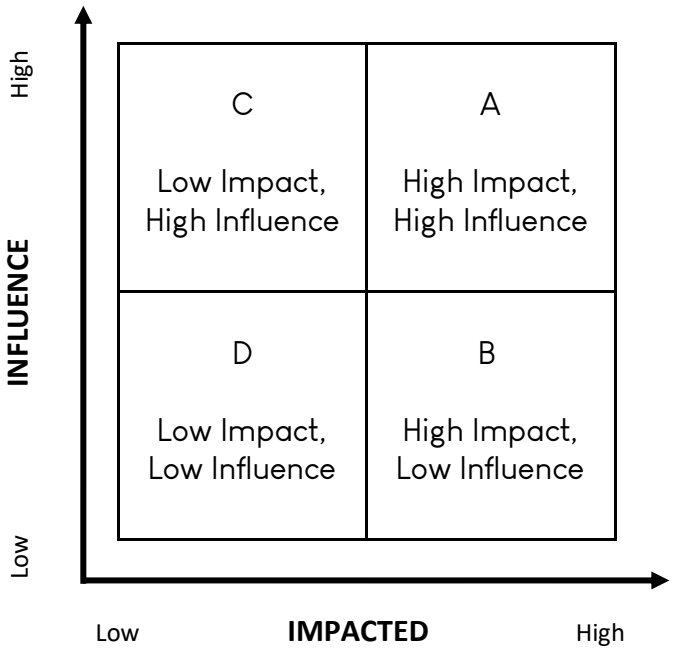
8. Draw the table below on a piece of paper and fill in. Levels are "High" and "Low".

Stakeholder	How the stakeholder influences the decision (Y-axis)		How the stakeholder is impacted by the decision (X-axis)	
	Level	In what way?	Level	In what way?

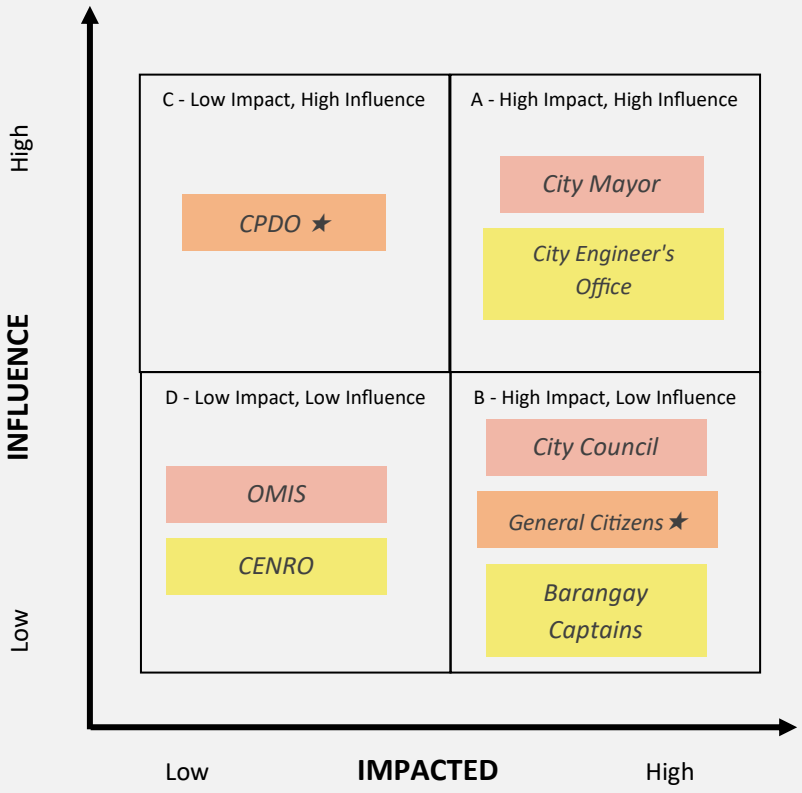
Example 2A—Flooding (example of the table above)

Stakeholder	*How the stakeholder influences the decision (Y-axis)*		*How the stakeholder is impacted by the decision (X-axis)*	
	Level	*In what way?*	*Level*	*In what way?*
City Mayor	*High*	*If he/she has a directive, we must follow*	*High*	*His/her image could be affected, his future decisions may be influenced*
City Council	*Low*	*They can advise us about certain policies relevant in the decision*	*High*	*Their future policies may be influenced by the decision*
OMIS	*Low*	*The information they provide can impact decisions*	*Low*	*They will have to store and manage data resulting from the decision*
CPDO	*High*	*The information they provide can impact decisions*	*Low*	*They will have to note the data resulting from the actions/decisions*
General Citizens	*Low*	*Their welfare is most important in the decision, given proper venue to voice out*	*High*	*Their lives are most impacted by the decision*
City Engineer's Office	*High*	*Their systems and actions influence the plans*	*High*	*Their decisions will be affected, especially related to drainage systems*
CENRO	*Low*	*The information they provide can impact decisions*	*Low*	*They will have to note the data resulting from the actions/decisions*
Barangay Captains	*Low*	*The information they provide can minimally impact the decision*	*High*	*They will have to implement our decision*

9. Draw the graph below (Stakeholder Map) on the Manila paper/ whiteboard/blackboard and plot your stakeholders according to the values in your table.



Example 2A—Flooding (example of the Stakeholder Map)



Suggested engagement with stakeholders:

A – Impacted High, High Influence

Collaborate with them. It is suggested that you do a collaborative conceptual modeling exercise with them, especially when you have conflicting views about the issue, or if they have minimal interests on the issue.

B – Impacted High, Low Influence

Engage and include them in the decision-making processes and discussions about the issue and initiatives to address the resilience issue or challenge. Take into consideration their suggestions and recommendations. Offer or link them to organizations that offer capacity-building programs that could help increase their level of influence.

C – Impacted Low, High Influence

Get their interest and have them to participate in the initiatives to address the issue. Involve them in the initiatives, win their support, and strategize ways to strengthen and sustain your partnership with them.

D – Impacted Low, Low Influence

Monitor them, and anticipate if they may have increasing influence or be impacted by the initiative over time.

DEBRIEF

- Which stakeholder has the greatest influence overall? What are the roles of this stakeholder?
- Which stakeholder is most impacted by the issue? Why?
- Which stakeholder will you need to approach to help your office address the resilience issue? Why?
- Overall, which stakeholder will you prioritize in the decision-making process and discussions on the resilience issue? Why?
- What are your concrete steps in approaching the stakeholders about the issue? Consider the resources you can mobilize, the time

your have to spend and the urgency of the actions.

ANOTHER EXAMPLE

Below are examples of the Network Mapping diagrams and tables as applied to a pandemic issue .

Example 2A - Pandemic
Office selected: City Health Department
Issue selected: Containing a pandemic of respiratory infection

Influencing Stakeholders	Impacted Stakeholders
– Epidemiology Experts – Healthcare Practitioners★ – Healthcare Industry★ – National Department of Health – President – Legislators (Senators and Congressmen) – City Mayor★	– Healthcare Practitioners★ – Healthcare Industry★ – Public Information Office/ Communications Department – Transportation Office – City Disaster Risk Reduction and Management Office – Barangay Health Centers – Barangay Captains – General Citizens – Business Owners – Service Industry – City Mayor★

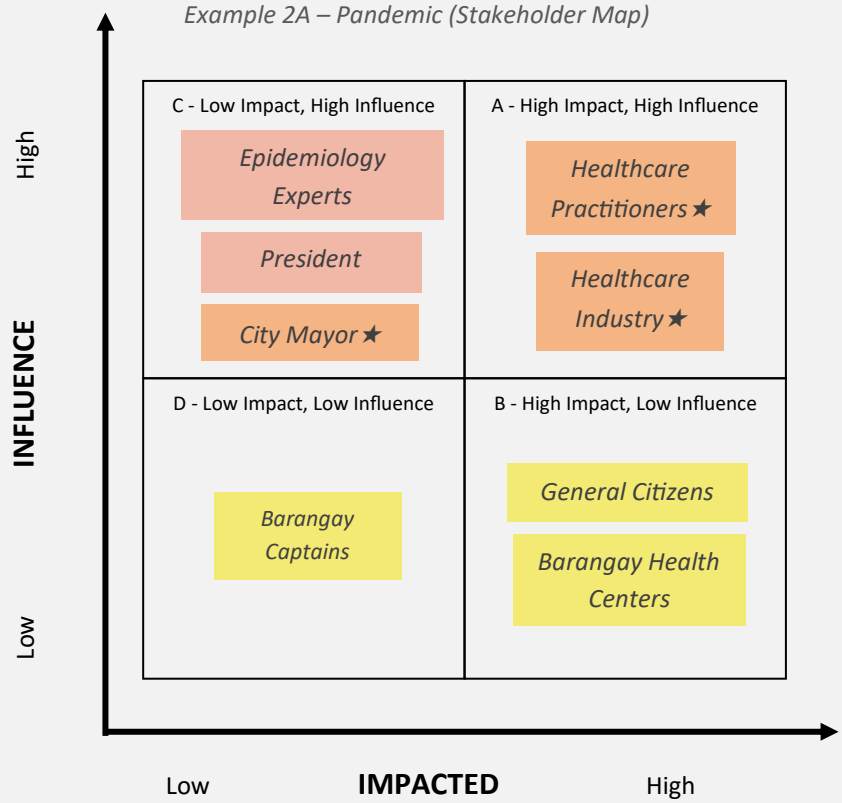
Example 2A—Pandemic
Shortlisted Stakeholder Metacards

Example 2A—Pandemic

Stakeholder	*How the stakeholder influences the decision (Y-axis)*		*How the stakeholder is impacted by the decision (X-axis)*	
	Level	*In what way?*	*Level*	*In what way?*
Epidemiology Experts	*High*	*Their expert advice would be needed for evidence-based decisions*	*Low*	*Our decision will not affect their capacity to do their work*
President	*High*	*Citizens must comply with the President's directives*	*Low*	*Our decision will not affect the President's capacity to do his/ her work*

Healthcare Practitioners	*High*	*How they weigh in on the situation and their capacity to serve affects how we will mobilize resources*	*High*	*Their welfare and capacity to work will be affected by the decision*
Healthcare Industry	*High*	*The capacity of healthcare facilities affect how we will mobilize resources*	*High*	*Our decisions will in turn also affect the extent to which they will deliver their services*
City Mayor	*High*	*Citizens and local offices must comply with directives of the City Mayor*	*Low*	*Our decision will not affect his/ her capacity to do work*
General Citizens	*Low*	*Citizens generally don't have direct influence on the decision*	*High*	*Their lives are most impacted by the decision*
Barangay Captains	*Low*	*The information they provide can minimally impact the decision*	*Low*	*They will have to implement our decision, but will not affect their capacity to work*
Barangay Health Centers	*Low*	*The information they provide can help in the decision, but somewhat minimally*	*High*	*Our decisions will in turn also affect the extent to which they will deliver their services*

Example 2A – Pandemic (Stakeholder Map)



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Greene, J. (2005). Stakeholders. In Encyclopedia of evaluation, edited by S. Mathison. Thousand Oaks, CA: Sage.

Stakeholder Dialogue/ Perspective Sharing

CHALLENGES TO BE ADDRESSED

The Myopia Principle states that no one person can see the whole of a complex system (Cabrera and Cabrera, 2019); thus, dialogue and collaboration are required among stakeholders. However, stakeholders may have conflicting views regarding an issue. This becomes a challenge when decision-making requires the consensus of all stakeholders, or when an intervention cannot proceed unless a certain stakeholder agrees to the terms. Negotiation is one tool, but still a challenge to use especially when fairness towards the interests of parties is concerned.

PURPOSE OF THE ACTIVITY

The activity uses causal loop diagram approaches to demonstrate the wealth of perspectives that can be considered to make the decision-making process more inclusive and meaningful across stakeholders. Collaborative conceptual modelling (CCM) (Newell and Proust, 2012) will also be used to assess similarities and differences in perspective towards conflict resolution. The activity also involves role playing to reach these goals.

RESILIENCE LINK

Our understanding of the resilience issue can be enriched by considering the perspectives of different stakeholders. More robust plans to promote resilience can then be developed considering the participation of multiple stakeholders. Even when disagreements exist, it would still be useful to recognize these points and to attempt to see where other stakeholders are coming from rather than outrightly dismissing their perspective. This will help foster smoother working relationships.

LEARNING OUTCOMES

- Practice negotiation with a stakeholder who might have a conflicting view of the issue.
- Identify and articulate negotiation points using the collaborative conceptual modeling.
- Explain how voices are heard or not heard in decision making.
- Strategize how to engage the public in resilience initiatives.
- Create a culture of inclusivity in decision-making.

SET UP

WHO

This activity requires no specific type of participant but basic knowledge of how to make causal loop diagrams is required. Take note of the affiliation of the participants.

NUMBER OF PEOPLE

A small number of people, typically 5-10, to be divided into two negotiating groups. If there are more than 10 people, the participants can divide themselves into groups of 3-5 members. There should be an even number of groups because two groups will have to negotiate with each other.

SPACE

There should be enough space for participants to sit comfortably .

TIME

This activity could take several minutes depending on your discussion.

MATERIALS & EQUIPMENT

- Manila paper
- Pieces of paper
- A pen or pencil
- Scotch tape/masking tape
- Optional but very useful material – Laptops and software for constructing causal loop diagrams: Vensim PLE (see "How to do we use this book?", page 7)
- LCD projector (if laptops and software will be used)

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Inform the participants that every decision they make should be based on which office/organization they belong to. Individuals belonging to the same office/organization must be in one group. If there are more than 5 members in a group, the group may split into two groups of 2-3 members each.

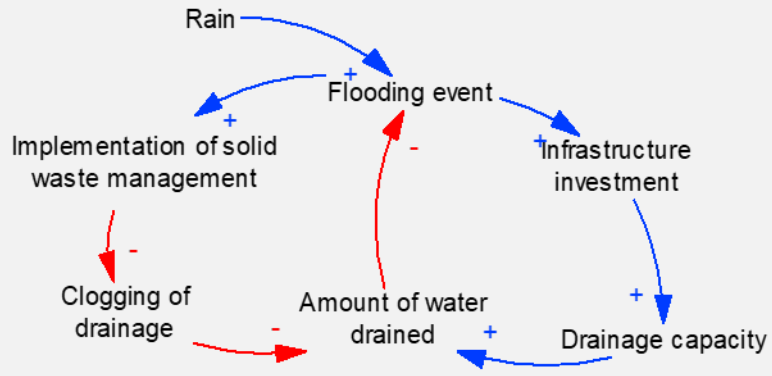
3. Ask participants to write the name of their group on a small piece of paper. Offices/organizations that have more than one group must have different group names. Set this aside for later.

4. Ask all participants, regardless of their group, to agree upon a resilience issue or challenge.

5. Ask each group to make a Causal Loop Diagram about the resilience issue. You may set a time limit for this step, around 15 to 20 minutes would be ideal. Each group must draw their CLD on a piece of paper. Ask the groups to keep the number of variables to a minimum, preferably 10 or less.
    - Also give each group time to discuss their answers to the question: "Based on your causal loop diagram, how can the resilience challenge be addressed?" They may provide more than one answer to this question.

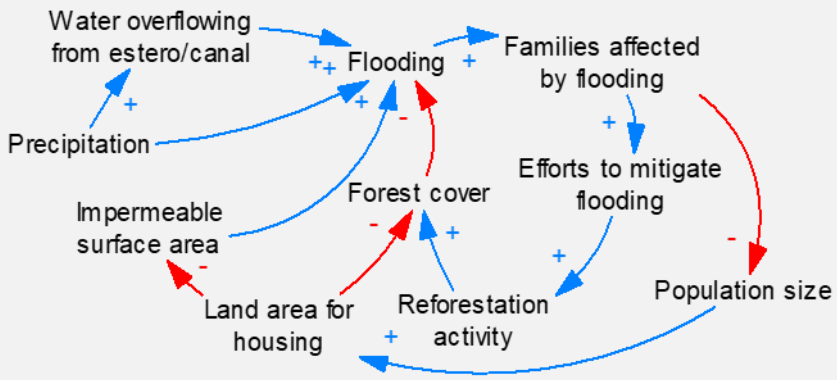
Example 2B - Flooding
Resilience issue selected: Flooding in the city during heavy rains

Group 1 Causal Loop Diagram:



How flooding can be addressed:
Allot more budget to increase the drainage capacity and implement solid waste management.

Group 2 Causal Loop Diagram:



How flooding can be addressed: Limit impermeable surfaces through reforestation activities and establish forest mitigation corridors

6. While the groups are making the CLD, take the pieces of paper with group names you set aside earlier and draw lots to determine the pairs of groups that will be working together for the Collaborative Conceptual Modelling.

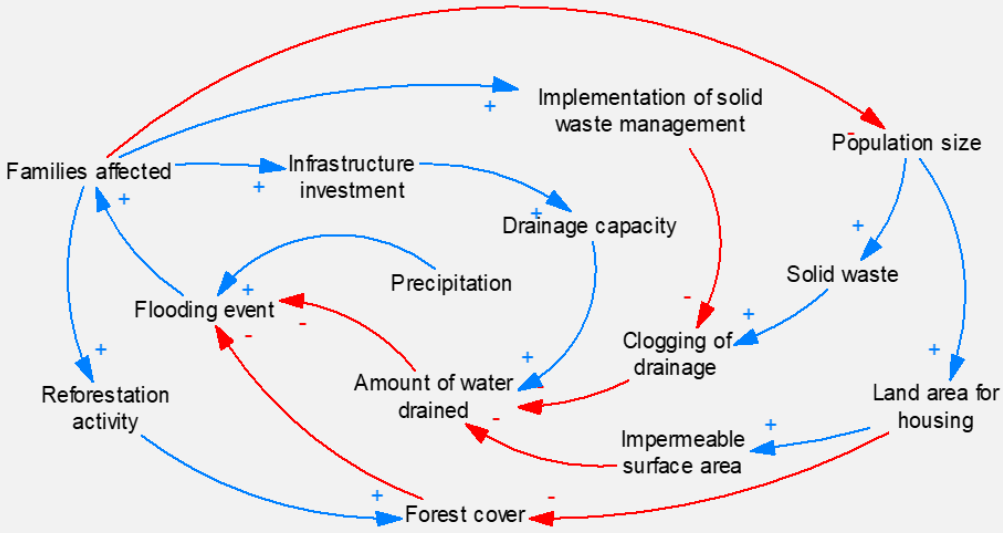
7. After all groups have finished with their CLD, ask the pairs of groups to sit together and discuss their CLDs to come up with only one CLD by negotiating and combining variables. This is the pair blending phase of CCM. Ask groups to keep the variables in their combined CLD to a minimum, preferably 15 or less. If there are many variables, then participants will have to discuss and negotiate with one another regarding which variables are important and should be kept in the diagram. Allot 30 to 40 minutes for this step. Ask them to draw the resulting CLD from the CCM on a Manila paper.

    - Note: if participants have a hard time combining the CLDs, you may carry out the activities on "*Participatory Learning*" (page 77) and "Negotiating *Terms of Agreement*" (page 86).

7. After finishing the pair blending phase, ask participants to identity feedback loops in their combined CLD. Also ask them to discuss the answer to the question "How do you think the resilience challenge can be addressed?"

8. Ask the groups to present their combined CLD and proposed solution to the resilience challenge.

Example 2B – Flooding
Pair Blending of Group 1 and Group 2 CLD



Important feedback loops identified:

- *Flooding event ⟶ Families affected ⟶ Implementation of solid waste management ⟶ Clogging of drainage ⟶ Amount of water drained*
- *Flooding event ⟶ Families affected ⟶ Infrastructure investment ⟶ Drainage capacity ⟶ Amount of water drained*
- *Flooding event ⟶ Families affected ⟶ Reforestation activity ⟶ Forest cover*

The above feedback loops are identified as balancing loops: they contain variables/ interventions that can reduce flooding event and, hence, the families affected due to flooding. These interventions are: increasing drainage capacity, implementing solid waste management properly, and increasing forest cover.

DEBRIEF

- During pair blending, did you discover common variables and feedback loops between your group's CLD and the other group's CLD?

- What was your process of combining your CLDs? Did you create a completely new CLD, did you eventually agree upon a CLD of the other group, did you attempt to incorporate and combine the different variables from the CLDs?

- Did you have to discuss which variables should be kept in the blended CLD and which could be removed? How did you come to an agreement? If you were not able to come to an agreement, what was the source of the disagreement and how did you finalize your diagram?

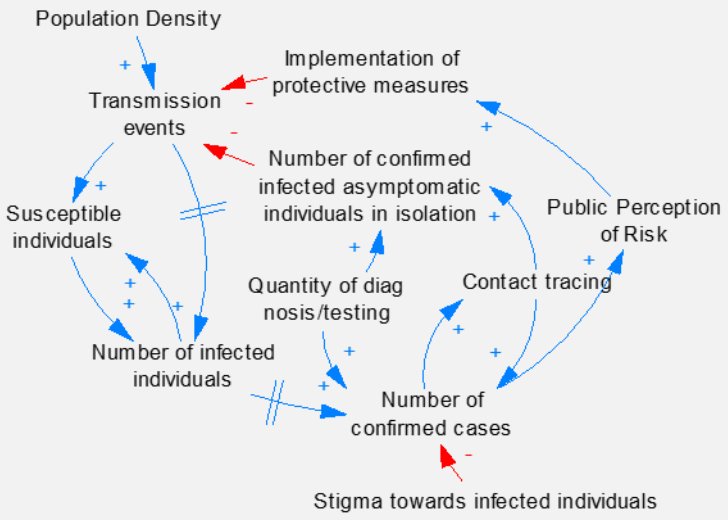
- Were there values and beliefs that surfaced when the groups discussed their CLDs to the statements? What are these?
- Were there data, historical information, or experiences that served as basis or context for the feedback loops in your combined CLD? If yes, what are these?
- What was the basis for your proposed initiative to address the challenge? Were you able to identify leverage points to efficiently address the challenge? What are the leverage points?
- What is the practical rationale for doing the pair blending? (e.i. why is it useful?)
    - Guide the participants towards realizing how pair-blending promotes discussion of worldviews, and how our understanding of a challenge can change by working together and considering each other's perspectives.

ANOTHER EXAMPLE

Below are examples of the Stakeholder Dialogue/Perspective Sharing diagrams as applied to a pandemic issue .

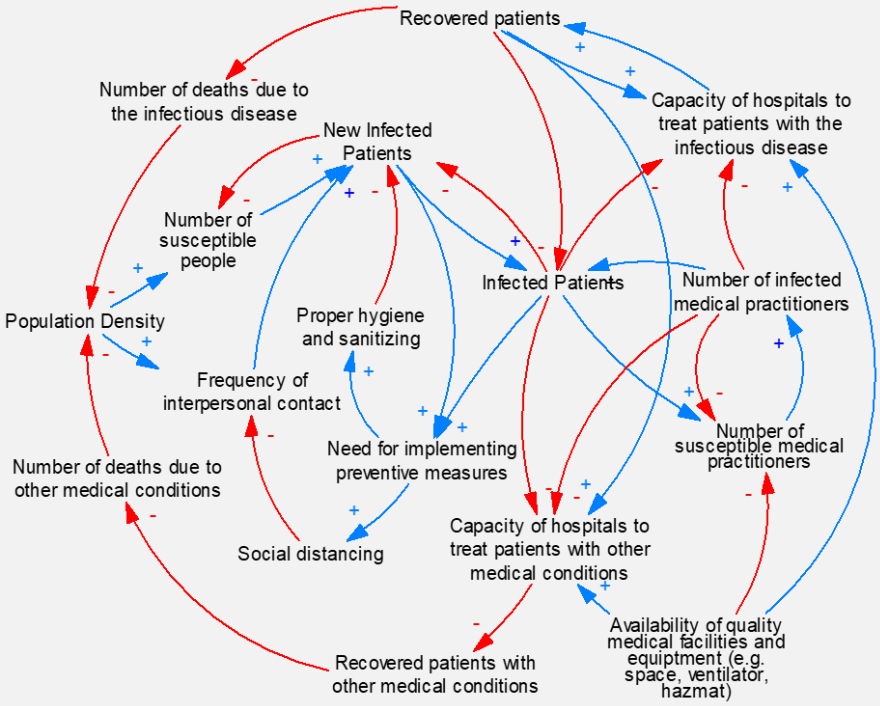
Example 2B – Pandemic
Resilience issue selected: Pandemic of respiratory infection

Group 1 Causal Loop Diagram:



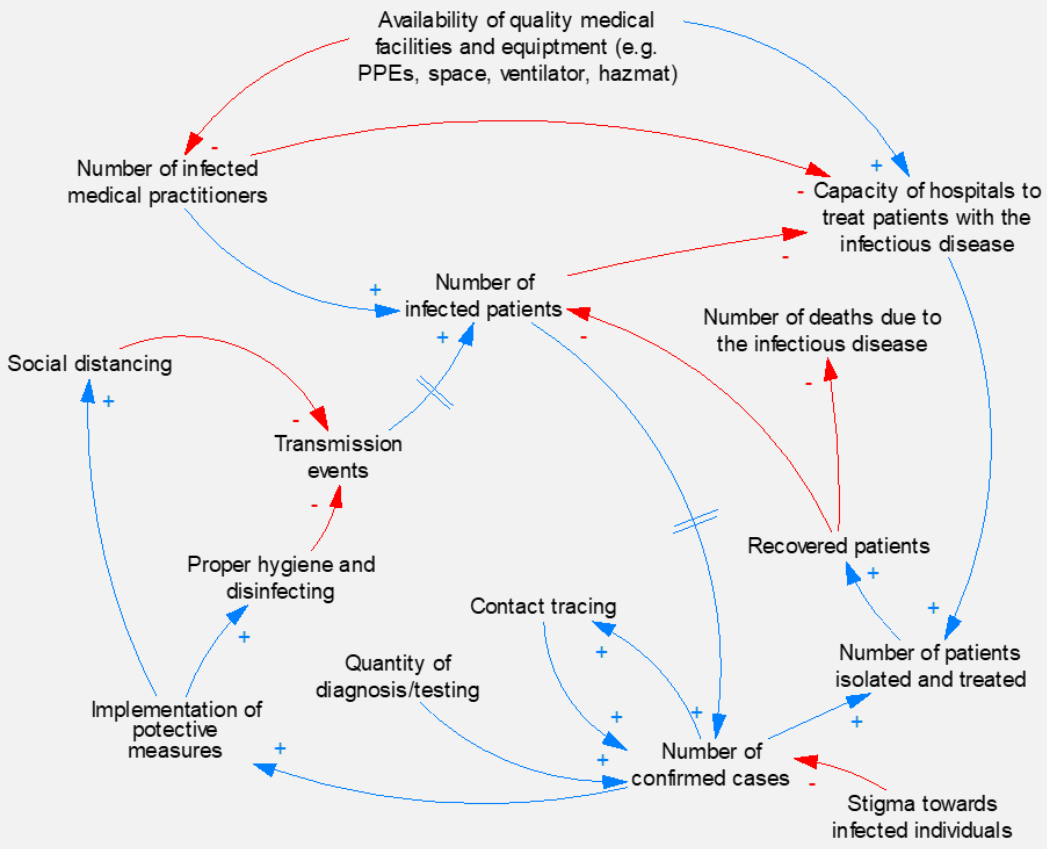
How the issue can be addressed:
Implement protective measures such as quarantines, increase testing capacity, and reduce stigma towards infected individuals.

Group 2 Causal Loop Diagram:



How the issue can be addressed: Implement preventive measures and increase capacity of the healthcare industry to respond to and treat patients

Example 2B – Pandemic
Pair Blending of Group 1 and Group 2 CLD (based on example above)



Important feedback loops identified:

- *Frequency of interpersonal contact ⟶ Transmission events ⟶ Number of susceptible individuals ⟶ Number of infected patients ⟶ Number of confirmed cases ⟶ Public Perception of Risk ⟶ Implementation of protective measures ⟶ Social distancing*
- *Number of susceptible individuals ⟶ Number of infected patients ⟶ Number of confirmed cases ⟶ Public perception of Risk ⟶ Implementation of protective measures ⟶ Proper hygiene and disinfecting ⟶ Transmission events*

The above feedback loops are identified as balancing loops: they contain variables/ interventions that can reduce transmission events, and consequently reduce number of infected individuals. These interventions are social distancing, and cleanliness in the form of proper hygiene and disinfecting the surroundings. It is worth noting that these loops also have delays, so the interventions must be sustained despite, for example, a dip in the number of confirmed cases.

The studies of Bradley et al. (2020); Brailsford, Angelis, and Mecoli (2007); and Luke and Stamatakis (2012) were useful in creating this causal loop diagram.

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Participatory Learning

CHALLENGES TO BE ADDRESSED

Engaging stakeholders, especially the marginalized groups towards genuine transformative participation process – i.e. from the intervention design to implementation – remains a challenge. This is crucial towards designing context-specific solutions and solving issues sustainably.

PURPOSE OF THE ACTIVITY

Engaging stakeholders allow us to see the problem more holistically (Cabrera and Cabrera, 2019; Senge, 1990). Each of us, each group, could have different values and beliefs that can also influence how we perceive an issue – we could have different mental models. This activity draws from the cognitive mapping and causal loop diagram approaches to demonstrate the wealth of perspectives that can be considered to make the decision-making process more inclusive and meaningful across stakeholders.

RESILIENCE LINK

Our understanding of the resilience issue can be enriched by considering the perspectives of different stakeholders. This means allowing them to participate in the planning process and to share their beliefs, values and cultures without fear of judgement. It also means recognizing and respecting differences if and when they arise, and working towards solutions that respect unique needs and contexts.

LEARNING OUTCOMES

- Describe what each group of actors/ stakeholders can learn from other groups.
- Articulate how learning from different stakeholders can help achieve resilience.
- Create a culture of inclusivity in decision-making.

SET UP

WHO

This activity requires no specific type of participant. It would be helpful to have more than one facilitator in this activity.

NUMBER OF PEOPLE

Around 30 participants to be divided into groups of 5-10, depending on the decision indicated in the third instruction below.

SPACE

A space big enough to comfortably fit 5-10 groups sitting in a circle.

TIME

The time for this activity could vary depending on whether other activities (Network Mapping, Stakeholder Dialogue) have already been conducted.

MATERIALS & EQUIPMENT

- Pen
- Pieces of paper per group
- Manila paper (or whiteboard/blackboard)
- Marker (or whiteboard marker/chalk)
- It would be helpful to already have metacard cut outs

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. If you have carried out the previous activities (Network Mapping or Stakeholder Dialogue/Perspective Sharing), you may skip Steps 3 and 4, and use the same issue and groupings for the role playing, then proceed to Step 5. If not, proceed to Step 3.

3. Start by having all participants agree upon a situation:

    - Select one resilience issue that your city/municipality is experiencing.

    - List down all the important groups in the city (e.g. city/municipal government, civil society organizations (CSOs), NGOs, private company, academe, youth, senior citizen, women's group, religious group).

4. Assign the participants to any of the groups above (e.g. government or CSO). Each group must have at least 2 members. Members of each group must play the role of their group (if they don't already below to such group).

5. Have all the participants agree to the questions they want to answer in relation to the issue by filling up the table below:

4Ws and H	Select or supply the verb	Finish the sentence
What	is/are/do/does/can/should/_	
Why	is/are/do/does/should/_	
Where	is/are/can/should/_	
Who	is/are/can/should/_	
How	can/_	

Example 2C – Flooding
Resilience issue: Reducing flooding due to heavy rains and clogged drainage

4Ws and H	*Select or supply the verb*	*Finish the question*
What	*is/are/do/does/can/should/ ____*	*What are the impacts of flooding?*
Why	*is/are/do/does/should/____*	*Why does it flood in the city?*
Where	*is/are/do/does/can/should/ ____*	*Where does it usually flood?*
Who	*is/are/can/should/____*	*Who are responsible in addressing this?*
How	*can/____*	*How can we address this?*

6. Break into groups now

- Allow time for each group to provide answers to the questions. Answers must be in complete sentences with complete thought (e.g. specify who "they" are; see example below). Each group must provide only one answer to each question. Remind them that they should be playing the part in providing the answer. Write answers in one sheet of paper. You may set a discussion time limit.

Example 2C – Flooding
Resilience issue: Reducing flooding due to heavy rains and clogged drainage

	Group 1 Answers	*Group 2 Answers*	*Group 3 Answers*
What	*Health-related concerns such as leptospirosis are the dangers of the flooding*	*Flooding causes heavy traffic*	*Flooding causes class and work suspension*
Why	*Clogged drainage causes flooding*	*Heavy rainfall causes flooding*	*Flooding occurs due to groundwater extraction*
Where	*Flooding occurs near the canal/estero*	*Flooding occurs in low-lying areas*	*It floods along the coastal areas*
Who	*Citizens along the estero must address this*	*The local government must address this*	*The law enforcers*
How	*Throwing trash properly can address this*	*The issue can be addressed by installing flood pumps*	*Law enforcers must apprehend those who illegally extract groundwater*

- While the groups are discussing their answers, cut out metacards that will fit the table below, and draw the table below in each of the metacards:

Statement	Group 1	Group 2	Group 3	Group 3	Group 4	…	Group N

- The number of columns after the statement must correspond to the number of groups (N). The number of metacards containing the table must also correspond to the number of groups.

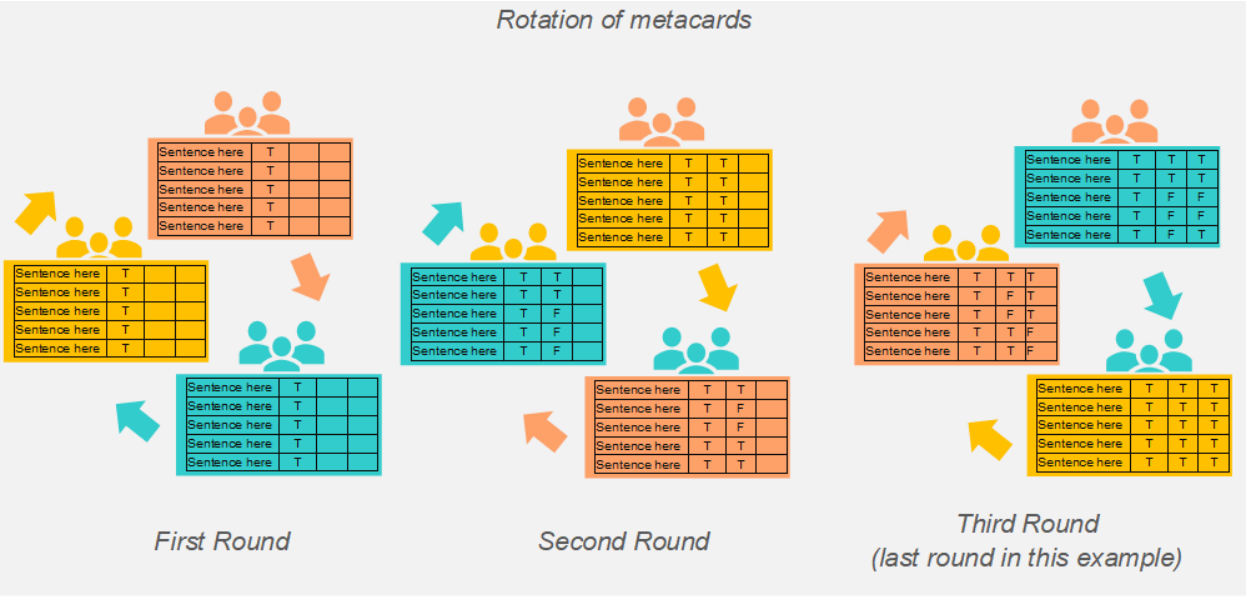
7. Give one metacard to each group and ask each group to write their answers in the "Statement" column.

8. Once all groups have finished providing their answers, focus everyone's attention to the metacard.

- The metacard will rotate until such time that the group receives their original metacard.

- For each rotation, the groups will indicate in their corresponding column T if they think the statement is true or F if they think the statement is false. All groups must answer including the group that provided the statement. The group that provided the statement must answer their metacard first.

- You may set a time limit for each set of rotation, ideally one to three minutes per rotation.



9. After all groups have answered the metacard, identify 3-5 statements that have the most conflicting answers (e.g. equal number of T or F across groups). If there is an odd number of groups, and results show unequal numbers of T and F, you may select statements in which there are at most 1 or 2 more Ts than Fs or vice versa. If there are more than 5 statements, select only 5 at random.

10. Write these statements on the board/Manila paper.

11. Ask the participants the following questions after reading each statement:

    - Which groups have answered T? Raise your hand. Which group answered F?

    - Ask: For groups that answered T, why is this your answer? For groups that answered F, why is this your answer?

Example 2C – Flooding

Health-related concerns such as leptospirosis are the dangers of the flooding	*T*	*T*	*T*
Clogged drainage causes flooding	*T*	*T*	*T*
Flooding occurs near the canal/estero	*T*	*F*	*F*
Citizens along the estero must address this	*T*	*F*	*F*
Throwing trash properly can address this	*T*	*F*	*T*
Flooding causes heavy traffic	*T*	*T*	*T*
Heavy rainfall causes flooding	*T*	*F*	*T*
Flooding occurs in low-lying areas	*T*	*F*	*T*
The local government must address this	*T*	*T*	*F*
The issue can be addressed by installing flood pumps	*T*	*T*	*F*
Flooding causes class and work suspension	*T*	*T*	*T*
Flooding occurs due to groundwater extraction	*T*	*T*	*T*
It floods along the coastal areas	*T*	*T*	*T*
The law enforcers	*T*	*T*	*T*
Law enforcers must apprehend those who illegally extract groundwater	*T*	*T*	*T*

DEBRIEF

- Are there similar statements across groups? If yes, why do you think this is so?
- Are there common explanations as to the T or F answer to the statements? If yes, why do you think so? If not, what could be the reason?
- Are there statements for which the groups were in conflict? What could be the reason behind this? Could the conflict be resolved by having more complete data, or are they cultural in nature?
- Are there values and beliefs that surfaced when the groups discussed their answers to the statements? What are these?
- Are there any insights you learned from the discussion of your group's T or F answers? What are these?
- Do you think participatory learning can help your city/municipality achieve resilience? Why?

ANOTHER EXAMPLE

Below are examples of the Participatory Learning tables applied to a pandemic issue.

Example 2C – Pandemic
Resilience issue: Pandemic of respiratory infection

4Ws and H	*Select or supply the verb*	*Finish the question*
What	*is/are/do/does/can/should/ ____*	*What can control the spread of the infection?*
Why	*is/are/do/does/should/____*	*Why are the number of cases increasing?*
Where	*is/are/do/does/can/should/ ____*	*Where are the highest cases located?*
Who	*is/are/can/should/____*	*Who are responsible for containing the spread of the infection?*
How	*can/____*	*How can we address this?*

Example 2C – Pandemic
Resilience issue: Reducing flooding due to heavy rains and clogged drainage

	Group 1 Answers	*Group 2 Answers*	*Group 3 Answers*
What	*Quarantine can help control the spread of the infection*	*Face masks can help control the spread of the infection*	*Clean surroundings and proper hygiene can help control the spread of the infection*
Why	*Cases are rising because we have only started mass testing*	*Cases are rising because asymptomatic individuals not tested can still interact with others*	*Cases are rising because we are only starting to detect more positives due to mass testing*
Where	*The highest cases are found in densely populated cities*	*The highest cases are in big cities*	*The highest cases are found in cities with many test kits*
Who	*All citizens are responsible for containing the spread of the infection*	*Medical frontliners are responsible for containing the spread of the infection*	*The local government is responsible for containing the spread of the infection*
How	*We can address this by complying with the quarantine measures*	*The issue can be addressed by enhancing the capacity of hospitals and medical centers to respond to the pandemic*	*We can address this by ensuring our surroundings are clean*

Example 2C – Pandemic

Quarantine can help control the spread of the infection	*T*	*T*	*T*
Cases are rising because we have only started mass testing	*T*	*T*	*T*
The highest cases are found in densely populated cities	*T*	*F*	*T*
All citizens are responsible for containing the spread of the infection	*T*	*T*	*T*
We can address this by complying with the quarantine measures	*T*	*T*	*T*

Face masks can help control the spread of the infection	*T*	*T*	*T*
Cases are rising because asymptomatic individuals not tested can still interact with others	*T*	*F*	*T*
The highest cases are in big cities	*T*	*F*	*T*
Medical frontliners are responsible for containing the spread of the infection	*T*	*F*	*T*
The issue can be addressed by enhancing the capacity of hospitals and medical centers to respond to the pandemic	*T*	*T*	*T*

Clean surroundings and proper hygiene can help control the spread of the infection	*T*	*T*	*T*
Cases are rising because we are only starting to detect more positives due to mass testing	*T*	*T*	*T*
The highest cases are found in cities with many test kits	*T*	*F*	*F*
The local government is responsible for containing the spread of the infection	*T*	*T*	*F*
We can address this by ensuring our surroundings are clean	*T*	*T*	*T*

REFERENCES

Cabrera D., Cabrera L. (2019) What Is Systems Thinking?. In: Spector M., Lockee B., Childress M. (eds) Learning, Design, and Technology. Springer, Cham. https://doi.org/10.1007/978-3-319-17727-4_100-1

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Negotiating Terms of Agreement

CHALLENGES TO BE ADDRESSED

Stakeholders may have conflicting views (i.e. different mental models) regarding an issue. This becomes a challenge when decision-making requires the consensus of all stakeholders, or when an intervention cannot proceed unless a certain stakeholder agrees to the terms. Negotiation is one tool, but still a challenge to use especially when fairness towards the interests of parties is concerned.

PURPOSE OF THE ACTIVITY

The activity uses Bargaining Arena (Duncan, 2015) to identify and articulate terms for negotiation. The activity also uses collaborative conceptual modelling (CCM) (Newell and Proust, 2012) to understand a certain issue from different stakeholder perspective and assessing the terms for negotiation to resolve conflict.

RESILIENCE LINK

While most people will agree on resilience as a goal or aspiration, we might disagree on the concrete actions to get there. Meaningfully engaging stakeholders means not ignoring these differences and instead providing opportunities for discussion and negotiation. In this way, we promote a sense of ownership across different stakeholder groups of the resilience plan that is developed.

LEARNING OUTCOMES

- Practice negotiating with a stakeholder who might have a conflicting view of the issue.
- Identify and articulate negotiation points using the collaborative conceptual modeling and the bargaining arena.

SET UP

WHO

This activity requires no specific type of participant but basic knowledge of how to make causal loop diagrams is required.

NUMBER OF PEOPLE

A small number of people, typically 5-10, to be divided into two negotiating groups. If there are more than 10 people, the participants can divide themselves into groups of 4-6 members. There should be an even number of groups because two groups will have to negotiate with each other.

SPACE

There should be enough space for participants to sit comfortably.

TIME

This activity could take 1-1.5 hours depending on your discussion and on whether the optional step on pair-blending CLDs is included.

MATERIALS & EQUIPMENT

- Pieces of paper
- Pen or pencil
- Scotch tape/masking tape
- Optional but very useful material – Laptops and software for constructing causal loop diagrams: Vensim PLE (see "How to do we use this book?", page 7)
- LCD projector (if laptops and software will be used)

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Start by briefing all participants of the situation around which the activity will revolve. For example:

    - Your city/municipality wants to implement measures to increase resilience against flooding.
    - Barangay A is one of the locations that experience flooding most frequently in the city/municipality. This barangay is located along a creek that overflows upon heavy rainfall.
    - The barangay comprises 50% informal settlements.
    - There are rumors circulating about the government planning to clear settlements within the 2-m buffer zone from the creeks in their jurisdiction.

3. Identify which groups will negotiate with whom (i.e. identify group pairs).

4. Let the negotiating groups select to be one of two parties in this example: city/municipal government or the people's organization in Barangay A. One group should represent the government, the other should be the people's organization.

5. Ask each group to make a Causal Loop Diagram about the resilience issue. They should play the part (e.g. as government or people's organization official) in accomplishing this. You may set a time limit for this step, around 15 to 20 minutes would be ideal. Each group must draw their CLD on a piece of paper or using Vensim PLE on a laptop.

6. Ask each group to discuss the following questions as they play the role of either the government or people's organization:

    - Based on your CLD, list down what you want to see or implement that you think can help increase the resilience of Barangay A against flooding. List down 3-5 items. Prioritize the list with 1 being the highest priority and 5 as the least priority. These are your terms.

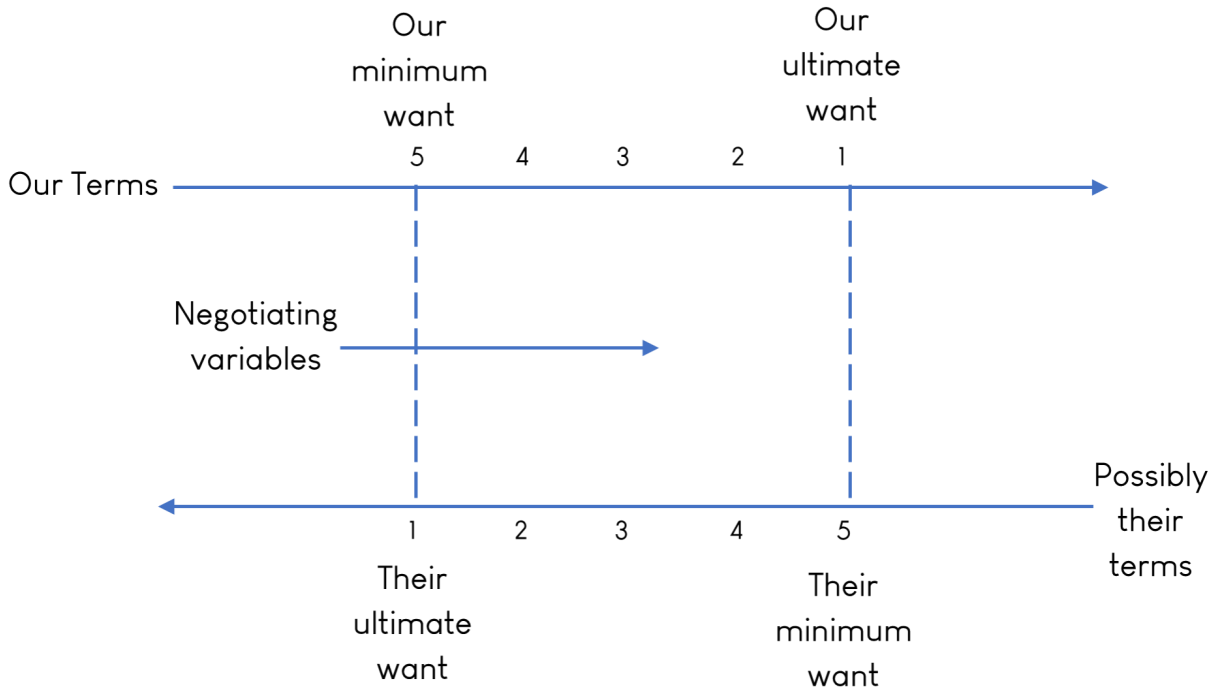
Example 2D – Flooding
(Based on Example 2B for flooding)

Our Terms:
Priority 1: Build flood walls along the esteros
Priority 2: Dredge the esteros regularly
Priority 3: Increase depth of esteros to increase capacity during flooding
Priority 4: Increase human resources to strictly implement solid waste management

Possibly Their Terms (considering the intervention of establishing forest mitigation corridors)
Priority 1: Relocate all settlers within the high risk flood zone
Priority 2: Clear out 5-m buffer along the estero
Priority 3: Clear out 2-m buffer along the estero
Priority 4: Widen the width of esteros

- Try to imagine what the opposite group might want to implement or see to increase the resilience of Barangay A against flooding. Prioritize the list as well from 1 to 5. These are possibly their terms.

7. Ask each group to plot the "Our Terms" and "Possibly Their Terms" in the figure below based on the discussion in Step 5. Draw the figure in a piece of paper. This is the Bargaining Arena.



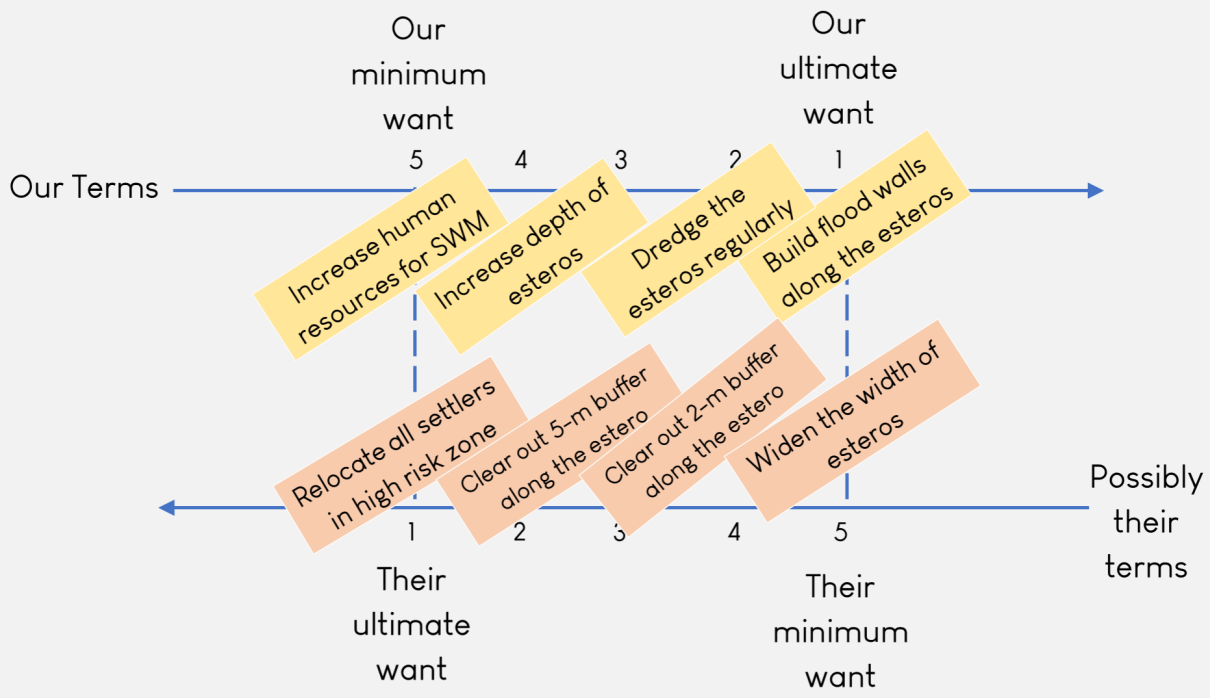
8. Ask each group to identify 2-3 negotiation points: aspects of their wants and the wants of the opposite group that may be used as points for negotiation. These can be in the form of "who", "what", "where", "when", or "how" variables. For example, if the government wants to relocate the households within the 2-meter buffer zone, but the people's organization wants the households to stay, the

government can try to negotiate up until "when" the households can stay to give them time to look for a new area or help them find "where" to relocate.

9. The next step is to give both groups time to present negotiation points to each other. Allot 5 minutes for this step. Ask whether the groups agree or not by answering yes or no (e.g. "Do you agree to these terms? Yes or No").

10. Ask the groups to discuss the negotiation points and agree on a set of terms. Try to accomplish this in 10 minutes.
    - If groups cannot come to an agreement: ask them to discuss the consequences of disagreement and how any adverse implications can be mitigated.

Example 2D – Flooding



Negotiation points:

- *Ask residents along the 1m buffer to adjust their settlement away from the buffer to make room for the flood wall*
- *Ask settlers to relocate voluntarily*
- *Gather volunteers to implement proper solid waste disposal*

11. (Optional: If time is limited, this step may be omitted.) After the groups present, give them time to discuss their CLDs to come up with only one CLD by negotiating variables. Allot 10 to 15 minutes for this step. This is the pair-blending part of Collaborative Conceptual

Modelling (CCM) process (see examples of pair blending in Stakeholder Dialogue activity, pages 71-75). Ask them to draw the resulting CLD from the CCM on a piece of paper (or using Vensim PLE).

DEBRIEF

- Did you have common or different CLD with the opposite group? What are the similarities? What are the differences? What do these indicate for how the different groups understand the same issue?
- Was it difficult to plot "our terms" and "possibly their terms"? How did you determine how to plot these terms from the "ultimate" to the "minimum"? Did everyone in the group agree on ultimate vs. minimum terms, and if not, how did you resolve conflicts?
- Did you agree with the negotiation points of the opposite group? Were you able to agree on terms? Why or why not? What did you do in cases when you could not reach an agreement?
- If pair-blending was done: How did your understanding of the issue change after doing the pair-blending of CLDs? Would you change your terms? Why or why not?
- Based on this activity, what did you learn about how to systematically negotiate terms and resolve conflict?

In your synthesis, discuss the importance of negotiation and collaboration in order to create win-win situations for both parties. However, recognize also that groups may not always come to an agreement, and that power dynamics may affect negotiating positions and willingness to compromise. Even if a final compromise was not attained, the activity can still be useful to show possible perspectives and at least start the process of dialogue.

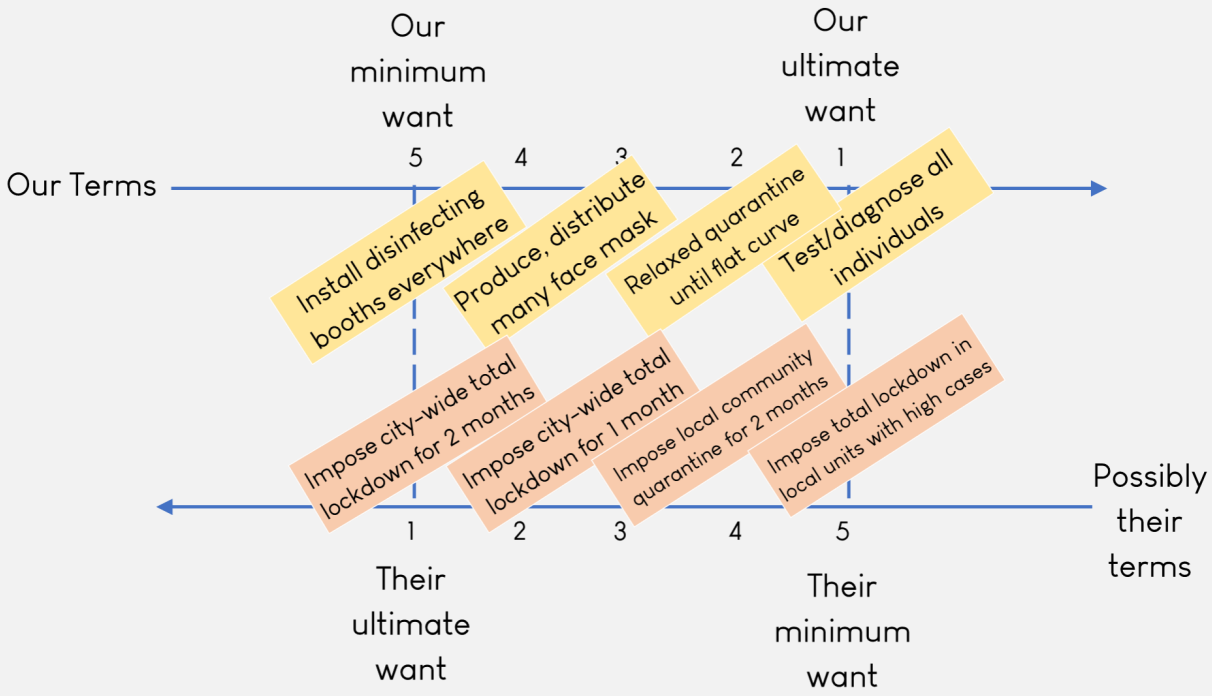
ANOTHER EXAMPLE

In the next page are examples of the Negotiating Terms of Agreement activity applied to a pandemic issue.

Example 2D – Pandemic
(Based on Example 2B for pandemic)

Our Terms:
Priority 1: Test/diagnose all individuals
Priority 2: Implement quarantine and social distancing until the curve flattens
Priority 3: Produce and distribute great quantities of face mask
Priority 4: Install disinfecting booths around the city

Their Terms:
Priority 1: Impose city-wide total lockdown for 2 months
Priority 2: Impose city-wide total lockdown for 1 month
Priority 3: Impose local community quarantine for 2 months
Priority 4: Impose total lockdown in local units with high cases



Negotiation points:

- *Carry out contact tracing and diagnose individuals from there*
- *Impose city-wide total lockdown for 1 month if majority of the cities have high incidence rates after other protective measures have been carried out: mass testing, distributing face masks, installing disinfecting booths; otherwise relax quarantine measures*

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ACTION PLANNING

This section contains activities that could help you and your team articulate desired goals, identify indicators, and plan out approaches to achieve your goals.

Vision-setting, pathways planning, and scenario-building

CHALLENGES TO BE ADDRESSED

Vision, or what people aspire for and deem desirable, are important in structuring actions and strategies, mustering support, and measuring progress. The vision helps define the functions or goals of systems (Senge, 1990). However, it is often left out in policy discussions, or assumed away.

The future is inherently uncertain, with different factors influencing how it may unfold. Combined with sparse data and drivers that are either difficult to measure or quantify, it makes managing challenges that span over long timescales more difficult.

PURPOSE OF THE ACTIVITY

This activity helps stakeholders describe the future that they want. It then uses this normative goal as a starting point to help them identify and structure different pathways, which consist of actions in the short, medium, and long-term to take them from where they currently are to where they want to be. This activity also enables stakeholders to evaluate the robustness of these actions and pathways across different plausible futures.

RESILIENCE LINK

A vision for what a resilient community or organizations looks like should serve as an anchor to align the planning process. Resilience cannot be attained overnight, so actions need to be broken down into concrete steps that build up over time. Furthermore, there are many uncertainties over how circumstances might develop in the future. Considering and planning for different scenarios will help build adaptability, flexibility and robustness within a community or organization, all of which contribute to resilience.

LEARNING OUTCOMES

- Articulate aspirations for the future.
- Develop steps and pathways to move from baseline conditions to the desired future.
- Identify critical factors and conditions that affect the feasibility and robustness of the different actions and pathways.
- Articulate different assumptions about the future and examine how it structures the space for transitioning from current conditions to envisioned future.

SET UP

WHO

No specific background is necessary, although it is ideal to have a diverse mix of participants.

NUMBER OF PEOPLE

Ideal size is 10 to 20 people that will be divided into groups of 3 to 5 .

SPACE

There should be enough space for participants to sit comfortably and break out into 3 to 5 groups .

TIME

This activity has three parts that can be run independently or sequentially. The time needed for each activity is as follows:

- Developing a shared vision – 30 minutes
- Formulating transition pathways – 90 to 120 minutes
- Building future scenarios – 30 minutes

MATERIALS & EQUIPMENT

- Metacards
- Permanent markers
- Adhesive tapes
- Manila paper

INSTRUCTIONS

This activity may follow the same groupings as the Issue Mapping activity in the Problem Diagnosis section if it was implemented.

Part 1: Developing a shared vision

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Ask the groups to discuss among themselves and identify one issue, theme, or sector that they would like to work on.

3. Have each of them write on a sheet of colored paper what their aspirations are for their chosen sector, issue, or theme of interest for the future. Ensure that these visions are clear and concrete. Inform them that these visions should not be limited to what they think is achievable given their histories and current conditions.

4. Ask them to share their individual visions with their group and come up with an integrated vision. This includes identifying contradictory elements and finding common grounds.

5. Instruct each group to write a coherent narrative of their vision. A coherent narrative is essentially a statement or a set of statements articulating the outcome that you want to achieve. It could also include what you see and feel if you achieve your aspirations.

Part 2: Formulating transition pathways

1. Using their vision as a starting point, ask groups to identify their scope (i.e. present time, end time, geographic boundaries) for planning. The scope establishes the boundaries of planning. The main boundary that participants need to set is the timeframe, or how long are they planning for, and how long they need to realize their vision.
    - After setting the timeframe, ask the groups to break down their time horizons for planning into the immediate/present

time, short-term, medium-term and long-term. It is up to the participants to identify how long is “short-”, “medium-” and “long-term” for their organizations or community, or given the urgency of the issue at hand.

- Other boundaries that participants can set are geographic boundaries/location and sector, depending on their planning objectives.

2. Ask each group to describe the current state vis-à-vis the desired future.

3. Have participants identify actions that will facilitate the transformation from where they are to where they want to be. Also have them identify the lead actors and members that are needed to implement each pathway. Use the table below to group the actions in a timeline. Ensure that similar actions build on each other sequentially.

4. Ask participants to cluster actions according to common themes and summarize them into overarching courses of action which we will now call “pathways.”

5. Have the participants articulate how each of the pathways contributes to achieving the vison.

Example 3A – Flooding *Vision: Locality is flood-free and flood-related impacts are minimized*					
Pathways and offices involved	*Actions Today/ Immediate Actions*	*Actions in the short-term (e.g. in 5 years)*	*Actions in the medium -term (e.g in 10 years)*	*Actions in the long-term (e.g. in 15-20 years)*	*Contribution to Achieving the vision*
Improve waste management *Lead:* *Environment and Natural Resources Office* *Members:* *Engineering office, Planning Office, Health Office, Public Information Office, Disaster Risk Reduction and Management Office, Representa-tives from civil society organizations and the academe*	*- Conduct waste stream and waste characteri-zation study and communicate results* *-Develop an improved waste management plan that addresses the issues raised from the study* *-Conduct information campaigns and implement incentive schemes to reduce waste generation at source* *-Gradually expand waste collection efficiency and recycling capacity* *-Conduct regular clean -ups of waterways*	*-Establish materials recovery facilities* *-Increase waste collection efficiency and materials recovery rate to 100%* *-Construct a solid waste disposal facility for residual wastes*	*-Convert solid waste disposal facility to a sanitary landfill* *-Increase recycling efficiency to 50%*	*-Recover energy from sanitary landfill*	*-Removes uncollected waste that clogs the storm drains and waterways* *-Removes breeding grounds for disease vectors*

Pathways and offices involved	Actions Today/ Immediate Actions	Actions in the short-term (e.g. in 5 years)	Actions in the medium-term (e.g in 10 years)	Actions in the long-term (e.g. in 15-20 years)	Contribution to Achieving the vision
Increase resilience of infrastructure to flood Lead: Planning and Development Office Members: Environment and Natural Resources Office, Engineering Office, Office of Architec-tural Planning and Design, Public Information Office, Disaster Risk Reduction and Manage-ment Office, Representatives from civil society organizations and the academe	-Assess the resilience of buildings to floods -Review existing building codes and update them to account for current and future flooding. Apply the revised building code to new projects -Evaluate the capacity of existing flood control infrastructures and explore non-engineering options	-Commence the retrofitting of existing buildings to make them flood-proof -Upgrade the capacity of flood control infrastructures (Ideally a mix of both engineering and non-engineering solutions) -Introduce flood insurance and other risk-sharing mechanisms	-Complete the flood-proofing of buildings -Continuously review and upgrade the capacity of flood control infrastructure -Increase the subscription to flood insurance and other risk sharing mechanisms to 50% -Allocate or purchase lands for managed setbacks	-Institute managed retreats for places that will be permanently inundated -Further increase subscription to risk sharing mechanisms to 100%	-Ensures that structures are resilient to flood and lessens economic losses due to flooding -Maximizes the co-benefits of flood control infrastruc-ture -Increases the capacity to reduce the volume of floodwaters and manage residual flood impacts
Rationalize land use Lead: Planning and Development Office Members: Environment and Natural Resources Office, Engineering Office, Office of Architectural Planning and Design, Public Information Office, Disaster Risk Reduction and Manage-ment Office, Representa-tives from civil society organizations and the academe	-Review land-use plans and compare with current land uses -Identify current land uses that has flood-related benefits and evaluate the feasibility of expansion -Develop a clear framework to evaluate tradeoffs and maximize benefits across different land-uses	Implement rationalized land-use plans using a combination of regulatory, economic, and information measures	Continue implementing the rationalized land-use plan	Continue implementing the rationalized land-use plan	-Reduces the exposure of assets to flood risk -Includes flood-related benefits in land-use decisions (e.g. increased infiltration, reduced exposure)

Pathways and offices involved	*Actions Today/ Immediate Actions*	*Actions in the short-term (e.g. in 5 years)*	*Actions in the medium-term (e.g in 10 years)*	*Actions in the long-term (e.g. in 15-20 years)*	*Contribution to Achieving the vision*
Improve domestic wastewater management *Lead:* *Environment and Natural Resources Office* *Members:* *Engineering office, Planning Office, Health Office, Public Information Office, Disaster Risk Reduction and Management Office, Representa-tives from civil society organizations and the academe*	*-Assess domestic wastewater treatment capacity, efficiency, and coverage* *-Study drivers of domestic wastewater generation and institute reduction measures*	*-Increase wastewater treatment capacity to cover 30% of total domestic wastewater generated* *-Improve treatment efficiency to be compliant with the national effluent standards*	*-Increase wastewater treatment capacity to cover 60% of total domestic wastewater generated* *-Make the effluent standards more stringent*	*Increase wastewater treatment capacity to treat all of the domestic wastewater generated*	*-Reduces risk of exposure to untreated sewage* *-Reduces risk of contaminating the water supply* *-Reduces the incidence of water-borne and water-related diseases during flooding*

Part 3: Building future scenarios

1. Ask each group to select two factors that are important in shaping the feasibility of their pathways and actions but are highly uncertain of in terms of future trends. Suggested categories are:
    - Social (e.g. preferences, behavior, consumption patterns, population characteristics)
    - Technological (e.g. efficiency, introduction of green technologies)
    - Economics (e.g. prices and costs, trade patterns and volume)
    - Environmental (e.g. climate change, waste production)
    - Policy Governance (e.g. governance structure, power balance, regulations, incentives)

In selecting the two factors, consider those that you think can have the most effect, in terms of hindering or enabling, your planned actions to realize your vision.

For example: In the case of flooding as the resilience issue, we might want to analyze possible scenarios in terms of population growth and extreme rainfall events (see example). Note, however, that this is not the only combination.

2. Based on the figure below, ask each group to assign their first factor in the x-axis and their second factor in the y-axis. Each quadrant represents a scenario that combines the possible future directions of their identified drivers.

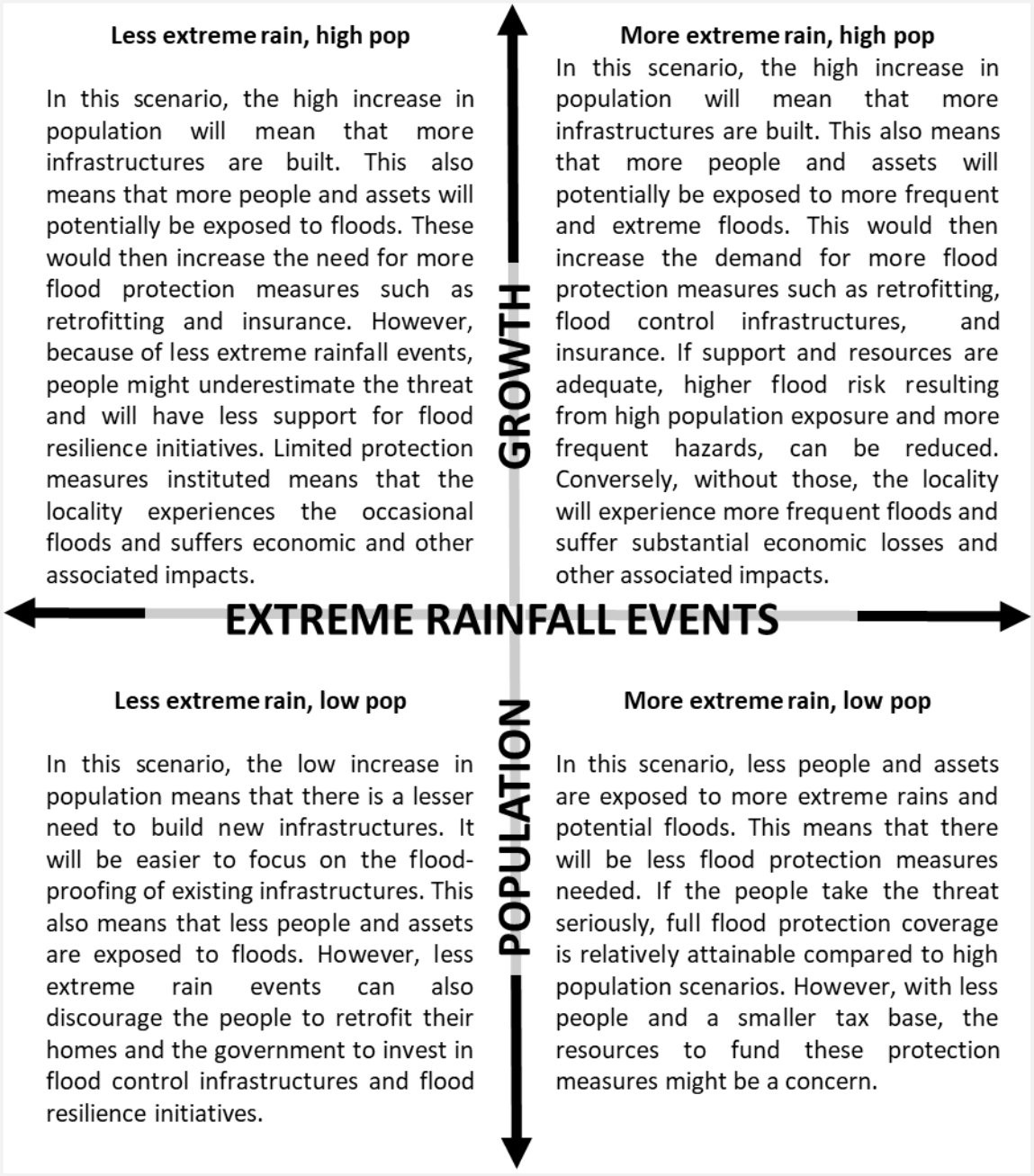
3. Ask participants to describe how each scenario might unfold in the future.

4. Have the participants assess the feasibility of each of their pathways under different scenarios. Depending on the scenario or pathway, the feasibility can be assessed in terms of economic, socio-cultural, political, environmental, and technical aspects. Ask participants to develop a short narrative to support their assessments, and place each narrative in the appropriate quadrant.

5. Have each group summarize which pathways are robust under different future scenarios.

Example 3A – Flooding

Scenario analyses for the pathway that aims to increase the resilience of flood control infrastructure. Selected factors are population growth and extreme rainfall (both frequency and severity of extreme events).



DEBRIEF

- Did the individuals in your group and/or the different groups share the same vision? If you disagreed on some elements, how did you resolve it?

- Was it useful to consider different timeframes in pathways planning? If so, how?

- While you were formulating your vision, did you think that it was attainable? After formulating actions and pathways, did your assessment on whether your vision was attainable change, or has it remained the same?

- Was it useful to consider combinations of factors in future scenario analysis? Why/why not? Would the specific actions of your pathways change depending on the scenario considered?

- Prior to this activity, what factors did you consider when you formulate your action plans? Have these factors changed or remained the same after the activity?

In your synthesis, explain the importance of the vision in setting the overall planning direction and in articulating the shared and desired futures of different stakeholders. Articulating what stakeholders deem as desirable can open possibilities for transformative actions and pathways because stakeholders are not constrained by what they deem as possible under present circumstances. Also highlight how disagreements in the vision elements might be inevitable given the diversity of stakeholders. Part of vision-setting is to bring those disagreements to the fore to be negotiated and resolved.

For developing transition pathways activity, explain how the assessment of the current conditions vis-à-vis the vision helps the participants determine their starting point and the series of actions needed to achieve their goal. The pathways method also structures the actions to sequentially build on each other and clarify how they contribute to realizing the vision. Proceed to explaining how scenario building familiarizes the participants to the notion of uncertainty and the possibility of preparing for them. Shortlisting the factors and

articulating how they think these factors affect the feasibility of the pathways can help them strategize and design options that are robust under different future conditions.

From here, it would be most advisable to move on to the activity on developing indicators. This will better ensure that the actions suggested are measurable and that progress can be monitored.

ANOTHER EXAMPLE

Below are the examples applying the activity to a pandemic issue:

Example 3B - Pandemic *Vision: Eradicate COVID-19 and minimize health and socio-economic impacts*					
Pathways	*Actions Today / Immediate Actions*	*Actions in the short-term* *(3 months)*	*Actions in the medium-term* *(6 months)*	*Actions in the long-term* *(1-5 years)*	*Contribution to Achieving the vision*
Isolate and treat confirmed cases	*-Build isolation facilities* *-Build testing facilities and repurpose existing facilities* *-Commence mass testing* *-Train LGUs to handle confirmed and suspected cases* *-Develop protocols and mechanisms for contact tracing*	*-Continue mass testing, contact tracing, and isolating suspect and positive cases* *-Increase number of testing facilities and their capacity* *-Build or repurpose secondary treatment centers to accommodate mild cases*	*-Continue mass testing* *-Build or repurpose buildings to monitor asymptomatic patients*	*-Fund researches that improve testing capacity and efficiency of contact tracing* *-Fund training of specialists and responders* *-Invest in a system for early detection of zoonotic diseases* *-Increase capacity of LGUs to handle infectious*	*-Reduces infection rates and mortality rates* *-Increases capacity to prevent subsequent outbreaks*

Pathways	Actions Today / Immediate Actions	Actions in the short-term (3 months)	Actions in the medium-term (6 months)	Actions in the long-term (1-5 years)	Contribution to Achieving the vision
Develop a vaccine or a cure for COVID-19	Provide funds for COVID-19 research	Continue to provide funds for COVID-19 research	Continue to provide funds for COVID-19 research	-Continue to provide funds for COVID-19 research -Invest in the development of laboratories, research infrastructure, and in educating and training scientists -Administer the vaccine or cure	-Reduces the susceptibility of the population to the virus -Reduces the mortality rate of those that get infected
Increase the capacity of the health care system	-Provide hospitals with necessary equipment, including PPEs -Constantly test health workers for the virus -Provide masks to the general population and affordable treatment to those infected	-Continue to provide essential supplies to hospitals and test health workers -Hire more health workers and increase the pay of existing health workers -Continue to extend affordable treatment to the infected population	Continue to provide essential supplies to hospitals and test health workers -Hire more health workers and increase the pay of existing health workers -Continue to extend affordable treatment to the infected population -Gradually expand capacity of health care infrastructure	-Continue to expand health care infrastructure and provide affordable health care -Expand the benefits of health care workers -Invest in programs that will make the population healthier -Invest in educating more health professionals	-Protects the healthcare workers from getting infected -Reduces the social impacts of the disease -increases the effectiveness to treat cases

Pathways	Actions Today / Immediate Actions	Actions in the short-term (3 months)	Actions in the medium-term (6 months)	Actions in the long-term (1-5 years)	Contribution to Achieving the vision
Increase the resilience of economic activities and businesses to shocks	-Provide emergency assistance to businesses and workers affected by policies to address COVID-19, such as community quarantines	-Assist businesses in developing and implementing business continuity plans -Streamline the supply chain of goods and services by identifying and addressing susceptibilities different types of shocks	-Continue to assist businesses in developing and implementing business continuity plans	-Diversify businesses and encourage localizing supply chains -Build stockpiles and institute other redundancy measures to minimize interruptions during shocks -Develop and increase the uptake of risk-sharing and risk-transfer mechanisms, such as insurance	-Reduces the risk of shocks to businesses -Increases the ability of businesses to recover from shocks
Increase the resilience of the education system to shocks	-Identify infrastructure and mechanisms that will enable remote learning while also ensuring universal access	-Build the infrastructure and mechanisms needed	-Gather feedbacks from teachers and students and refine those mechanisms -Upgrade infrastructure if needed	-Increase the capacity of schools to limit crowding (e.g. more classrooms and teachers) -Increase investment in education to increase the literacy rate and trained specialists	-Reduces the transmission rate -Reduces the social impacts of the disease

Pathways	Actions Today / Immediate Actions	Actions in the short-term (3 months)	Actions in the medium-term (6 months)	Actions in the long-term (1-5 years)	Contribution to Achieving the vision
Support the population to sustain social distancing and other measures to reduce the transmis-sion of the virus	- Clearly communicate the nature of the threat, responses taken, and the role of the population to limit virus transmission -Provide immediate assistance to groups that are affected by the policies (e.g. homeless, urban poor, daily wage workers) -Develop a plan to resume socio-economic activities under different scenarios -Impose a price freeze on masks and other essential goods to ensure access -Provide isolation facilities and temporary shelters to decongest dense settlements and ensure social distancing	-Gradually resume socio-economic activities while ensuring precautions are taken to prevent outbreaks -Divert the production of some industries to ensure adequate local supply of masks and other essential goods	-Resume socio-economic activities while instituting precaution-nary measures -Continue local production of essential goods -Continue to support affected populations	-Increase the capacity of public facilities to limit crowding -Raise the minimum wage to a livable amount to reduce vulnerabi-lity of families to shocks -Establish infrastruc-ture for timely distribution of assistance to affected populations for future shocks	-Reduces transmissio n rates without prolonging radical measures such as general lockdowns -Allows the population to better respond to and minimize outbreaks -Reduces the social impacts of the diseases

Example 3B – Pandemic
Building future scenarios: Selected factors are technological development and the strength of governance and other institutions

Low technological development, Strong institutions

In this scenario, institutions work for the benefit of the population and technologies are developed and harnessed for the common good. Thus the locality is able to prepare the population for outbreaks like Covid-19 in terms of detection and isolation of cases, robust healthcare system, provision of basic needs through sheer resourcefulness. A trusting relationship is also present between the population and the government. Thus, people willingly cooperate with policies that limit the infection rate. For example, people are willing to limit their movements and employ social distancing. They also comply with the closure of non-essential services because the owners and workers are given economic safety nets. All these will contain the disease outbreak. However, because of low technological development, a cure or a vaccine might not be forthcoming so the social and economic systems of the locality will have to be adjusted and restructured to sustain social distancing. The private sector, schools, and government will also have to look for new and effective systems that will limit crowding.

High technological development, Strong institutions

In this scenario, institutions work for the benefit of the population and technologies are developed and harnessed for the common good. The disease outbreak is contained early because it has developed a system to detect and respond to the risk of outbreaks. It also has the capacity to test a significant fraction of its population, isolate suspect cases, and treat positive cases. Given its robust technological and research infrastructure, a vaccine, or a cure is also likely to be developed. The population trusts the government and readily cooperates with policies that limit the spread of the disease, such as temporary closures of non-essential businesses and social distancing measures. Aside from trust, the citizens also cooperate because the government has given them adequate support to enable them to do so. Supply of masks, for example, are made available for everyone, and assistance is provided to those that are affected by the distributive impacts of the policies. In this scenario, loss to human lives and socio-economic impacts are minimized.

STRENGTH OF INSTITUTIONS

TECHNOLOGICAL DEVELOPMENT

Low technological development, Weak institutions

The threat of the outbreak will force the institutions to come up with mechanisms that will limit the infection rate amongst its population. This includes policies that will limit the movement and interaction of the people. Examples of these are heavy lockdowns, prolonged closures of establishments and cancellation of mass transportation. However, these policies will greatly impact socio-economic systems. Because of the absence of safety nets, people will eventually run out of resources and will look for opportunities to work. There will be an increased clamor for the resumption of economic activities and the institution will either impose stricter policies or give in to the demands without a plan on how to continuously limit the spread of the disease. In this case, it will be difficult to limit the infection rate and the death rate will also increase because of the lack of support to the healthcare system. The lack of technological development in terms of vaccine and cure will worsen the infection and death rates.

High technological development, Weak institutions

Given the high technological development, the locality has the ability to undertake massive testing. It is also likely to develop a cure or a vaccine. However, access to these advancements might be a concern because the institutions are primarily concerned with protecting the interests of the few. These institutions, however, will still try to limit the spread of the disease because outbreaks can foment discontent among the populace and challenge its legitimacy. These institutions will resort to policies that are highly disruptive such as heavy lockdowns and prolonged closures of businesses, schools, and other activities, without regard for their socio-economic impacts. Because feedback and accountability mechanisms are limited, they are unable to assess the effectiveness of these policies and adjust accordingly. In this scenario, death toll and human suffering are high, with the poor being disproportionately affected.

Developing Indicators

CHALLENGES TO BE ADDRESSED

Indicators are important in tracking progress and in supporting decision-making. They are likewise instrumental in shaping what people come to value. However, when defined inappropriately, indicators can confound efforts and produce unintended results and negative outcomes.

Developing indicators is inherently tentative and is subject to correction and improvement over time. It is, thus, not a one-off process. While important, developing indicators is also only one component of a broader information management system that systematically measures, reports, and evaluates initiatives and goals.

PURPOSE OF THE ACTIVITY

This activity helps participants to develop indicators to monitor outputs, outcomes, and unintended effects of initiatives and actions. It applies systems thinking to further develop integrated indicators that provide a snapshot of the baseline conditions or the goals vis-à-vis the initiatives that aim to change or achieve them.

This activity is intended to follow from the previous "Vision-settings" and "Pathways planning." The "Scenario-building" component is not necessary to conduct this activity.

RESILIENCE LINK

Resilience is not built overnight. Indicators are needed to track our progress and ensure that we are oriented towards our vision of a resilient community or organizations amidst changing conditions.

LEARNING OUTCOMES

- Develop indicators that measures progress and support decision-making.
- Formulate a plan for periodically revising and updating indicators to understand the evolutionary process of indicator development.

SET UP

WHO

Participants should be a mix of experts and other stakeholders.

NUMBER OF PEOPLE

Ideal size is 10 to 20 people that will be divided into groups of 3 to 5.

SPACE

There should be enough space for participants to sit comfortably and break out into 3 to 5 groups.

TIME

This activity will take about 90 minutes to complete.

MATERIALS & EQUIPMENT

- Permanent markers
- Manila paper

INSTRUCTIONS

1. Briefly explain the purpose, expected outcomes, resilience link, and mechanics of the activity.

2. Recall the visions, pathways, and actions that the participants formulated. Given these, ask the participants to state their aims in developing indicators (e.g. evaluate initiatives, raise awareness, support policy). It might be helpful to present a list of all the actions, or, to select the actions that will be prioritized in this activity.

3. Have participants brainstorm on possible indicators for each of the actions and cluster indicators according to:

    - Indicators of Outputs: indicators of concrete and measurable tasks and deliverables that represent the efforts to achieve an outcome.

    - Indicators of Outcomes that directly contribute to the vision: indicators relating to what the outputs (of the tasks) are supposed to achieve, contributing to the overall vision.

    - Other Outcome Indicators: indicators of impacts of the outputs that do not contribute to this goal but may influence other sectors or other goals; or indicators of outcomes that are implications of achieving this vision (e.g. implications of actions on budget). The influence can be good or bad, desirable (in this case, a co-benefit) or adverse.

4. Ask the participants to review and streamline similar indicators. It would be helpful for indicators to be formulated such that they represent a comparison with the baseline condition, actual goal, or a vision element (ideally expressed as a ratio or a fraction).

Example 3C – Flooding *Vision: Locality is flood-free and flood-related impacts are minimized* *Pathway: Improve waste management* *Aim: Track improvements in waste management and its contribution to the envisioned flood-free locality*			
Actions	*Indicators of Outputs (Measurable)*	*Indicators of Outcomes (Estimate how much they contribute to the vision)*	*Other Outcome Indicators (Can be good or bad)*
Gradually expand waste collection efficiency and recycling capacity	*-% of households covered by waste collection system* *-fraction and volume of waste collected from total waste generated* *-fraction and volume of recyclable waste recovered from total recyclables generated*	*-% increase in discharge capacity of waterways and storm drains due to the reduction of uncollected waste* *-% reduction in the incidence of flood-related diseases*	*-Additional income earned from recycling in Php* *-Reduction in pollution loads resulting from improperly disposed and uncollected waste (units, e.g. ppm, etc., depend on the pollutant being considered)* *-Increased expenditure for waste collection and disposal in Php*
Conduct information campaigns and implement incentive schemes to reduce waste generation at source	*-% of households that participate in the incentive schemes* *-% decrease in waste generation relative to the baseline*	*-% decrease in the volume of uncollected waste that ends up in waterways* *-% increase in discharge capacity of waterways and storm drains due to the reduction of uncollected waste*	*-Additional household income from possible incentives in Php* *-Faulty incentives can result to leakages and higher volume of waste generated (e.g. disposing waste in neighboring locality that does not have collection fees, increase in backyard burning, increase in generating other waste types that do not have additional environmental fees)* *-Potential savings from planned expansion of collection and disposal capacities because of lower waste generation volumes, in Php*

Conduct regular clean ups of waterways	*-% of waterways cleaned up over total waterways in municipality* *-Frequency of clean-up* *- Volume of waste recovered from the waterways*	*-% increase in discharge capacity of waterways due to the removal of uncollected waste*	*-Increased expenditure for the clean-up activities in Php* *-Exposure to health hazards of clean-up workers/ volunteers*

5. Ask the participants to present and share their indicators and their rationale for indicator selection with other groups. Solicit inputs and feedback from other groups. Guide questions for feedback may include:

    - Are the indicators clear and concrete?
    - Are the indicators relevant and aligned with the outputs and outcomes (i.e. directly match and measure progress on the proposed outputs and outcomes of the pathway)?
    - What data are needed for these indicators? Are these data already being gathered? Who is or would be responsible? How often are data-gathered? Does a monitoring protocol exist? (Specifically, baseline data for the proposed indicators would be important since progress cannot be measured without knowing the baseline.)

6. Have the participants develop a brief plan on reviewing and updating the set of indicators. Among others, the plan should cover:

    - Frequency of updating and evaluating the validity of indicators.
    - Participants who will be part of the periodic review.

Indicators for Pathway 1: Improve flood management					
Action 1 indicators: *Gradually expand waste collection efficiency and recycling capacity*	*Baseline year*	*Data collection frequency*	*Offices responsible for data collection and processing*	*Review frequency of indicator validity*	*Offices responsible for reviewing indicator validity*
% of households covered by waste collection system	*2010*	*annual*	*Environmental and Natural Resources Office*	*Every three years*	*Environmental and Natural Resources Office, Engineering Office, Disaster Risk Reduction and Management office, Local academic partners*
fraction and volume of waste collected from total waste generated	*2010*	*quarterly*	*Environmental and Natural Resources Office*	*Every three years*	*Environmental and Natural Resources Office, Engineering Office, Disaster Risk Reduction and Management office, Local academic partners*
% change in discharge capacity of waterways and storm drains due to the reduction of	*2010*	*annual*	*Engineering Office*	*Every three years*	*Environmental and Natural Resources Office, Engineering Office, Disaster Risk Reduction and Management office, Local academic partners*
% change in the incidence of flood-related diseases	*2010*	*biannual*	*Health Office*	*Every three years*	*Health Office, Engineering Office, Environmental and Natural Resources Office, Local academic partners*
income earned from recycling in Php	*2010*	*monthly*	*Environmental and Natural Resources Office*	*Every three years*	*Environmental and Natural Resources Office, Local academic partners*
Expenditure for waste collection and disposal in Php	*2010*	*annual*	*Budget Office*	*Every three years*	*Budget Office, Environmental and Natural Resources Office, Disaster Risk Reduction and Management office, Planning and Development Office*
Action 2 Indicators…					

DEBRIEF

- Did How do the indicators aid in monitoring and evaluation?
- Did the process of developing indicators help clarify how actions and pathways contribute to the goals & in what way?
- Prior to the workshop, what factors do you consider when you develop indicators? Have these factors changed or remained the same after the activity?
- How have the backgrounds of the group members contributed or hindered the formulation of indicators?
- Do the selected indicators match current data-gathering and monitoring processes and protocols? Or are there gaps between the data needed and the data gathered? If so, what can be done to close the gap?

In your synthesis, emphasize the importance of well-defined indicators for monitoring progress towards the overall vision, and how we can have different types of indicators. So as not to conflate outputs with outcomes, we need to develop indicators that measure effectiveness (i.e. towards the outcome) and not just intensity of efforts/activities (i.e. the outputs). Stakeholder feedback could be important in setting indicators to encourage the breadth of perspective (e.g. people from other sectors could see other indicators) and ensure that these indicators are feasible (e.g. that data is being gathered or can be gathered to assess these indicators).

ANOTHER EXAMPLE

Below is the example of Developing Indicators table as applied to a pandemic issue:

Example 3C – Pandemic *Aim: Monitor the effectiveness of measures to test, isolate, and treat COVID-19 cases*			
Actions	*Indicators of Outputs (Measurable)*	*Indicators of Outcomes (Estimate how much they contribute to the vision)*	*Other Outcome Indicators (Can be good or bad)*
Increase the capacity of hospitals to treat COVID-19 cases	*-Capacity of hospitals dedicated to COVID-19 cases/Total cases needing hospitalization* *-Number of ventilators and other hospital equipment available to handle COVID-19 cases/Total cases needing that particular equipment* *-Number of health professionals/Total cases needing support of health professionals* *-Case fatality rate* *-Average length of stay*	*-Increase in number of recoveries* *-Decrease in fatalities*	*-Diversion of resources dedicated for other diseases and development priorities to handling COVID-19* *-Increased expenditure for hospital infrastructure, human resources in Php* *-Demand for more healthcare workers* *-Increased exposure of health care workers*
Detect disease prevalence through testing	*-Number of individuals tested/Total population* *-Number of tests that are positive/number of tests conducted* *-Sample processing time*	*-% Positives that are detected vis-à-vis modelled estimates* *-% Reduction in transmission rate due to rapid detection and isolation of positive cases*	*-Increased cost of testing in Php* *-Reduction of new cases and potential reduction in fatality rates due to early detection* *-Limits spread of the disease & potential savings resulting from avoided hospitalizations and disruptions in socio-economic activities* *-Exposure of laboratory analysts*

Actions	Indicators of Outputs (Measurable)	Indicators of Outcomes (Estimate how much they contribute to the vision)	Other Outcome Indicators (Can be good or bad)
Develop and implement a system for contact tracing	-People traced and contacted/modelled estimates of likely number of people the infected interacted with -Number of identified clusters -Time taken to trace all the possible contacts	-% reduction in disease transmission due to timely and thorough contact tracing	-Reduction of new cases and potential reduction in fatality rates -Limits the spread of the disease and potential savings from avoided hospitalizations and disruptions in socio-economic activities -Potential violations to privacy

Glossary of Terms

Archetypes – system archetypes are common patterns of behavior that can be found across different systems. They usually represent recurring "traps" that systems may find themselves in; however, recognizing these "traps" may lead to opportunities for improvement.

Causal loop diagram – a visual representation of causal relationships within a system, depicting the polarities of relationships (+/–) and overall types of feedbacks of the loops (balancing or reinforcing).

Influence diagram – similar to a causal loop diagram, this is a visual representation of factors that influence each other in a system, but often without the details on the polarities of the arrows and overall loop types.

Mental models – worldviews or perspectives; one's way of understanding and interpreting the world that often underpins structures and actions

Outcomes – the end result or achievement, often defined in relation to an overall vision or goal

Outputs – concrete tasks and deliverables intended to contribute towards achieving a certain outcome

Pathways – an overall course of action or way of proceeding towards, in this case, achieving a specific vision

Scenario – a hypothetical set of circumstances, often projected in the future

System – comprises components that relate or interact with each other in specific ways to perform a function or achieve a purpose or goal.

System boundaries – the scope of a system, often needing to be delineated in accordance with the planning concern or research

question at hand, given the complex interconnections of human society-environment systems.

System structure – the specific arrangement of components in a system

Time horizon – period of time over which the analysis, planning or action is being conducted

City Resilience Toolkit (CResT):
A Compendium of Systems Thinking
Activities for Resilience Planning
Pilot Version

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