

STICHTING DELTARES

Circle-Bao Workshop Guideline

**A participatory workshop on Critical Infrastructure
and cascading effects**

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This is a practical guideline for conducting a participatory Circle-Bao workshop on Critical Infrastructure and cascading effects. Please read this document thoroughly for preparing, planning and conduction of the workshop.

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1 Overview

Circle-Bao workshops facilitate the process of knowledge co-creation among critical infrastructure (CI) operators and other relevant stakeholders. Expert knowledge is gathered in a participatory manner about the vulnerability of the CI to floods, their interdependencies and cascading effects with one another. The objective is also to identify the severity of cascading impacts on different vulnerable groups based on age, gender, income, disabilities and geographical location. Through this process, the stakeholders build their awareness and learn from one another about risk management measures and possible means for cooperation, ultimately resulting in cooperative mitigation strategies.

The Circle-Bao workshop employs the Circle-Bao tool, inspired by the famous Eastern African game 'Bao', to collect and visualise this information. Circle-Bao tool is an analogue version of the Circle tool developed by Deltares. The analogue format allows for the use of the tool in a setup with limited technical facilities.

For conventional workshops, hazard maps, exposure data and expose maps are collected and used as the inputs for the workshop to support the knowledge co-creation process. The typical output of a workshop is a visualisation in the digital version of the Circle tool.

A Circle-Bao workshop can utilise the Circle-Bao tool alone or be combined with other tools to support a more detailed discussion. The Circle-Bao workshop can consist of a standalone workshop or multiple workshops depending on the clients' perspective needs and expected outputs.

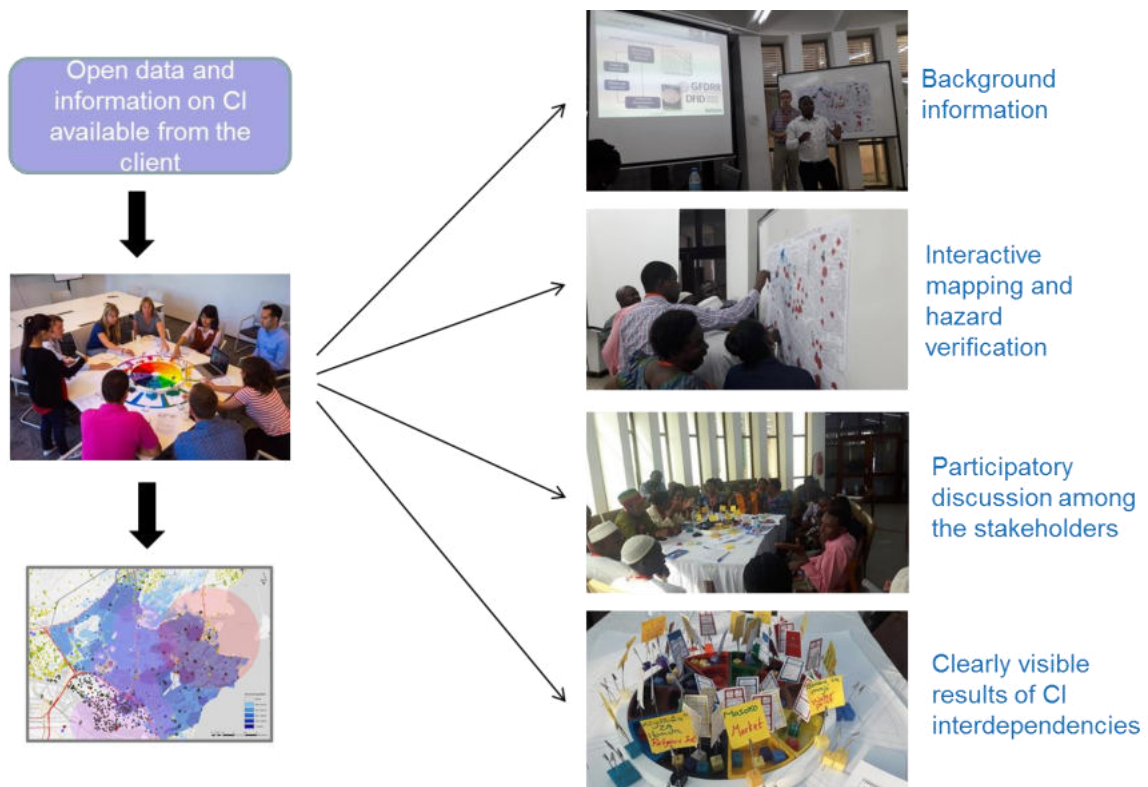


Figure 1 Circle-Bao approach

1.1 Objectives

Following are the general objectives of Circle-Bao workshop:

- Identifying the direct impacts of flooding on CI and vulnerable groups in the society
- Getting an overview of the interdependencies among the CI networks
- Comprehensive visualisation of the cascading effects of disruption or failure of CI
- Identifying the most significant and vulnerable CI
- Identifying priority risk reduction measures to increase the resilience of CI and reduce the vulnerability of the society
- Increased cooperation between stakeholders

1.2 Preparations

Preparation before the Circle-Bao workshop is vital. Following steps are essential to take into consideration.

- Collect hazard and exposure data collection
 - CI locations from Open Street Map or other data
 - Flood extent simulation or map
- Generate maps or animations for the workshop given the available data
- Organise a meeting with relevant CI operators

1.3 Output

Following outputs can be expected from a Circle-Bao workshop

- Circle-Bao visualisation, later translated into digital Circle visualisation
- Animation which uses the set of knowledge rules collected in the workshop
- Recommendations on basic measures

2 Workshop delivery

The following steps outline the main activities and outputs at different stages of the Circle-Bao workshop preparation, delivery and follow up.

2.1 Workshop preparation

- A. Define the workshop objectives and expected output together with the client
- B. Collect hazard and exposure data to generate maps for the workshop.
- C. Support the client to organise participation from as many of the relevant CI operators and vulnerable object and groups' representative as possible.
- D. Assign roles to the team members and the clients supporting staff for the workshop. The main team roles include;
 - i. Facilitator: Controls the overall discussion
 - ii. Data manager: Adds information directly into the cards of the Circle-Bao tool
 - iii. Observer: Assesses the situation in the room and advises the facilitator
 - iv. Recorder: Takes notes of the complete session
- E. Collect supporting movies and powerpoint presentation materials.
- F. Prepare the Circle-Bao kit (for direct impact, and cascading impacts). Check if the cards are to be prepared in local language. The quantities of materials given in Table 1 are for a single workshop. If the idea is to hold several workshops, then increase the number of materials accordingly.

Table 1 Circle-Bao workshop preparation materials

	Quantity	Remarks
Pawns	Take 10 for each colour	
Direct impacts	15	Print and cut-out
Low cascading impact	50	Print and cut-out
Medium cascading impact	50	Print and cut-out
High cascading impact	50	Print and cut-out
Data storage excel sheet	2	Print
Circle of influence	3	Print
Evaluation form	Depending on the number of participants, always take few more	Print
Reflective information	Each for facilitator and co-facilitator	Print
Post-its, stickers		As per need
Hazard map	2	
Screen shots of time steps	2 sets	

2.2 Workshop Delivery

The following steps can be taken during the workshop. All the steps are described in detail below.

Step 1: Introduction of CI, direct and cascading impacts

Step 2: Interactive mapping discussion

Step 3: Hazard verification

Step 4: Critical Infrastructure prioritisation

Step 5: Prepare the Circle-Bao tool

Step 6: Circle-Bao tool session

Step 7: Prioritization of Risk-reduction measures

Step 8: Feedback and reflective information

Step 9: Data storage

Step 10: Data visualisation

Step 1: Introduction of CI, direct and cascading impacts

- A. A short Powerpoint presentation to give brief introduction to CI, direct impacts of flooding on CI and cascading impacts of CI disruption or failure
- B. This should include some examples of the series of these impacts. For e.g. Flooding occurs, Direct impact of flooding on Road, Cascading impact of Road disruption on Industry because supplies cannot reach there.
- C. The introduction can include the videos of previous Circle workshops e.g. Cork, Waterland
- D. **Output:** General idea about direct impacts of flooding on CI and cascading impacts of flooding

Step 2: Interactive mapping of CI in the area on a Hazard Map

- A. A hazard map (flood extent) is presented in a hard copy map stuck on the wall e.g. 1/50 yr (see below for Manzese ward, Dar es Salaam, Tanzania)
- B. Discuss the missing CI data and add on the map. This can be done in different ways:
 - i. Use stickers and basic mapping on paper in 2D
 - ii. Participants can draw on the map or stick additional symbols where CI objects are missing.
- C. **Output:** Verification of CI mapped and mapping of missing CIs on the map

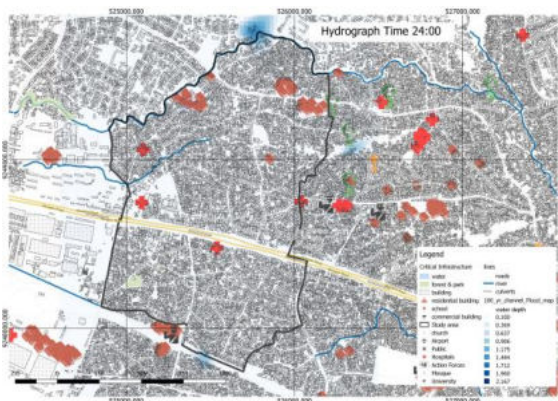


Figure 2 Flood hazard map for Manzese ward, Dar es Salaam, Tanzania (50 year return period)



Figure 3 Interactive mapping exercise with local stakeholders

Step 3: Hazard verification

- A. Validate the hazard map with the stakeholders and discuss if the hazard presented is the most relevant
- B. Discuss the CI locations in the hazard map. If possible, clarify the objects and highlight the most vulnerable objects on the map
- C. **Output:** The hazard map will be validated. Also, the vulnerabilities of CI to the flooding will be visible.

Step 4: Critical Infrastructure prioritisation

- A. Ask the stakeholders to introduce themselves stating
 - i. The CI they represent
 - ii. Their ability to handle such a hazard event as presented in the map
- B. Discuss which are the most important CI in the area
- C. Identify and categorise 10 most important CI in the region for further discussion during Circle-Bao session. e.g. electricity substations above or below ground level
- D. **Output:** Prioritization of the most important CI in the area, that will be further discussed in Circle-Bao session

Step 5: Prepare the Circle-Bao tool

- A. Decide which box in the board will represent which CI
- B. Hand the pawns of respective color to the representative of the CI
- C. **Output:** Circle-Bao tool is ready for the Circle-Bao session

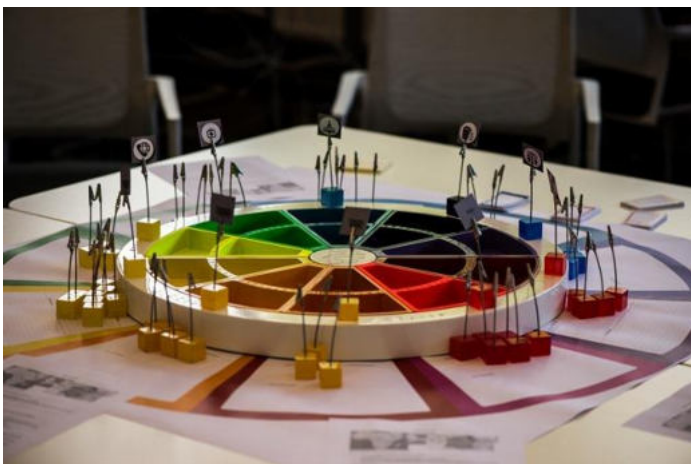


Figure 4 Circle-Bao tool ready for Circle session

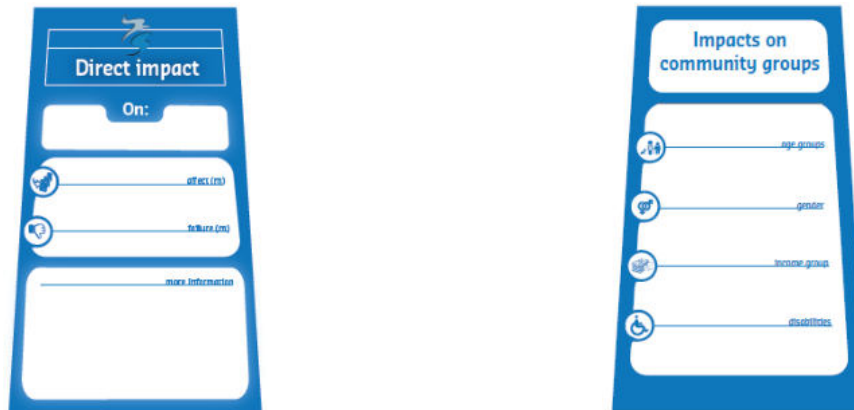
Step 6: Circle-Bao tool session

For this session, the facilitator, data manager, observer and recorder must be alert throughout the session.

A. Direct impacts identification:

For identifying the direct impacts of flooding on each CI, the facilitator must first single out one infrastructure system to begin the discussion. Ask not only the quantitative values but also ask for explanation on how they are affected. The information gathered under direct impacts include the thresholds when the CI starts getting affected and when it fails (see Figure 5a). On the other side of

the direct impact card, the impacts on the vulnerable groups of the communities (see Figure 5b) should be filled in.



- a. Information on the water depth when the CI gets affected or fails
- b. Information on impacts on the community groups due to disruption or failure of the CI

Figure 5 Two sides of the Direct impact card

Following questions can be used to get the information for identifying direct impacts of flooding on CI.

1. ***Does the CI you represent get affected during flooding? How?***
2. ***After how much water does the CI start getting affected?***

If the SH are not familiar with the measurement unit of meters, feel free to be flexible and adapt with the unit they are comfortable in such as feet, or even tentative measurement terms as ‘Ankle level’, ‘Knee level’, ‘Waist level’ and ‘Neck level’.

3. ***What happens when the CI is affected? (e.g. when the water is 5 cm traffic starts getting heavier, after 10 cm the road also starts getting damaged)***
4. ***After how much water does the CI completely fails to function?***
5. ***What happens when the CI fails? (e.g. transportation through the road is not possible anymore after the water is 30 cm)***
6. ***Which age group is most vulnerable when your CI is affected? How are they impacted?***
7. ***Which gender group is most vulnerable when your CI is affected? How are they impacted?***
8. ***Which income group is most vulnerable when your CI is affected? How are they impacted?***
9. ***Are people with disability more vulnerable when your CI is affected? How are they impacted?***

While the SHs are providing information, the data manager should write the information on the card. In case of confusion, the data manager must verify with the CI operator. Clip the card for the CI with the same colour paper clip and place it in the Direct Impact Ring area of that CI.

Once the direct impact for a CI is completed, this can be followed by another CI operator in a clockwise direction. It is very important that you go in a clockwise direction so that everyone can hear what other CI operator is saying. If someone is not sure what to say, skip the CI operator and go to the next person. After finishing with all the other, come back to the operator who should now be ready to provide input.



Figure 6 Direct Impact Ring in Circle-Bao

B. Discuss the cascading impacts:

After completing the discussion on the direct impacts, ask the stakeholders about the cascading effects from a particular CI. Referring to the direct impact on one CI ask which of the other CI suffer cascades. Start with one CI and then go in clockwise direction. The information gathered under cascading impacts is the time and economic losses that the CI suffers as a result of disruption of another CI (see Figure 8). The information collected is also about the intensity of the impacts i.e. whether the impact is high, medium or low represented by red, yellow and green cards respectively (see Figure 8). Following questions can be used for smooth discussion:

1. ***When CI XXX is affected which of the other CI are impacted?***
2. ***How are you impacted when CI XXX is affected or fails?***

With this questions also discuss the intensity of the impact choose one among the three colours of the cards (RED- High impact, YELLOW- Medium impact and GREEN- Low impact).

3. ***How much of delay do you suffer when CI XXX is affected?***
4. ***What are the causes of the delay?***
5. ***How much money do you lose? Or How much economic damage do you suffer?***
6. ***What are the causes of the economic damage when CI XXX is affected?***

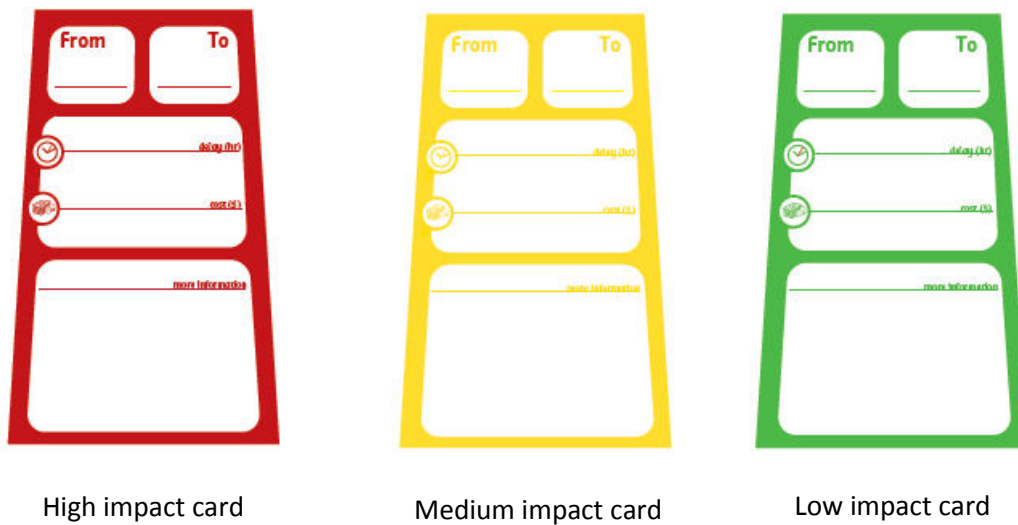
For e.g. When the cascading impact is high from Road (Grey) to Hospital (Blue), choose a RED card to write the information. Clip the card on the paper clip of Road (GREY PAPER CLIP) and place it in the Cascading Impact Ring area (see Figure 7) of Hospital (BLUE BOX). So, the paper clip from the representative of ROAD is handed to the representative of the HOSPITAL.



Figure 7 Cascading impact ring

While the SHs are providing information, the data manager should write the information on the card. Data manager must verify with the CI operator in case there is confusion. The data manager should then clip the card with the paper clip from where the cascade is occurring and hand it to the CI representative who is suffering the cascade. The facilitator and observer must very carefully notice whether the sharing of the clip is correct or not.

Once the cascading impact from one CI is completed, continue to another CI in a clockwise direction, until every Critical Infrastructure is visited in turn. It is very important that the discussion is completed in a round, so that everyone can hear what a CI operator is saying.



High impact card

Medium impact card

Low impact card

Figure 8 Cascading impact cards

C. Summarise the results

Request the stakeholders to stand around the table and look at the results on the Circle-Bao board. Give them some time to observe the board. Ask for their general reactions. Start to summarise the results to the SH. Following questions can be asked.



Figure 9 Circle-Bao after the workshop

1. Who has the highest number of clips on the cascading impact ring?
This gives the CI that suffers the highest number of cascades.
2. Who has the highest number of red cards on your cascading impact ring?
This gives the CI that suffers severe cascading impacts.
3. Who has given away the highest number of paper clips?
This is the CI that causes the highest number of cascades on other CI.

D. Output

Direct impacts of flooding on CI are known, and the links of interdependencies and cascading impacts among the CI networks are created. Summarisation of the results to the SH is done.

Step 7: Prioritisation of Risk-reduction measures and role identification

The level of detail in this step will depend on the objective defined at the beginning. At a minimum level the need for risk reduction measures should be highlighted and the facilitator should gather information on the (recently) implemented or planned measures.

- A. Discuss the existing risk reduction measures that can be applied to different CIs by for example changing the height of the CI, increasing the protection wall around the CI.
- B. Come up with 3 major risk reduction measures to reduce as many cascades as possible.

Figure 10 Risk reduction measure card

- C. For each of the risk reduction measures, stakeholders have to identify the roles of the stakeholders with the help of Circle of Influence method. This method will help to see the influence, power of the stakeholders in the implementation of certain measures. It will also help to identify which of the stakeholder groups must work closely together for implementing the risk reduction measure.

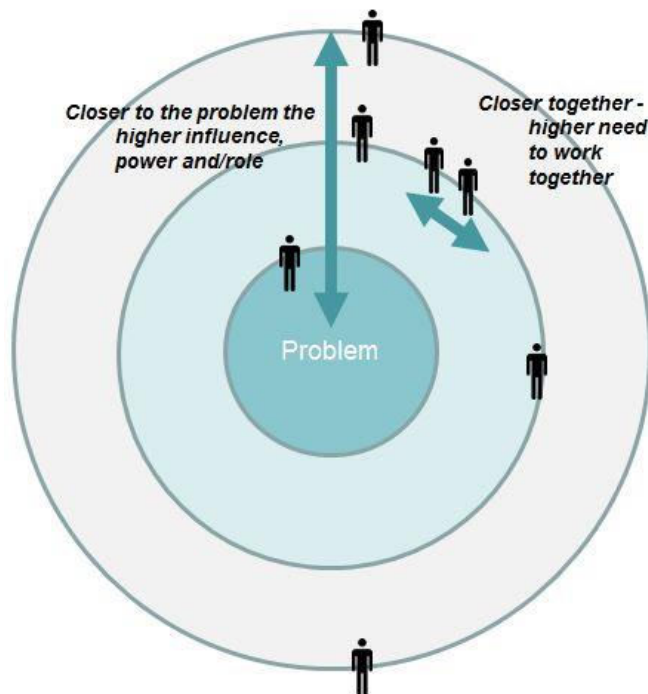


Figure 11 Circle of influence

Step 8: Feedback and reflective information

It is critical to receive feedback from the participants to ensure that the workshop meets the client’s needs. General open floor feedback can be received from the participants. Also, distribute the feedback form (ANNEX A) to the participants so that participants are more open and honest about their opinions towards the tool and the workshop.

It is equally essential to get the reflective information form from (ANNEX B) the facilitators and co-facilitators.

Step 9: Data storage

Data must be carefully stored in hard copies, the format of the tables are given in Table 2 and Table 3.

Table 2 Direct impact data storage table

S.No.	From	To	Description	Affected (m)	Failure (m)	Age	Gender	Income groups	Disability

Table 3 Cascading impact data storage table

S.No.	From	To	Severity	Description	Delay (hr)	Cost (Local currency)

Step 10: Data visualisation

Data visualisation can be done in one of two ways:

Animation in the game engine: Such as [Cork video on YouTube](#)

Depending on the requirement of the client, interactive modelling can be used to visualise the cascading impacts.

In powerpoint with time lapse and pop-up: Such as [Waterland video on YouTube](#)

Visualisation of the results of the workshop can also be done in the form of powerpoint slides turned into a movie. This will require screenshots of the time lapse of flood simulation. For each of the screenshots, the cascading impacts of CI can be described in the pop-up boxes.

The results of the workshop can later be visualised in the digital Circle tool to have more comprehensive overview of the links among the CI.

3 Workshop follow up

After the first workshop, the following steps should be taken:

1. Data analysis: Collect the knowledge rules from the excel file
2. Animation preparation: Update the OSM data with the new data collected during the workshop and integrate the knowledge rules in the GIS analysis
3. Feedback the results to the client
4. Prepare the next workshop with the client

A second workshop can be held which goes into more details on different aspects such as

- Reduction measures
- Crisis management or urban planning. More detailed discussions can be held using additional supporting tools and methods.
- A. Map the communication lines in crisis management.
- B. Testing different urban design measures using the Adaptation Support Tool.

ANNEX A

Impact assessment- Critical Infrastructure Feedback form- Stakeholders

Thank you for attending the Circle-Bao participatory workshop.

We are interested in your feedback about this workshop. Please take a moment to give us your opinion on this evaluation form.

Please indicate the strength of your agreement with each statement below	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
The workshop was a valuable use of my time					
The purpose of the workshop was clear					
The workshop was the right length of time					
If you disagreed with the above question, was the workshop...	Too long			Too short	
The workshop generated a better picture of interdependencies of the CI networks in the area					
The format of the workshop was effective for achieving its aims					
We engaged in a fruitful discussion					
I feel that the workshop contributed to broadening my overview on the CI, direct and cascading impacts of flooding in the area					
The workshop was a good forum for prioritising the most effective risk reduction measures.					
I have a better understanding of the roles of each and every stakeholder in the implementation of those risk reduction measures					
I am satisfied with the outcomes of the workshop					

Were any of the results surprising to you, or did you expect these results?

In your opinion, what was the most interesting part of the workshop?

In your opinion, what was the least interesting part of the workshop?

OTHER COMMENTS:

ANNEX B

Impact assessment- Critical Infrastructure Feedback form-Facilitators

Form to be filled in by the facilitator and co-facilitator

Case study area	
Facilitator	
Co-facilitator	
Date of the workshop	
Start time of the workshop	
End time of the workshop	
No. of participants	

1. What did you like the most about facilitating a workshop?

2. What was the most challenging part of facilitating the workshop?

3. Were there any difficulties with the content (e.g. wording, topic information, explanation of tool, etc.) you experienced while facilitating the workshop?

4. Were there any problems with the design of the workshop? (Duration, group division, etc.)

5. What could have been done differently and why?