

# Strengthened drought and flood management through improved science-based information availability and management in Myanmar

Deliverable 2 (activity 1.2) Workshop report and cases for validation



This report has been prepared under the DHI Business Management System certified by Bureau Veritas to comply with ISO 9001 (Quality Management)

ISO 9001  
Management System Certification

BUREAU VERITAS  
Certification Denmark A/S



Approved by

23-01-2019

X 

Oluf Z. Jessen

Head of Projects

Signed by: Oluf Zeilund Jessen

# Strengthened drought and flood management through improved science-based information availability and management in Myanmar

Deliverable 2 (activity 1.2) Workshop report and cases for validation

Prepared for UNEP  
Represented by Ms Jaime Revenaz-Webbe

---

Project manager	Sílvia Rodrigues Saavedra Leirião and Nisha Gill Hansted
Quality supervisor	Bertrand Richaud
Prepared by	Sílvia Rodrigues Saavedra Leirião and Nisha Gill Hansted

Project number	11820065
Approval date	15 December 2018
Revision	Final 1.0
Classification	Open



## EXECUTIVE SUMMARY

This report describes the first national workshop of the Climate Technology Centre and Network (CTCN) technical assistance to Myanmar entitled '*Strengthened drought and flood management through improved science-based information availability and management*' (reference number 2016000035). It took place on 4<sup>th</sup> and 5<sup>th</sup> of December 2018 in Naypyitaw, Myanmar, gathering 36 participants from 20 different institutions.

The workshop was organized with the support of the National Designated Entity (NDE) of the CTCN, the Environmental Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MONREC). The official opening was delivered by Director General U Hla Maung Thein.

The objectives of the workshop were to present the scope of the technical assistance; to present the existing web portal and data and information available; and, to discuss requirements and gaps in information base for climate change adaptation and flood and drought management in Myanmar.

The outcomes were specifications and requirements of data, information and reporting needs of the stakeholders; and discussion of testing and validation on a maximum of two well documented locations in Myanmar.

The portal provides access to state of the art remote sensing data and information, tools and reporting abilities, for Myanmar. The portal address is: [www.flooddroughtmonitor.com](http://www.flooddroughtmonitor.com)

The approach was to have introductory presentations to the project scope and outputs, alongside hands-on sessions about the portal data and tools. As an attachment to this report, are all workshop materials including the step-by-step exercises in Myanmar and English languages.

We conducted a 10-question survey to assess the data and reporting needs of the stakeholders and collect their views regarding the next steps, particularly which 2 datasets/locations should be selected for the validation activity. Within this report we gather all options suggested by stakeholders.

The workshop was evaluated by the participants before its official closure with 35 evaluations in total collected. In summary, 77% of participants thought the course was good, 17% rated it as excellent, one person as acceptable, and 86% of the participants would recommend it.

The findings of the first national workshop will directly inform the next deliverable of this technical assistance the "Technology specifications and methodology for validation" report at the end of Activity 1.3.



## CONTENTS

<b>1</b>	<b>Introduction .....</b>	<b>5</b>
1.1	Background .....	5
1.2	National plans and frameworks.....	5
1.3	First national workshop .....	7
<b>2</b>	<b>Participation and approach .....</b>	<b>8</b>
<b>3</b>	<b>Portal step-y-step guided tour.....</b>	<b>10</b>
3.1	Data and Information .....	10
3.2	Issue Analysis .....	11
<b>4</b>	<b>Stakeholder Survey .....</b>	<b>16</b>
4.1	Data and reporting needs .....	16
4.2	Validation and next steps .....	19
<b>5</b>	<b>Feedback from participants.....</b>	<b>21</b>
<b>6</b>	<b>Next steps .....</b>	<b>23</b>

## FIGURES

Figure 1.1	Director General of Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation, Myanmar, U Hla Maung, Thein delivering the official opening speech. ....	7
Figure 1.2	Group photograph with participants and project team on the first day of the first national workshop.....	7
Figure 3.1	Home page of the portal, the applications object of this technical assistance signalled in red. ....	10
Figure 3.2	Example of CHIRPS rainfall over Myanmar on 24/08/2018 .....	11
Figure 3.3	Participants during the hands-on exercise on the Data and Information.....	11
Figure 3.4	Group work session during the second day of the workshop working on the Issue Analysis application exercise. ....	12
Figure 3.5	Group presenters sharing results of the analysis .....	13
Figure 4.1	Description of data related activities .....	16
Figure 4.2	Data types and application frequency.....	17
Figure 4.3	Importance of selected data types and availability .....	18
Figure 4.4	Scoring of how to select the cases for validation.....	19
Figure 4.5	Scoring of cases for data validation.....	19
Figure 4.6	Stakeholders views on Activities 2 and 3.....	20
Figure 5.1	Overall impression of the course.....	21
Figure 5.2	Most interesting topic. Participants can choose more than one answer. Note that number of participants is shown, not percentages.....	21
Figure 5.3	Feedback on workshop content.....	22
Figure 5.4	Time management of the workshop.....	22
Figure 5.5	Venue and organization of the workshop.....	23

## APPENDICES

### APPENDIX A

Workshop Agenda

### APPENDIX B

Attendance Register

## ACCRONYMS & ABBREVIATIONS

CTCN	Climate Technology Centre & Network
DHI	<a href="http://www.dhigroup.com">www.dhigroup.com</a>
DMH	Department of Meteorology and Hydrology
ECD	Environmental Conservation Department
GCF	Green Climate Fund
GHG	Green House Gases
HAI	Hydro and Agro Informatics Institute of Thailand.
IWUD	Irrigation and Water Utilization Department
MIID	Myanmar Institute for Integrated Development
MOALI	Ministry of Agriculture Livestock and Irrigation
MOC	Ministry of Construction
MOEE	Ministry of Electricity and Energy
MONREC	Ministry of Natural Resources and Environmental Conservation
MOTC	Ministry of Transport and Communication
MSWRR	Ministry of Social Welfare, Relief and Resettlement
NDE	National Designated Entity
WCRP	World Climate Research Programme

# 1 Introduction

This report consists in Deliverable 2 of Activity 1.2 of the Climate Technology Centre and Network (CTCN) technical assistance to Myanmar entitled ‘*Strengthened drought and flood management through improved science-based information availability and management*’ (reference number 2016000035). This report describes the first national workshop which took place on 4<sup>th</sup> and 5<sup>th</sup> of December 2018 in Naypyitaw, Myanmar.

## 1.1 Background

The Department of Meteorology and Hydrology provides meteorological, hydrological and related services in support of national needs. The current challenges are to sustain and maintain the current limited observation network and provide reliable and updated information, as there are few ground stations and a significant delay before data is made available from the stations. There are some ongoing programmes to support these efforts, such as JICA providing Doppler radars and automated weather stations for the lower Ayeyarwady basin, and the planned World Bank planned investments supporting weather stations within the entire Ayeyarwady basin. However, while these investments will yield data and information over time, they are geographically limited in scope and, in the case of the World Bank intervention, will take some years before they are fully operational.

Myanmar requested support from the CTCN to strengthen water management and increase adaptation to climate variability and climate change, through the use of a web-based portal. The Green Climate Fund (GCF) Readiness and preparatory support funding was allocated to the aforementioned request and the CTCN established an agreement for cooperation with DHI on the 13th July 2018, for the implementation of the Response Plan to the request for technical assistance. To carry out this technical assistance, DHI is working together with the Myanmar Institute for Integrated Development (MIID), and as a regional expert the Hydro and Agro Informatics Institute (HAI) of Thailand.

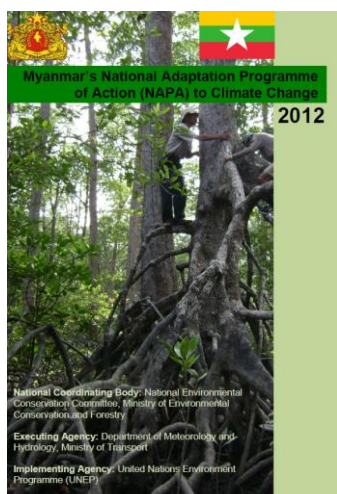
DHI will build on the web portal established during the “Flood and drought management tools” project (GEF and UNEP 2014-2018) and apply it to Myanmar.

The activities will focus on workshops and training, satellite data validation and generating a strong user community. As a parallel objective, it is intended that outputs from the assistance contribute directly to the design of a future project proposal to the GCF to strengthen effective climate finance planning and investment decision making for flood and drought management.

## 1.2 National plans and frameworks

During Activity 1.1 and 1.2, DHI carried out a review of current gaps related to the information base for climate change adaptation already identified in existing national plans and frameworks. Here we emphasize two key documents analysed, the National Adaptation Programme of Actions (NAPA, UNEP 2012), and the Intended Nationally Determined Contribution (INDC, 2015).

The following table captures highlights from these documents specifically addressing the goals and priority activities for Myanmar’s immediate and urgent adaptation needs, where lack of data and information (focus on climate data and indicators), capacity and knowledge is a cornerstone.



With the identification of 32 Priority Adaptation Projects for effective climate change adaptation in Myanmar for i) Agriculture; ii) Early Warning Systems; iii) Forest; iv) Public Health; v) Water Resources; vi) Coastal Zone; vii) Energy, Industry, and viii) Biodiversity; the main barriers to their implementation were also identified:

*“limited technical capacity of local and national stakeholders for planning (...) and implementing climate change adaptation;”*

*“limited availability of locally relevant, usable climate information for the end users;”*

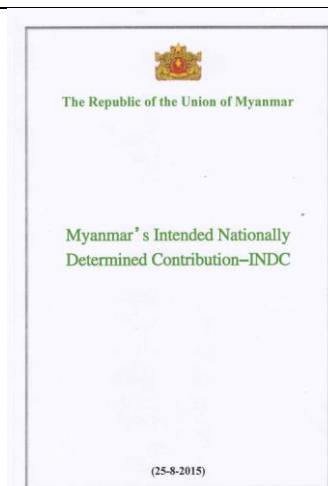
*“limited effective assessment of climate change impacts in Myanmar, which in turn limits the planning of effective adaptation activities;”*

To address these barriers:

*“improving national institutional capacity to undertaking effective adaptation planning;”*

*“improving adaptation knowledge and awareness by facilitating information gathering and exchange structures;”*

*“facilitating research (including long-term research) on the impacts of climate change, costs and benefits of adaptation and appropriate adaptation measures for addressing these impacts.”*



The identification of mitigation actions and policies in the primary areas of forestry and energy amongst others, to reduce GHG emissions and benefit development, also identifies needs:

*“To strengthen the climate change related institutional and policy environment through sharing of technical knowledge and best practice, training and institutional support.”*

*“To increase awareness of climate change at national, state and region and local level.”*

*“To consistently monitor and take stock of the status of national environmental quality (i.e. through the use of standardised indicators)..”*

*“To increase the understanding of the potential of renewable power in Myanmar’s future growth plans”*

In sum, the above supported that a critical weakness in the current situation is a general lack of access to data and information, capacity and knowledge sharing, to assess and manage resources and extreme events.

### 1.3 First national workshop

The first national workshop follows the Activity 1.1 which consisted in a first round of meetings with identified stakeholders (for more, please view Deliverable 1 Bilateral meetings report).

The objectives of the workshop were to present the scope of the technical assistance to be delivered and refine activities and work plan; to present the existing web portal and data and information available; and, to discuss requirements and gaps in information base for climate change adaptation and flood and drought management in Myanmar.

The expected outcomes of the workshop were specifications and requirements of data, information and reporting needs of the stakeholders; discussion of testing and validation on a maximum of two well documented locations in Myanmar.

The workshop was organized with the support of the National Designated Entity (NDE) of the CTCN, the Environmental Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MONREC). The ECD also hosts the National Designated Authority (NDA) of the GCF. The official opening speech of the workshop was delivered by Director General U Hla Maung Thein.

The workshop agenda is in Appendix A and attendance register in Appendix B.



Figure 1.1 Director General of Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation, Myanmar, U Hla Maung, Thein delivering the official opening speech.



Figure 1.2 Group photograph with participants and project team on the first day of the first national workshop.

## 2 Participation and approach

The first national workshop list of invitees was put together by the project team, based on the outputs from the first round of meetings, with the support of the ECD. This resulted in a very high attendance of key national institutions within water resources and disaster management frameworks.

The workshop took place in Naypyitaw, however there were participants coming from Yangon, Mandalay, Bago, Yezin and Shan. There were 25 participants from Naypyitaw and 11 from outside, adding up to a total of 36 participants of which 15 females and 21 males. To assist DHI with the workshop, there were two female MIID staff to assist with simultaneous translation of the DHI presenter and logistical organization of the workshop. Additionally, two remote sensing and water resources experts from HAI supported during the hands-on usage of the portal. Following the official opening speech, the agenda kicked off with a summary of the challenges faced by Myanmar due to climate change by the managing director of MIID.

The following list presents all institutions that were present at the workshop, most of them on both days:

1. Climate change division, ECD<sup>1</sup>, MONREC
2. Environmental Impact Assessment division, ECD, MONREC
3. Department of Forestry, ECD, MONREC
4. Department of Meteorology and Hydrology, Ministry of Transport and Communication (MOTC)
5. Directorate of Water Resources and Improvement of River Systems (MOTC)
6. Department of Disaster Management, Ministry of Social Welfare, Relief and Resettlement (MSWRR)
7. Irrigation and Water Utilization Department, Ministry of Agriculture Livestock and Irrigation (MOALI)
8. Department of Social Welfare, MSWRR
9. Department of Agriculture, MOALI
10. Department of Irrigation, MOALI
11. Department of Building, Ministry of Construction (MOC)
12. Water Supply and Sanitation Department, MOC
13. Department of Hydropower Implementation, Ministry of Electricity and Energy (MOEE)
14. Ministry of Health and Sports
15. General Administration Department, Ministry of Home Affairs
16. Civil Engineering Department, Yangon Technological University

---

<sup>1</sup> The ECD hosts both the CTCN NDE and the GCF NDA.

17. Yezin Agricultural University
18. Mandalay Technological University
19. Myanmar Sustainable Development Engineering Services Co., Ltd
20. Myanmar Environmental Assessment Association

Another key stakeholder is the Ayeyarwady Integrated River Basin Management (AIRBM) project. Representatives from this project, including the project director and the Hydro Informatics Centre (HIC) could not be present at the stakeholder workshop.

We set up the portal for the Myanmar and Ayeyarwady areas during Activity 1.1, therefore, it was up and running for the first national workshop. This made it possible to have an approach with introductory presentations to the project scope and outputs, alongside hands-on sessions about the portal data and tools. In these sessions, stakeholders were able to start using the portal immediately with the purpose of using this workshop as an opportunity for early-on training.

As an attachment to this report, are all workshop materials including the step-by-step exercises in Myanmar and English languages.

### 3 Portal step-y-step guided tour

At the first national workshop, DHI introduced the portal to the stakeholders – note some of them had already seen it during the first round of meetings documented in Deliverable 1 of this technical assistance.

The portal provides access to state of the art remote sensing data and information, tools and reporting abilities, for Myanmar. The portal address is: [www.flooddroughtmonitor.com](http://www.flooddroughtmonitor.com)

After registering, once users log in, the Home page displays all the applications made available to the stakeholders in the form of four buttons, that when clicked will take users to the respective portal section. More to come in the Technology specifications and methodology for testing and validation report (Deliverable 3 of Activity 1.3).

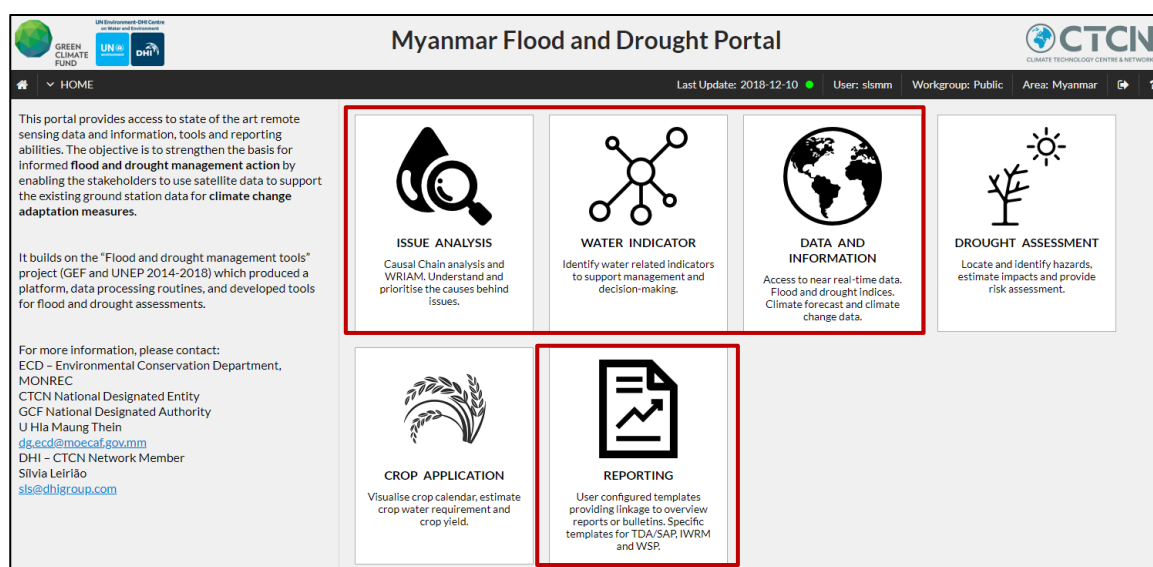


Figure 3.1 Home page of the portal, the applications object of this technical assistance signalled in red.

The team presented the portal and four applications constituting the deliverables of this technical assistance:

- Issue Analysis
- Water Indicator
- Data and Information
- Reporting

There are two more which have been added to the portal at the request of the AIRBM project, however these will not be the subject of this technical assistance. For the first national stakeholder workshop, we selected to focus mostly on the Data and Information, as well as the Issue Analysis applications of the portal.

#### 3.1 Data and Information

As the main deliverable of this technical assistance, it was crucial to expose the participants to the data and information available in the portal, this being covered during the first day immediately after the introduction and project overview presentation. A step-by-step exercise translated to Burmese language was distributed and allowed participants to get acquainted with the user interface and functionality of the portal.

Within this application, users find all the data that is available, mostly from remote sensing sources. There are raw datasets, downloaded and processed, but also indicators the portal calculates based on the raw datasets.

Users can view the data directly in the portal with several different plot types or tables or can download the data for further processing.

During this step-by-step exercise, participants worked individually, and were asked to start by looking at rainfall datasets, but also able to freely explore the data. Below, images from the data and information afternoon session, on the first workshop day.

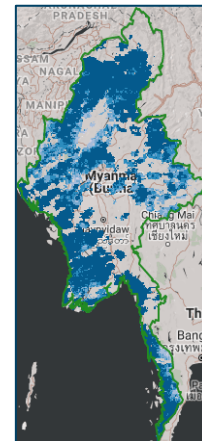


Figure 3.2 Example of CHIRPS rainfall over Myanmar on 24/08/2018



Figure 3.3 Participants during the hands-on exercise on the Data and Information.

By the end of the first day of workshop, participants knew how to log in, enter the data application select the datasets they wish to look at, view and download data to their computers.

### 3.2 Issue Analysis

The issue analysis application is a tool that can be used in workshops such as this, as a way to identify and prioritize environmental issues nationally by stakeholder groups but can also be used in depth by the stakeholders when carrying their own specific impact assessments as the initial screening tool.

This tool allows users to evaluate the causes behind key environmental issues. It gives the possibility to prioritise the impacts to be targeted in future plans. Users analyse the impacts of a given issue by considering the underlying causes through a Causal Chain Analysis (CCA). And prioritize impacts through the application of the Water Resources Impact Assessment Method (WRIAM).

A step-by-step guide was provided to the stakeholders, who were divided into 6 round table groups.



Figure 3.4 Group work session during the second day of the workshop working on the Issue Analysis application exercise.

In the following two pages, we share the step-by step exercise using the issue analysis tool, presented by each group. The issues chosen and respective impacts each group focused on are:

- Group 1 – Issue is Floods; focused on impacts of loss of lives and property including the effects in urban drainage systems.
- Group 2 – Issue is Heavy rainfall; impacts on landslides in hilly region and flood in delta areas
- Group 3 – Temperature rise caused by climate change and environmental and agricultural impacts
- Group 4 – Flash floods; impacts analysed are shortage of water and structural damage
- Group 5 – Issue is Floods; impacts are flooding and loss of biodiversity
- Group 6 – Issue is Flash floods and the impacts were land degradation, loss of life and property damage.

It is noteworthy that this was the first time the participants used the tool. The results and details obtained are not crucial in this case, but rather the general topics discussed and the hands-on experience they got in using the tool and applying the CCA and WRIAM methodology.

Following the exercise, each group rapporteur shared the results of the group’s analysis. Below, images from the six participants presenting for their groups.



Figure 3.5 Group presenters sharing results of the analysis

From this exercise, we can conclude participants consider flash floods, flooding and temperature rise as burning issues. This means flood related datasets should be given high relevance throughout this technical assistance. Additionally, loss of life, biodiversity, agriculture and damaged property are amongst the key impacts being studied, socio-economic datasets might be required to support their activities, along with climate change projections, including temperature, as well as vegetation related indicators.

**Issue:** Group1Flood  
**User:** ThandarwECD  
**Last change:** 2018-12-05 08:57:20  
**Description:** 1.Loss of Lives and Property

**Issue analysis**

No importance  Slight negative impact  Moderate negative impact  Negative impact  Significant negative impact  Major negative impact

Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
loss of Lives and property	high depth and duration of flooding	Heavy rainfall and poor drainage system	Rainfall Pattern Changes due to Global Warming	National (3)	Significant change (2)	Temporary (2)	Reversible (2)	Moderate (2)	Some (2)	36	Significant negative impact
effect drainage system in Urban Area	flood in city and residential area and no link communication	High sedimentation in River Bed and poor drainage system	Changes River morphology due to climate change of global warming	Subnational (2)	Significant change (2)	Temporary (2)	Irreversible (3)	Strong (3)	Some (2)	32	Negative impact

**Issue:** Group2\_HeavyRainfall  
**User:** DWIR  
**Last change:** 2018-12-05 08:57:58  
**Description:** Heavy Rainfall cause mostly landslides and flood around Myanmar

**Issue analysis**

No importance  Slight negative impact  Moderate negative impact  Negative impact  Significant negative impact  Major negative impact

Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
Landslides on hilly region	Heavy Rainfall lack of trees	Deforestation, shifting cultivation	Weak on forest management	Subnational (2)	Significant change (2)	Temporary (2)	Irreversible (3)	Moderate (2)	Little (1)	28	Negative impact
Flood in delta areas	sedimentation	uneven rainfall, bank erosion	climate change	Subnational (2)	Significant change (2)	Temporary (2)	Reversible (2)	Moderate (2)	Some (2)	24	Negative impact

**Issue:** Group3Temperature Raise  
**User:** Tinyunaing  
**Last change:** 2018-12-05 08:57:00  
**Description:** temperature raise s is basis impact of climate change

**Issue analysis**

No importance  Slight negative impact  Moderate negative impact  Negative impact  Significant negative impact  Major negative impact

Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
impact 1	Environmental impact	Lack of knowledge for reforestation and energy efficiency	Poor linking between social and political	National (3)	Major change (3)	Permanent (3)	Reversible (2)	Strong (3)	Some (2)	72	Major negative impact
impact2	agricultural area	little exposure	deforestation, inappropriate land use and planning	National (3)	Major change (3)	Temporary (2)	Reversible (2)	Moderate (2)	Some (2)	54	Significant negative impact

<b>Issue:</b> Group 4_Flash Flood Analysis <b>User:</b> Latt <b>Last change:</b> 2018-12-05 09:03:37 <b>Description:</b> Analysis of Flood Impacts on Storage Reservoirs											
<b>Issue analysis</b> <input type="checkbox"/> No importance <input type="checkbox"/> Slight negative impact <input type="checkbox"/> Moderate negative impact <input type="checkbox"/> Negative impact <input type="checkbox"/> Significant negative impact <input type="checkbox"/> Major negative impact											
Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
Subsequent Flooding and Shortage of Water Availability	Prolong Intense Rainfalls and Sedimentation	(1)Watershed Degradation (2) Improper reservoir operation due to the lack of real time forecast (3) lack of river development scheme	(1) Deforestation, (2)Improper land management and exploitation. (3)Lack of emergency action plan	Local (1)	Significant change (2)	Temporary (2)	Irreversible (3)	Moderate (2)	Some (2)	14	Moderate negative impact
Structural Damages	Prolong Intense Rainfalls and defect in structural soundness	(1)Sedimentation (2) Improper reservoir operation due to the lack of real time forecast (3) progressively deteriorated condition	(1)Progressive failure mechanism due to unexpected natural disasters like earthquakes. (2)Lack of advanced monitoring system	Local (1)	Significant change (2)	Permanent (3)	Reversible (2)	Moderate (2)	Some (2)	14	Moderate negative impact
<b>Issue:</b> Group 5Climate Change <b>User:</b> DrThuraAung89 <b>Last change:</b> 2018-12-05 08:56:56 <b>Description:</b> Global Warming and Sea Level Rising											
<b>Issue analysis</b> <input type="checkbox"/> No importance <input type="checkbox"/> Slight negative impact <input type="checkbox"/> Moderate negative impact <input type="checkbox"/> Negative impact <input type="checkbox"/> Significant negative impact <input type="checkbox"/> Major negative impact											
Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
Flood	Global warming	Uncontrolled GHG emission	Mal production practices	Transboundary (4)	Major change (3)	Permanent (3)	Irreversible (3)	Strong (3)	Little (1)	108	Major negative impact
Loss of bio-diversity	Changes in Ecosystem	Deforestation, slash and burns	Poor Knowledge and poor control measures	National (3)	Major change (3)	Permanent (3)	Irreversible (3)	Moderate (2)	Little (1)	72	Major negative impact
<b>Issue:</b> Flash Flood <b>User:</b> MYOTUNOO <b>Last change:</b> 2018-12-05 08:57:18 <b>Description:</b> Group6FloodFlash											
<b>Issue analysis</b> <input type="checkbox"/> No importance <input type="checkbox"/> Slight negative impact <input type="checkbox"/> Moderate negative impact <input type="checkbox"/> Negative impact <input type="checkbox"/> Significant negative impact <input type="checkbox"/> Major negative impact											
Immediate impact	Immediate cause	Underlying cause	Root cause	Extent	Seriousness	Permanence	Irreversibility	Cumulative character	Level of documentation	Score	Assessment
Loss of life and damage properties	heavy rain within a day	Cyclonic storm crossing this area	cyclone track is changing due to climate change	Local (1)	Major change (3)	Temporary (2)	Reversible (2)	Moderate (2)	Little (1)	18	Moderate negative impact
Land degradation	Soil erosion	Deforestation	Social Economic Problem	Local (1)	Significant change (2)	Temporary (2)	Irreversible (3)	Moderate (2)	None (0)	14	Moderate negative impact

## 4 Stakeholder Survey

On the first day of the workshop, we conducted a 10-question survey to assess the data and reporting needs of the stakeholders and collect their views regarding Activities 2 and 3 of the technical assistance. Particularly regarding the issue of which 2 datasets/locations should be selected for the validation activity. On the second day of the workshop, the results were reviewed collectively prior to the closing of the workshop.

Number of responses to all questions were varied as some participants skipped one or two of the questions, mostly two of the open-ended ones. On average the number of responses to all 10 questions is 21; not considering the open-ended questions, average number of responses is 24.

The following subchapters present the survey results and gathers the main feedback and comments collected.

### 4.1 Data and reporting needs

Firstly, participants were asked what type of data related activities they carry out. 64% of participants state they read indicators regarding floods; 56% use both drought indicators and plots of meteorological parameters. Climate change projections and forecasts follow at 48% (see Figure 4.1).

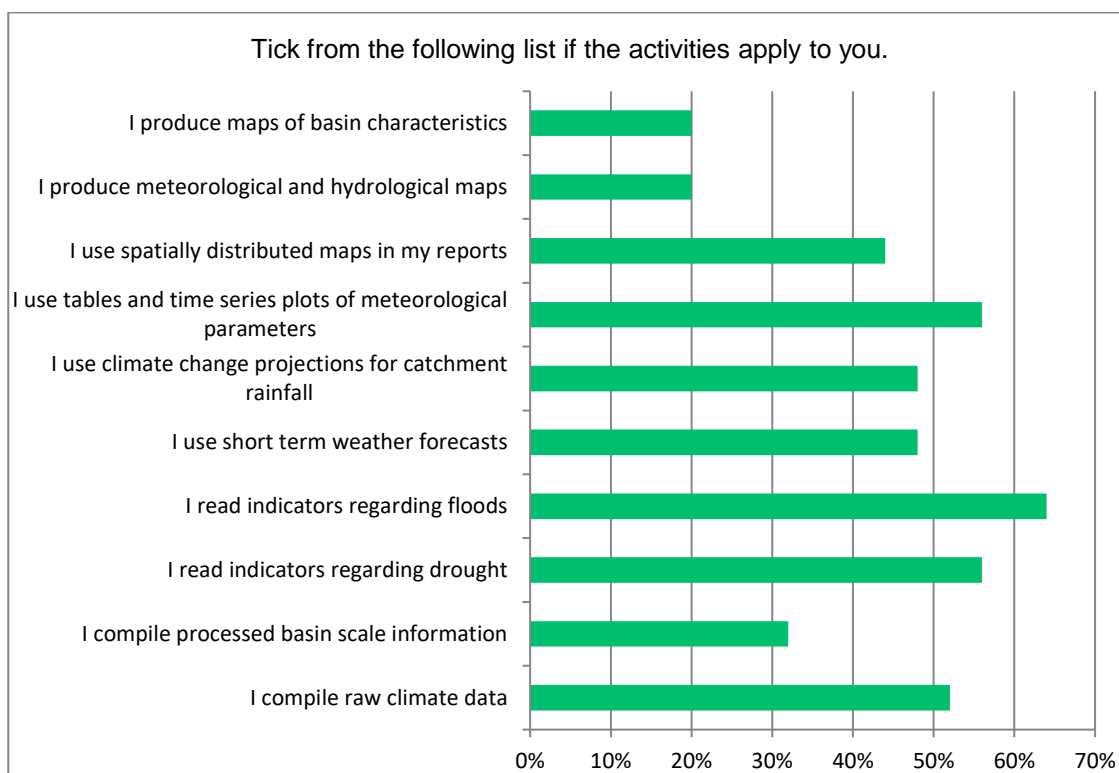


Figure 4.1 Description of data related activities

Regarding data production 52% of participants compile raw climate data, which is representative of the technical level of the workshop participation, with many technical staff from data producing Ministries.

Data and information within the portal can be used to inform other types of instruments the stakeholders may or may not use in their activities, and with different frequencies. The next question contemplates strategic scale plans down to data levels and has a clear focus on integrated water resources management.

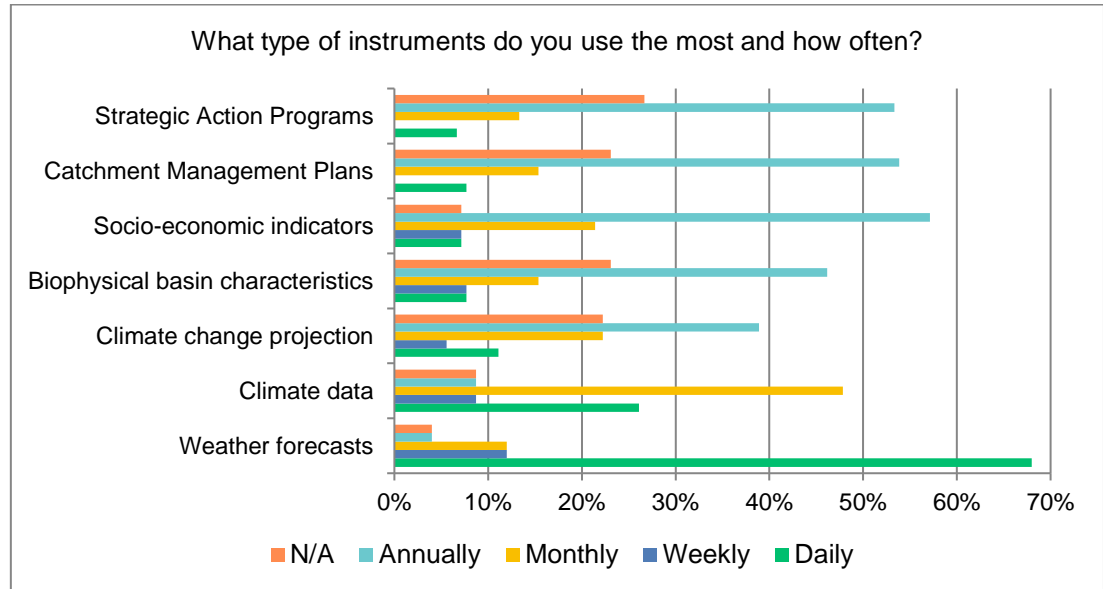


Figure 4.2 Data types and application frequency.

The results show us the most frequently used dataset (daily) is required by most participants: weather forecasts used daily at 68%. The following most popular instruments are used annually: socio-economic indicators at 57%, and catchment management plans and strategic action programs at 53%.

To the open-ended question “If you could get a report with recently updated data, which data should be included and in which format (reports, short technical notes, maps, raw data)?”, below are some of the responses representative of most:

- Report with indices, tables, maps and forecast and socioeconomic data of population.
- Maps, raw data, tables, technical notes
- Raw data and maps will be needed for climate change related research
- Soil erosion and sedimentation information
- Climate, Socio-economic data and data on sea level rise are also needed with different format.
- Weather data e.g. temperature, light etc. in the form of short technical notes.
- Maps with specific location data
- Rainfall time series data in good spatial and temporal resolution.
- Temperature, rainfall, weather forecasts
- Daily rainfall, temperature, water level, discharge
- Flood maps

Regarding the question “What information on a weekly basis (if any) do you think should be communicated to other members of your team and in which format (reports, maps, etc.)?” we found most participants are interested in flood and drought around the world, and weather data especially temperature rise, flooding and droughts in report format. There was mention to rainfall and potential evapotranspiration trends. The most referred to formats were plots and maps.

There was also mention of day versus night temperature data, information on coastal erosion, and degradation of coastal ecosystem, UV indexes, sea level.

The final question regarding data and reporting needs contrasts relevance and availability. This provides us a measure of whether participants consider that the data they need is available to them. It also allows us to know which exact data types they consider important to their daily tasks and to what degree.

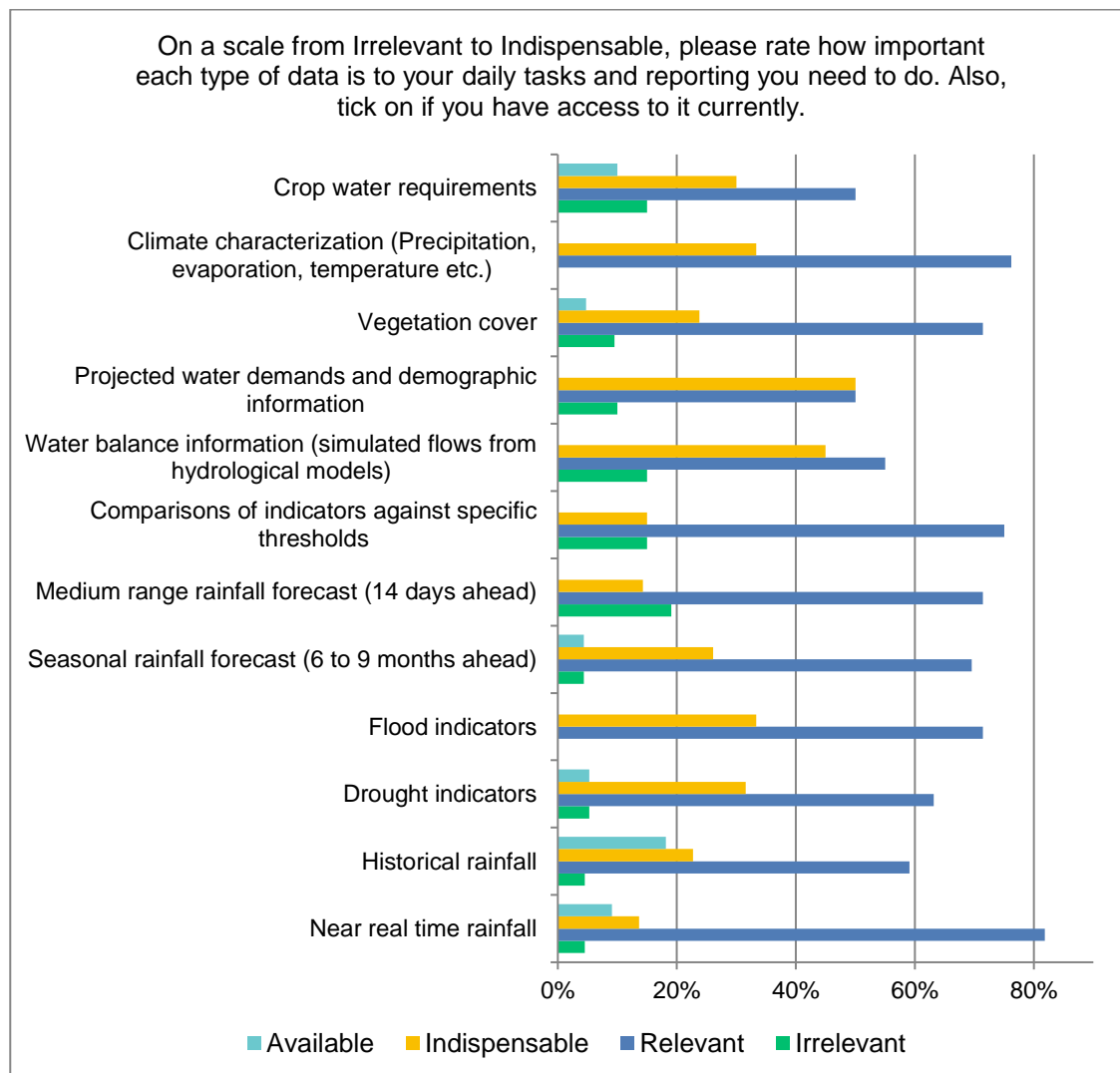


Figure 4.3 Importance of selected data types and availability

Figure 4.3 shows us the datasets considered by participants to be indispensable are projected water demands and demographic information, flood and drought indicators, water balance information and climate data. Some of these needs can be met by remote sensing information whereas others cannot, for example: rainfall and evapotranspiration data from the portal constitute members of the water balance equation, however the user of the data must source the remaining members to close the water balance, most likely from their own institution or the DMH (MOTC). Additionally, the portal has demographic projections for the nation which can be used to calculate national level projected water demands.

Finally, it can clearly be seen most datasets are considered by most participants to be unavailable to them. It is the goal of the portal to fill in the gaps when considered by the users technically sound and appropriate.

## 4.2 Validation and next steps

One of the most important outcomes of the workshop is the selection of two locations in Myanmar, with observed data, to be used to validate datasets from the portal. Figure 4.4 shows participants views on how we should choose the two locations and datasets. The highest score was obtained by “based on availability of ground measurements”. This falls exactly in line with our technical recommendations and together with the ECD, we will make our best efforts to source the ground measurements from the appropriate national institutions, should they be available to assist the data validation.

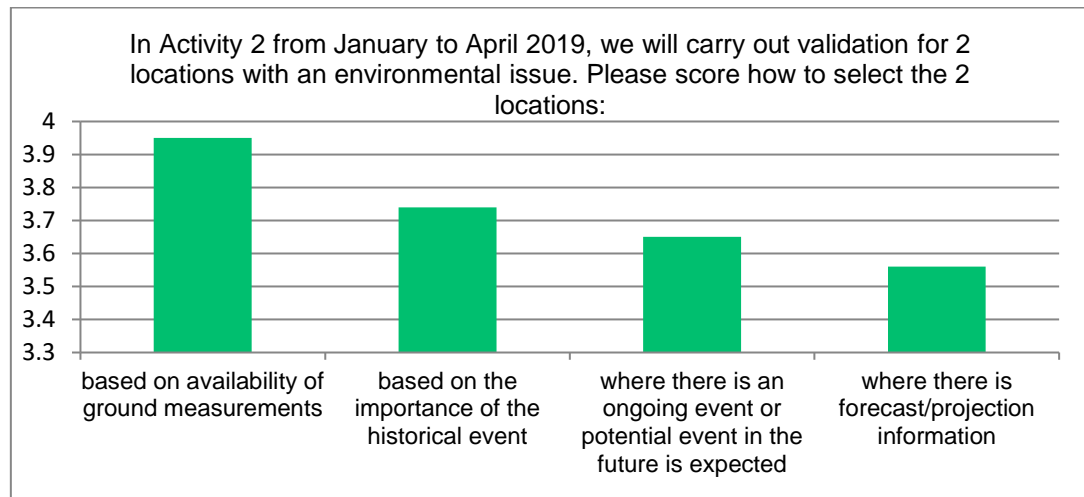


Figure 4.4 Scoring of how to select the cases for validation.

Figure 4.5 shows the participants views with regards to which locations/events they believe we should look at when validating the portal data. The highest score was obtained by the Mawlamyine flood of 2018 (6.58) and Kayin state Hpa-An city floods (5.95), followed by Shwe Kyin city 2018 flood (5.28).

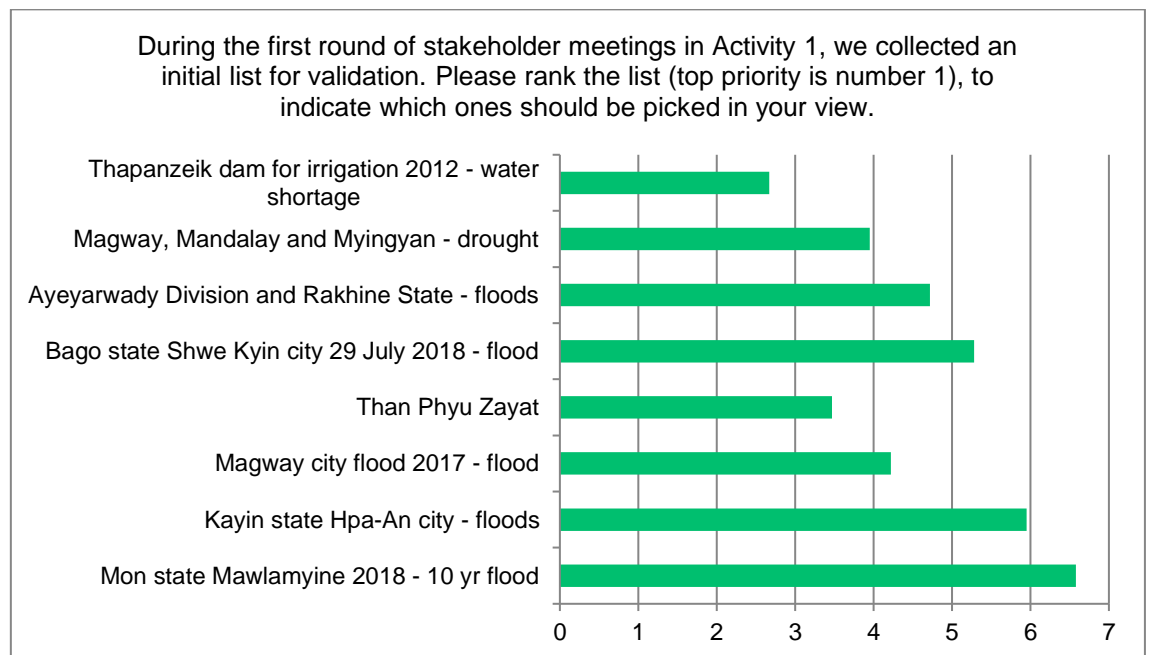


Figure 4.5 Scoring of cases for data validation.

The following options scoring the highest are: Ayeyarwady and Rakhine flood events (4.72) Magway city flood (4.22) and drought in Magway/Mandalay and Myingyan (3.95).

We asked participants to add new locations and associated environmental issues which should also be considered and were not on the list. This resulted in the following:

- Magway, Saging, Mandalay & Bago drought areas
- Mon, Tanantharyi, Kayin & Bago flood areas
- The Kalay flood
- Shwe Bo and some cities from Kachin State under the danger of flash flood
- Special Economic Zones in Myanmar
- Belin flood 2018
- Hakha
- Rakhine storms

It is beneficial to have many options due to fact that at this point, the team does not yet know if observed data is available and/or attainable, for the locations/events scored highest. Additionally, the initial list was compiled based on our experience and pre-existing knowledge of the study area and had not been informed by the stakeholders directly.

To carry out the final selection, the above results will be used, and guidance sought from the ECD.

The last workshop question is related to the next steps and the parallel upscaling objective of having the outputs from this technical assistance support stakeholders with the initial drafting of a larger proposal to the GCF. A number of options were made available to the participants and 47.83% of respondents listed as the next step the listing of existing funding opportunities for such a proposal followed by the forming of committees to develop priority lists at 43.48% and engaging higher ministerial levels at 34.78%.

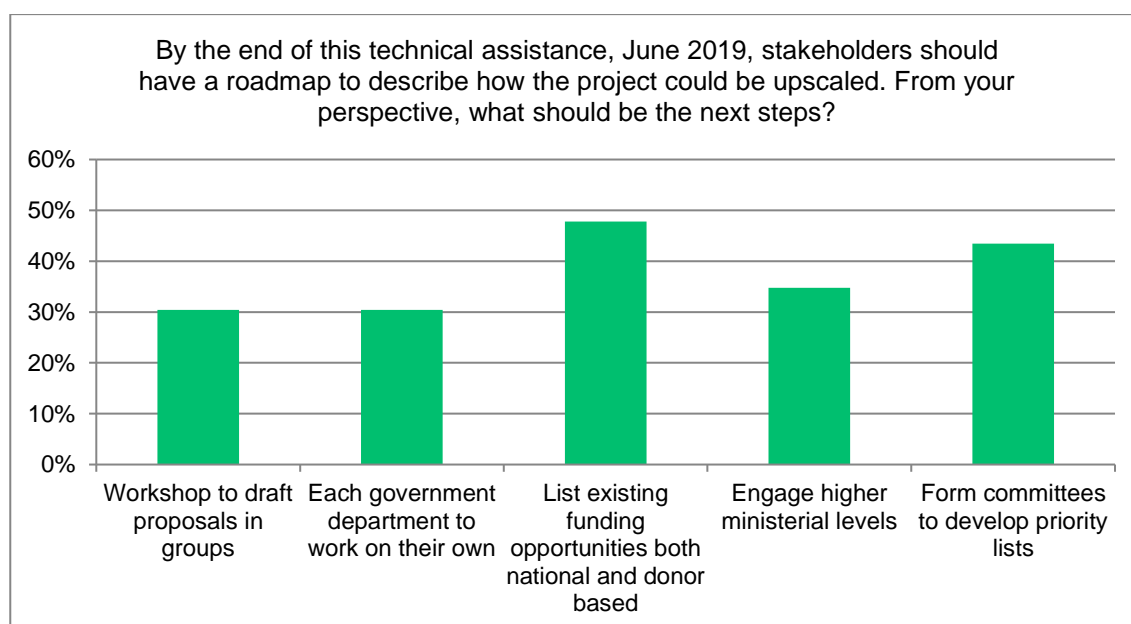


Figure 4.6 Stakeholders views on Activities 2 and 3.

## 5 Feedback from participants

This chapter summarises the evaluation of the course by the participants. There were 35 evaluations in total.

The overall impression of the course is good (77%). 17% thought the course was excellent, and only 3% (one person) thought that it was only acceptable. 86% of the participants would recommend the course to others.

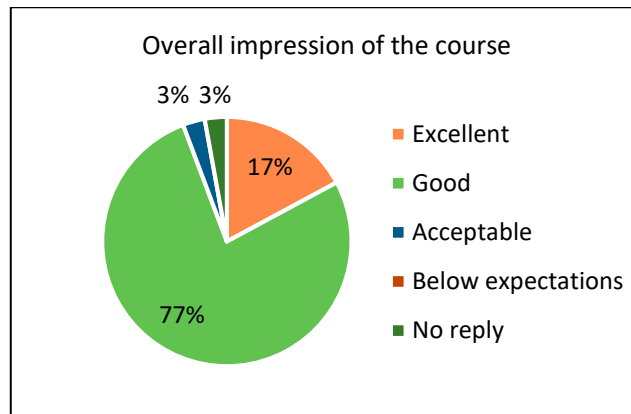


Figure 5.1 Overall impression of the course.

Generally, all topics are found interesting, except the use of water indicators, which only 5 participants put among their most interesting topics. The most interesting topic was the issue analysis, closely followed by data and information. This is due to the fact that during the workshop, we did not have time to go in depth into it and decided to leave this topic to the next workshop.

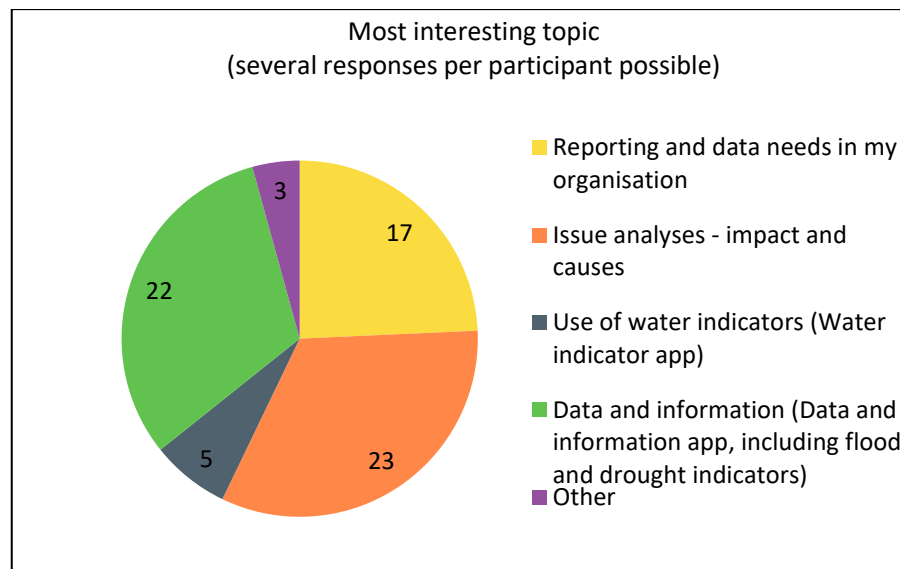


Figure 5.2 Most interesting topic. Participants can choose more than one answer. Note that number of participants is shown, not percentages.

Participants are overall satisfied with the course content, and everyone was happy with the technical content and the hands-on exercises. Generally, the participants find the workshop material clear and comprehensive, agree that the content will make more members in their team use the Portal, and think that the Portal will be useful in their day-to-day activities. However, as

seen in the following figures, for these three topics there were also some “neither/nor” responses so possibly some more effort should be put into these points.

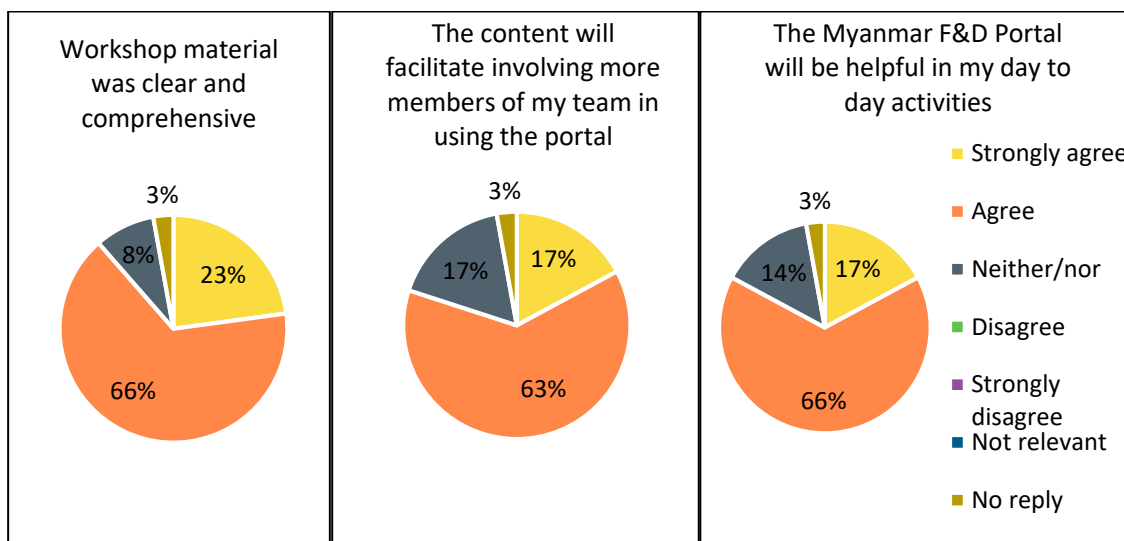


Figure 5.3 Feedback on workshop content.

Regarding the workshop execution, all participants agreed or strongly agreed that the instructors presented the subject in an interesting way. 94% agreed or strongly agreed that the instructors had a good knowledge of the subject. Most participants were happy with the duration of the course and the time for hands-on exercises and discussions, but not all participants agree, as seen in the following figures. Several of the comments also state that there was too little time for hands-on exercises or that the duration of the course was too short.

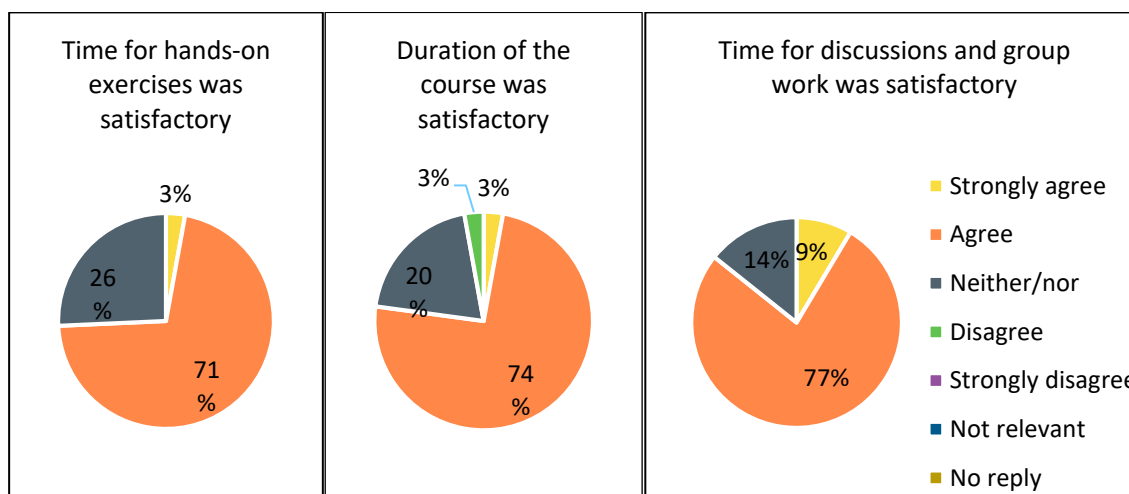


Figure 5.4 Time management of the workshop.

Participants are generally happy with the logistic aspects related to the workshop. However, three participants did not agree that practical information was given well in advance, and only 14% strongly agreed, which is the lowest percentage of strongly agree in this section. Several of the comments say that the internet connection was not strong enough. One person commented that the projector was too small and had a blurry screen.

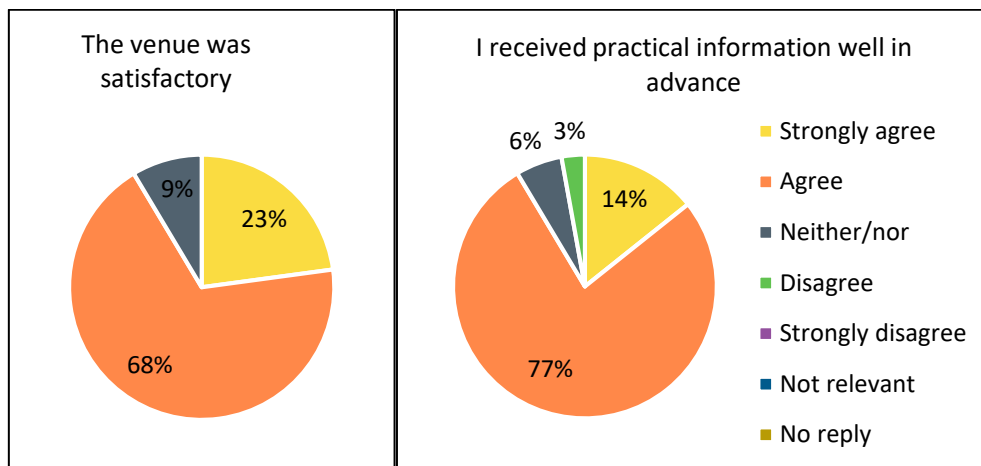


Figure 5.5 Venue and organization of the workshop.

Some comments are calling for more data such as CO<sub>2</sub> emission data, annual maximum rainfall, days of successive rainfall, and more environmental data in general. There are also requests for examples based on real events. One comment requests another basemap but does not specify why.

In conclusion, participants are overall satisfied with the course, but have some complaints, mainly that there is not enough time for exercises and discussion and that the internet connection is not strong enough. The water indicator application was found the least interesting, while the remaining topics were all found interesting.

## 6 Next steps

Following the first national workshop a number of actions for DHI and the ECD were agreed upon and are outlined as follows:

- DHI and ECD to work on the detailed work plan for Activity 2 and 3 with MIID support;
- ECD to coordinate obtaining observed data for the 2 locations;
- DHI and ECD to coordinate next workshop with the logistical assistance of MIID.
- DHI and ECD to discuss the approach to the drafting of the concept note for a proposal to the GCF for upscaling the outcomes of this technical assistance.

The next phase of the technical assistance is **Activity 1.3 Identification and design of the information**, and the output is the **Technology specifications and methodology for validation report** - a key deliverable of this technical assistance. It is directly informed by the data collected and presented herein.



# APPENDIX A

## Workshop Agenda



**Strengthened drought and flood management through improved science-based information availability and management in Myanmar**

4th & 5th December 2018 - Aureum Palace Hotel & Resort, Naypyitaw

<b>First National Workshop Day 1</b>		
Presentation of the project scope, objectives and outcomes. Introduction to the Flood and Drought Management tools project and portal. Drivers or causes behind flood and drought in Myanmar.		
<b>Time</b>	<b>Title</b>	<b>Responsible</b>
09.00 – 09.10	Welcome and Presentation of participants	ECD
09.10 – 09.20	Disaster risk reduction in Myanmar	MIID
09.20 – 09.40	<p><b>Overview of the Project</b>  <i>Introduction to the GCF and CTCN. Presentation of the project background and objectives</i></p> <ul style="list-style-type: none"> <li>• Introduction to the GCF and CTCN</li> <li>• Objectives</li> <li>• Ongoing projects and opportunities</li> </ul>	DHI
09.40 – 10.20	<p><b>The Flood and Drought portal</b>  <i>Introduction to the Flood &amp; Drought management tools web portal.</i></p> <ul style="list-style-type: none"> <li>• Data and Information</li> <li>• Overview of tools</li> </ul> <p>Outcome: Knowledge of the different portal components, what they are and can be used for.</p>	DHI
10.20 – 10.40	Tea break	
10.40 – 12.00	<p><b>Data and Information</b>  <i>Overview and understanding of available near real time data for flood and drought assessment.</i></p> <ul style="list-style-type: none"> <li>• Hands-on exercises – based on the Data and Information app.</li> <li>• Basic introduction to the functionality and the different data types.</li> </ul> <p>Outcome: Knowledge and understanding of available data to be used for flood and drought assessment.</p>	DHI Participants with assistance from DHI
12.00 – 13.00	Lunch	
13.00 – 15.00	<p><b>Data and Information</b>  <i>Completion of previous session and focus on forecast data</i></p> <ul style="list-style-type: none"> <li>• Hands-on exercises – how key indicators could be used for flood assessment</li> <li>• Specific examples from Myanmar</li> </ul> <p>Outcome: Capacity and knowledge to use key indicators for flood assessment in Myanmar.</p>	DHI
15.00 – 15.20	Tea break	
15.20 – 15.50	<p><b>Survey on data and reporting needs</b>  <i>Answering a survey to assess data, information and reporting needs.</i></p>	Participants
15.50 – 16.00	<p><b>Wrap-up</b>  <i>Feedback and questions from participants.</i></p>	DHI

<b>First National Workshop Day 2</b>		
Overview and knowledge of relevant data to be used for flood and drought assessment; use of indicators to measure the specific flood and drought causes; value and applications of near real-time data.		
<b>Time</b>	<b>Title</b>	<b>Responsible</b>
09.00 – 10.20	<p><b>Issue analysis</b>  <i>Identify and prioritize the key environmental impacts from drought and flood using a Causal Chain Analysis and WRIAM approach</i></p> <ul style="list-style-type: none"> <li>• Group work based on the Issue Analysis app.</li> <li>• Discussion on the identified and prioritised causes</li> </ul> <p>Outcome: Identification of prioritised impacts and the underlying causes of flood and drought events in Myanmar.</p>	<p>DHI</p> <p>Participants with assistance from DHI</p>
10.20 – 10.40	Tea break	
10.40 – 12.00	<p><b>Water indicators</b>            Identify relevant indicators for monitoring of flood and drought.</p> <ul style="list-style-type: none"> <li>• Group work based on the Water Indicator app.</li> </ul> <p>Outcome: Identification of indicators and the required data for assessing the state of flood and drought in Myanmar.</p>	<p>DHI</p> <p>Participants with assistance from DHI</p>
12.00 – 13.00	Lunch	
13.00 – 13.45	<p><b>Data and reporting needs</b>  <i>Presentation of results</i></p> <ul style="list-style-type: none"> <li>• Identify the current gaps related to the information base for climate change adaptation, flood and drought management in Myanmar</li> </ul> <p>Outcome: Summarize the needs, constrains and potentials for the portal.</p>	DHI
13.45 – 15.00	<p><b>Roundtable discussions</b>  <i>Group discussion points and presentation of results</i></p> <ul style="list-style-type: none"> <li>• Feedback on project scope and content</li> <li>• Linkages and potential synergies with other current and planned initiatives of relevance</li> <li>• How to utilise the satellite based data in local case studies</li> </ul>	Participants
15.00 – 15.20	Tea break	
15.20 – 15.40	<b>Next steps</b>	DHI
15.40 – 16.00	<b>Evaluation of workshop and closure</b>	DHI

**Participants should bring their own laptops or at least one per institution. All presentations and content used during the workshop will be compiled and disseminated to all participants.**

# APPENDIX B

## Attendance Register



No	Name	Department	Ministry	Job Title	Email	Phone
1	Daw Toe Toe Than Naing	Department of Disaster Management	Ministry of Social Welfare, Relief and Resettlement	Staff Officer	<a href="mailto:toetoethannaing@gmail.com">toetoethannaing@gmail.com</a>	09-250553345
2	Daw Nway Nway Soe	Department of Disaster Management	Ministry of Social Welfare, Relief and Resettlement	Assistant Director	<a href="mailto:nwaynwaysoe1976@gmail.com">nwaynwaysoe1976@gmail.com</a>	09-422203910
3	Dr. Ei Phyu Win	Yezin Agricultural University, Yezin	Ministry of Agriculture, Livestock and Irrigation	A.L	<a href="mailto:eiphyu000@gmail.com">eiphyu000@gmail.com</a>	09-421176775
4	Daw Swe Swe Yee	Department of Agriculture	Ministry of Agriculture, Livestock and Irrigation	Staff Officer	<a href="mailto:swesweyee16@gmail.com">swesweyee16@gmail.com</a>	09-795433919
5	Daw Aye Aye Khaing	Department of Agriculture	Ministry of Agriculture, Livestock and Irrigation	Staff Officer	<a href="mailto:aayekhaing2016@gmail.com">aayekhaing2016@gmail.com</a>	09-43017225
6	Daw Zin Mar Khaing	Department of Social Welfare	Ministry of Social Welfare, Relief and Resettlement	Staff Officer	<a href="mailto:zinmar198436@gmail.com">zinmar198436@gmail.com</a>	09-401585427
7	U Kyaw Soe Win	Environmental Conservation Department	Ministry of Natural Resources and Environmental Conservation	PSO?	<a href="mailto:kyawsoewin.ecd@gmail.com">kyawsoewin.ecd@gmail.com</a>	09-250803879
8	Daw Htwe Htwe Win	Department of metrology and hydrology	Ministry of Transport and Communications	Assistant Director	<a href="mailto:htwehtwewin12@gmail.com">htwehtwewin12@gmail.com</a>	09-230954645
9	Daw Thandar Wint Wint Khaing	Environmental Conservation Department	Ministry of Natural Resources and Environmental Conservation	Assistant Director	<a href="mailto:tdwindwrm@gmail.com">tdwindwrm@gmail.com</a>	09-450028742
10	U Aung Tin Soe Tun	Department of Hydropower Implementation(DHPI)	Ministry of Electricity and Energy	Staff Officer	<a href="mailto:aungtinsoetun@gmail.com">aungtinsoetun@gmail.com</a>	09-43091865
11	Daw thin Thuzar Win	Environmental Conservation Department	Ministry of Natural Resources and Environmental Conservation	Deputy Director	<a href="mailto:thinthuzar1981@gmail.com">thinthuzar1981@gmail.com</a>	
12	Daw Thida Sann	Department of Hydropower Implementation(DHPI)	Ministry of Electricity and Energy	Deputy Director	<a href="mailto:thidasann@gmail.com">thidasann@gmail.com</a>	09-256116672
13	May Myat Mon	ECD, EIA Division	Ministry of Natural Resources and Environmental Conservation	Staff Officer	<a href="mailto:maylay.yau1981@gmail.com">maylay.yau1981@gmail.com</a>	09-420719076
14	U Aye Ko	Department of Construction	Ministry of Construction	Assistant Director	<a href="mailto:be.ayeko@gmail.com">be.ayeko@gmail.com</a>	09-5147819
15	U Soe Moe Kyaw	Department of Construction	Ministry of Construction	E.E	<a href="mailto:soemoekyaw.civil@gmail.com">soemoekyaw.civil@gmail.com</a>	09-420219596

No	Name	Department	Ministry	Job Title	Email	Phone
16	U Kyaw San Naing	Environmental Conservation Department	Ministry of Natural Resources and Environmental Conservation	Director	<a href="mailto:kyawsannaing.env@gmail.com">kyawsannaing.env@gmail.com</a>	09-420704775
17	Dr. Thura Aung	Occupational and Environmental Health Division (OEHD)	Ministry of Health and Sports	Medical Officer	<a href="mailto:drthuraaung1989.lfc@gmail.com">drthuraaung1989.lfc@gmail.com</a>	09-5040735
18	Dr. Thet Tun Aung	Occupational and Environmental Health Division (OEHD)	Ministry of Health and Sports	Medical Officer	<a href="mailto:thettunaung322@gmail.com">thettunaung322@gmail.com</a>	09-797245463
19	U San Myint Tun	Forest Department	Ministry of Natural Resources and Environmental Conservation	Assistant Director	<a href="mailto:smtun2014@gmail.com">smtun2014@gmail.com</a>	09-448537378
20	U Hein Latt	Environmental Conservation Department	Ministry of Natural Resources and Environmental Conservation	Assistant Director	<a href="mailto:nyilatt48@gmail.com">nyilatt48@gmail.com</a>	9953789828
21	U Than Naing Win	Forest Department	Ministry of Natural Resources and Environmental Conservation	Assistant Director	<a href="mailto:tnwin39@gmail.com">tnwin39@gmail.com</a>	09-450261907
22	U Hlaing Tun	Directorate of Water Resources and Improvement of River Systems Directorate of Water Resources and Improvement of River Systems	Ministry of Transport and Communications	Deputy Director	<a href="mailto:hlaingtun1974@gmail.com">hlaingtun1974@gmail.com</a>	09-5165518
23	U Tun Tun Naing	Directorate of Water Resources and Improvement of River Systems	Ministry of Transport and Communications	A.E	<a href="mailto:dwir5.npt@gmail.com">dwir5.npt@gmail.com</a>	067-3411428
24	Dr. Myat Taw Htat	PCD, NPT DC	Naypyitaw Development Committee	A.C.E	<a href="mailto:myattaw@gmail.com">myattaw@gmail.com</a>	0673-414525
25	U Zaw Lnn Aung	Naypyitaw Development Committee	Naypyitaw Development Committee	E.E	<a href="mailto:zlinag1978@gmail.com">zlinag1978@gmail.com</a>	09-43017921
26	Dr. Zaw Khaing Oo	Mandalay Technical University	Ministry of Education	Professor	<a href="mailto:zawkhaingoo2012@gmail.com">zawkhaingoo2012@gmail.com</a>	09-422232426
27	Daw Su Su Swe	Department of Meteorology and Hydrology, Mandalay	Ministry of Transport and Communications	Staff Officer	<a href="mailto:sususwemdy@gmail.com">sususwemdy@gmail.com</a>	09-789663750

No	Name	Department	Ministry	Job Title	Email	Phone
28	U Zaw Zaw Latt	Irrigation and Water Utilization Management Department (IWUMD), Mandalay	Ministry of Agriculture, Livestock and Irrigation	Assistant Director	<a href="mailto:zawzawlatt@khalsa.com">zawzawlatt@khalsa.com</a>	09-5140175
29	Daw Hla Hla Sann	General Administration Department		Assistant Director	<a href="mailto:hlahlasan443@gmail.com">hlahlasan443@gmail.com</a>	09-5301516
30	Dr. Zin Marlar Tin San	Civil Department, Yangon Technical Univerity	Ministry of Science and Technology	Professor	<a href="mailto:zinmarlar@gmail.com">zinmarlar@gmail.com</a>	09-5043933
31	Dr. Aye Myint Khaing	Civil Department, Yangon Technical Univerity	Ministry of Science and Technology	Demonstrator	<a href="mailto:ayemyintkhing410@gmail.com">ayemyintkhing410@gmail.com</a>	09-2305671
32	U Tint Zaw Htet	General Administration Department		Assistant Director	<a href="mailto:tintzawhtet.tzh@gmail.com">tintzawhtet.tzh@gmail.com</a>	09-43007434
33	U Soe Zaw	Yangon City Development Committee	Yangon City Development Committee		<a href="mailto:soe.zaw93@gmail.com">soe.zaw93@gmail.com</a>	09-5183597
34	U Soe Maung Hla	Water Supply and Sanitation Department	Mandalay City Development Committee	Assistant Director	<a href="mailto:diamondsoe5@gmail.com">diamondsoe5@gmail.com</a>	09-2010927
35	U Kyaw Myo Nay	Water Supply and Sanitation Department	Mandalay City Development Committee	JE	<a href="mailto:kyawmyonaingkmn@gmail.com">kyawmyonaingkmn@gmail.com</a>	09-442877766
36	U Aung Nanda	Myanmar sustainable Development Engineering Services Co., Ltd		Managing Director	<a href="mailto:nanda@m-sdes.com">nanda@m-sdes.com</a> <a href="mailto:nanda.msde@gmail.com">nanda.msde@gmail.com</a>	<a href="tel:09-5160905">09-5160905</a>