



Initiative for Climate Action Transparency - ICAT

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Guideline: Multi-hazard Early Warning Systems Monitoring and Evaluation Framework for South Africa

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1. Introduction

Early Warning Systems (EWS) are essential tools in responding to disaster risks and in adapting to climate change, and thereby reducing or even avoiding the damages caused from hazards. It is not only necessary to have EWS in place, but to also ensure that they can be evaluated against a set of criteria or indicators, in order to ensure its effectiveness.

A framework of Monitoring and Evaluation (M&E) indicators for Multi-Hazard Early Warning (MH-EWS) has been developed for South Africa. The framework aligns with existing policy and legislation regarding disaster risk, climate change adaptation and existing M&E systems or instruments. The different elements of the framework have been integrated into a Microsoft Excel format to serve as a self-contained tool for the M&E of the effectiveness of the MH-EWS.

This guideline document, is intended to support key stakeholders involved in disaster risk reduction and climate change adaptation to use the M&E tool to routinely assess their MH-EWS. It is expected that the tool can be scaled up or down across government levels and geographical scales.

2. Purpose of the guidance document

The guide will support initiatives aimed at understanding the effectiveness of EWS in the country, through:

- **Methodology for the assessment of the effectiveness of EWS:** provides a framework of indicators and criteria
- **Monitoring and evaluation:** An Excel based tool that will serve as a repository for data collection and analysis overtime
- **Reporting:** Supports consistent and transparent reporting
- **Decision-making:** help policymakers and other decision-makers to update plans and policies related to EWS

The guidance and related tool can support national reporting(e.g. South Africa's Desired Adaptation Outcomes) and international reporting (e.g. climate change reporting to the United Nations Framework Convention on Climate Change - UNFCCC).

At a local level where the MH-EWS is implemented, it is envisaged that through reporting using the M&E tool, users will also be able to identify opportunities for improvements in the implementation of the EWS and for the planning thereof.

3. Intended users

A "user" of this guideline and the related tool, refers to the individual in an organisation that will have the responsibility of implementing the M&E framework for MH-EWS. The intended users are primarily those in government departments that deal with issues of disaster risk management and climate change adaptation.

Examples provided below highlight how different users may benefit from the tool or the information contained therein:

- **Local government:** To assess the effectiveness of MH-EWS and track progress on the implementation of improvements made to MH-EWS. Identify gaps and opportunities to strengthen preparedness and reliability of systems in place.
- **Provincial and national government:** Assess the challenges being faced by local municipalities in terms of the capacity and capabilities in implementing MH-EWS toward supporting policies, programmes and training needs.
- **Research institutions and academia:** Assess key trends and provide support to decision makers across all spheres on government on actions needed to strengthen responses.

4. M&E MH-EWS framework

The indicators that make up the M&E MH-EWS framework are grouped into three elements namely “Efficiency of processes”, “Reliability” and “Impacts”. The general description of the type of information that is meant to be captured within these elements is shown in Figure 1 below.

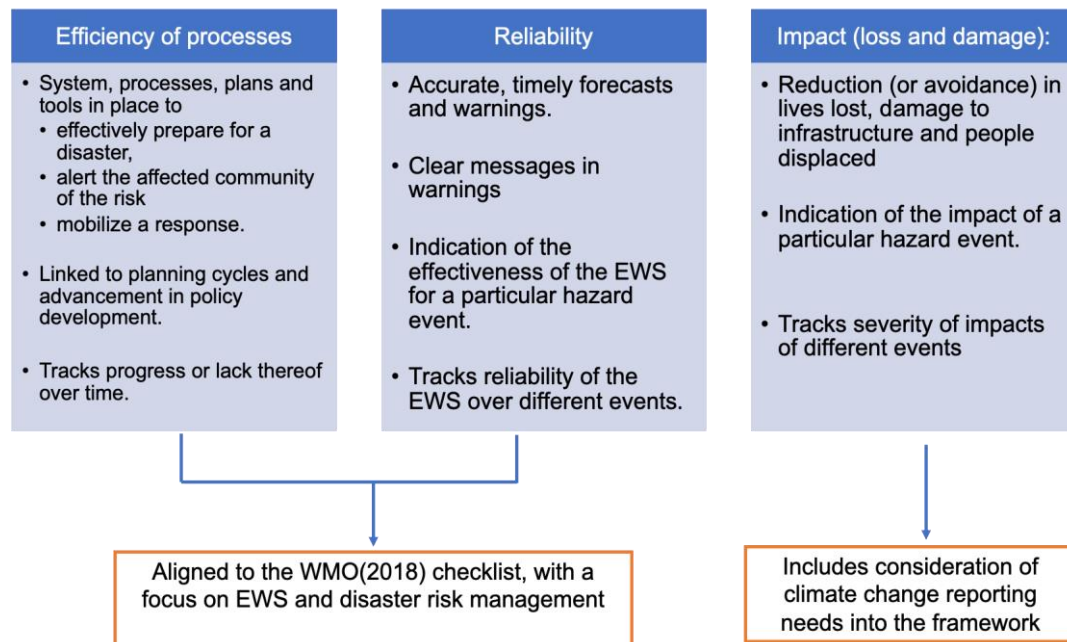


Figure 1: Elements of the framework for the M&E of MH-EWS in South Africa

The assessment of all the three elements of the framework would be for the same calendar year. The first of these elements "Efficiency of processes" needs to be assessed to provide an indication of the status of the indicators for that particular year, whereas the indicators for "Reliability" and "Impact" are focussed on assessing a particular hazard event within the year. Over time the assessment will allow the user to identify if corrective measures are having the desired effect on poor performing indicators and overall on effectiveness of the different elements of the framework.

5. Overview of M&E of MH-EWS Microsoft Excel Tool

This tool developed based on the framework described above in section 4, allows the user to capture information related to MH-EWS used for Disaster Risk Reduction. Key information related to the plans and processes in place, the reliability of the MH-EWS and the impact of weather and climate related disasters are captured in the tool as shown in Figure 2.

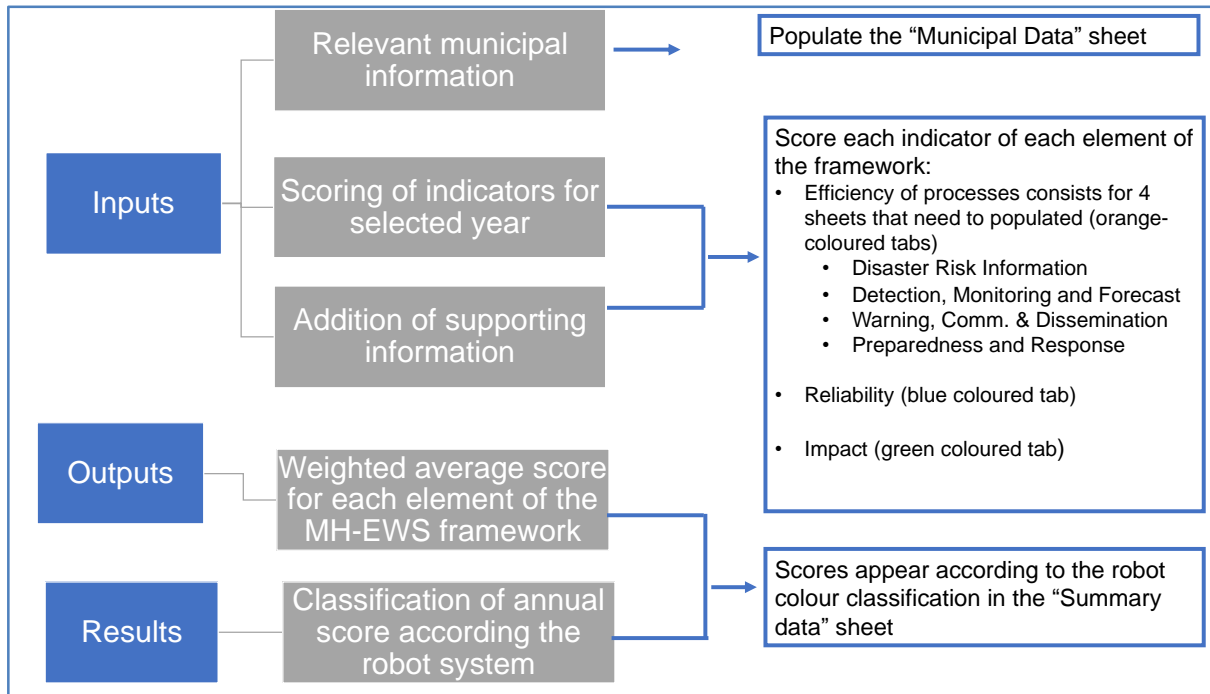


Figure 2: High-level overview of the M&E MH-EWS tool

6. Steps for use of the M&E of MH-EWS Microsoft Excel Tool

The suggested core steps to navigate through the spreadsheet based M&E tool and to guide the capturing of information is provided below.

In the **first step** the "Municipal Data" sheet is used to capture information on the hazard to be assessed and the year of the assessment (Figure 3).

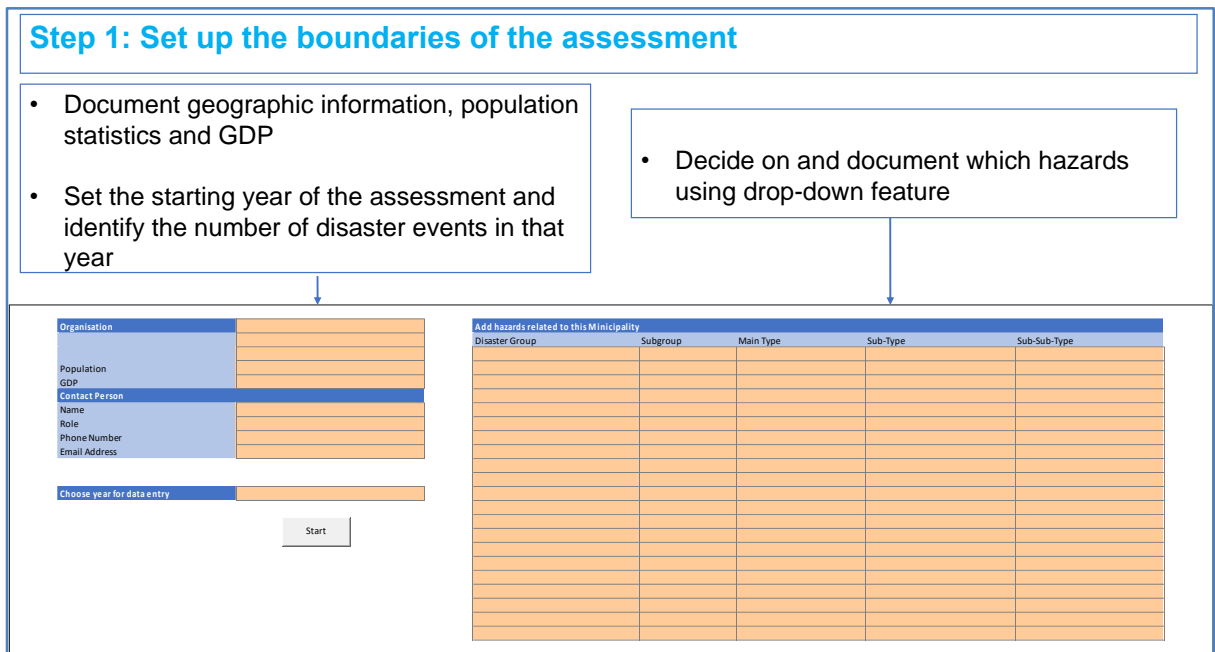


Figure 3: Capturing information in the municipal data sheet of the M&E tool.

In the **second step**, the user will need to source the relevant information for the different indicators that are contained within the M&E tool. The tool has different spreadsheets that cover the three elements of the framework. The element of "Efficiency of processes" has four sub-elements of:

- Disaster Risk Information
- Detection, Monitoring and Forecasting
- Warning, Communication and Dissemination
- Preparedness and Response

The "Reliability" and "Impact" elements each have one spreadsheet only. Each of the spreadsheets for the different elements have a list of indicators. Each of these indicators need to be assessed.

The assessment must be based on the stated objectives and the definitions for the different levels of deployment per indicator. The score is entered into the column called "Assessment of level of deployment".

Step 2: Collect the necessary information and score the indicators

Obtain all the required data from the relevant departments and make requests for data that may be stored externally for the identified year and disaster events therein:

- Assess the level of deployment for each indicator
- Each indicator must receive a score of 1, 2 or 3

1

A low level of deployment and most critical elements are not met

2

Indicates some level of deployment but some critical elements are not met

3

Indicates a high level of deployment and all key elements are met

		Level of deployment			Assessment of level of deployment	Additional detail on status of indicator	Reference to data source <small>The citation of the report/ database reference/ govt. department/ organisation report</small>
		1	2	3			
1	Networks in place to disseminate flash flood alerts issued by disaster management centres	Professional networks established to receive and disseminate warnings widely	No networks in place	Networks in place and not fully operational/ utilised	Networks in place and fully operational/ utilised		
2	Surveys in place to quantify last-mile connectivity within the municipalities	Understanding of last-mile connectivity to know which population groups can be reached	No surveys in place	Surveys in place but not assessed	Surveys in place and assessed regularly*		
Final Score					0		
Select Year					2022	Submit	

Figure 4: Assessment of the level of deployment

The user is required to provide an assessment for each of the criteria, in order for the final score to be generated in the tool.

In the **third step** the user will enter an explanation to justify the score that was given to an indicator, under the column called 'Additional information on the status of the indicator'. There is also a need to document the source of the data used to inform the assessment as well as any other relevant supporting information (Figure 5).

This information is important in terms of ensuring transparency and allows for ease of continuity, should a different user populate the tool for the same municipality for the next assessment year.

Step 3: Collect the necessary supporting information

For each indicator document any relevant supporting information on who collects relevant information and where that information is stored

Assessment of level of deployment	Additional detail on status of indicator	Reference to data source The citation of the report/ database reference/ gov. department/ organisation report	Supporting Information			
			Roles and Responsibilities Who collects and produces the information (stakeholders involved, govt, scientific community, communities) ?	Data Custodian Who stores this/ manages in terms of quality (ownership of data)?	Frequency How often are measurements made or criteria assessed?	Policy link Is there a requirement that the municipality reports on the data captured in the indicator, and what is the policy?

Final Score:

Select Year:

Figure 5: Collection of supporting information within the M&E tool

In the **final step** of using the tool, the user is able to extract scores on the overall effectiveness of each element of the MH-EWS framework. The scores entered within each element or sub-element is automatically converted within the tool to provide a weighted average score. These scores are found in the "Summary Sheet". As the tool allows for the extraction of aggregated information through this summary sheet, the average scores across elements are ranked using the robot classification system according to the ranges shown in Figure 6 to report on the overall effectiveness, as being either "Not effective to Slightly effective", or "Moderately effective" or "Very effective to Extremely effective".

Step 4: Estimate the effectiveness of the EWS for hazard events

- Once each indicator is given a score, the average weighted average per element of the framework is automatically calculated.
- The user may extract calculated scores of “Efficiency of Processes, “Reliability” to gauge effectiveness
- Extract calculated scores of “Impact” to understand how the severity of impact varies over hazard events
- The scores are colour coded according to the robot system

Tracking Efficiency of Processes			
	Weights	2007	2013
Disaster Risk Information	0.25	1,166666667	2,333333333
Detection, Monitoring, and Forecasts	0.25	1,666666667	2,333333333
Warning, Communication, and Dissemination	0.25	1,5	1,5
Preparedness and Response	0.25	1	1,8
Average score for efficiency of processes		0,833333333	0,497916667

Tracking Reliability			
	Weights	2007	2013
Warnings reach intended stakeholders	0.33	2	2
Clarity of warning message	0.33	3	1
Warning lead time	0.33	3	2
Average score for reliability		0,444444444	0,555555556

Tracking Impact			
	Weights	2007	2013
Deaths avoided	0.33	2	2
Damage to infrastructure	0.33	1	1
People Injured	0.33	3	3
Average score for impact		0,444444444	0,666666667

Summary of overall effectiveness			
		2007	2013
Efficiency of Processes		0,833333333	0,497916667
Reliability		0,444444444	0,555555556
Average scores		0,388888889	0,526736111

Classification	Range
Not Effective	0.0 - 0.2
Slightly Effective	0.2 - 0.4
Moderately Effective	0.4 - 0.6
Very Effective	0.6 - 0.8
Extremely Effective	0.8 - 1.0

Figure 6: Summary sheet of the M&E tool

The disaggregated information across each element of the framework can also be used to help support other climate change, sustainable development and disaster management objectives, that include:

- Sendai Framework for Disaster Risk Reduction (Targets A-D)
- Review and update of information in Municipal Disaster Management Plans (as required by Disaster Management Act, 2002)
- Reporting on Sustainable Development Goals (1,11 and 13)

7. Key considerations when using the framework and tool for the M&E of MH-EWS in South Africa

The existing legislation and policies around climate change and disaster management are key facets in creating an enabling framework for promoting the need for adaptation and the M&E of actions in South Africa. MH-EWS and the M&E thereof is one of the key elements needed in an effective disaster risk and climate change adaptation response. The M&E of MH-EWS and the outcomes thereof therefore must be viewed within the broader context of adaptation and gaps that may still exist in a country's disaster risk management and climate change response.

Glossary of terms

Disaster risk management plans	Municipal Disaster Management Plans describe the arrangements for managing disaster risks and for preparing for and responding to disasters within Municipality as required by the Disaster Management Act.
Disaster risk information	The systematic collection of data and disaster risk assessments for the development of disaster risk knowledge is important for efficient, people-centred early warning systems. Disaster risk knowledge in the context of EWS can be defined as the likelihood of harm or loss due to the action of hazards or other external threats on vulnerable structures, services, areas, communities and households anticipated in the future which can be synthesized for the purpose of issuing of advisories about the potential adverse impacts of physical hazards and the precautionary measures which can be taken timeously to mitigate potential threats. While risk and vulnerability information may not have geospatial attributes when integrated into a decision support system for EWS, it is in the best interests for the local disaster management authorities to manage such risk information within a geospatial data repository so that decision makers can appraise vulnerable populations, buildings and infrastructure in a timely and efficient manner.
Detection, monitoring and prediction	Monitoring of climate/weather related variables lie at the core of an EWS. They underpin the scientific basis of forecasting hazards/disasters. There are three crucial elements of monitoring: observation, measurement and prediction. Observation consists of an environmental behaviour that anyone can see. Measurement is something expressed in numerical form, for example, the water level in a river. Prediction involves an analysis and is what is expected in the future based on this measurement. This probably triggers an action if said measurement reaches a (min, max) level. This will provide users with the information needed for effective planning and operations to respond to climate hazards.
Early warning system	An early warning system (EWS) refers to the combination of disaster risk information, hazard monitoring, dissemination of warnings and preparedness plans and processes that would enable communities, individuals, governments amongst others to be alerted to the threat of a hazard and to take timeous action to reduce the disaster risk.
Flood	In South Africa floods are typically occur due to cut-off lows, thunderstorms and tropical cyclones which result in the significant rainfall. Typical types of floods experienced include flash floods, river floods and coastal floods.

Hazard	A hazard refers to a potentially damaging physical event (e.g., rainfall or temperature) that may result in loss of lives, damage to infrastructure and properties, and may cause disruptions to services and the economy. The weather and climate related hazards relate to extreme heat and heat waves, floods, and droughts.
Indicator	Indicators are used to track the state or level of some aspect of a system. Indicators are therefore key aspects of a monitoring and evaluation framework as it provides information that enables the monitoring and measurement of performance overtime.
Impact	This framework considers the impact of flooding events on people's lives and livelihoods. Impact includes the number of lives lost, damage to property and the number of people that were displaced. Impact indicators provide a measure of the impact (loss and damage) of a particular hazard event/period.
Monitoring and evaluation	Monitoring and Evaluation (M&E) refers to the process that helps improve current and future management and achieve outcomes. It is a tool to support the understanding and prioritization of actions to assist decision making. M&E is critical in ensuring the long-term success of climate adaptation initiatives, plans and actions.
Preparedness and response	It is key to assess and track over time the preparedness of the municipality to actively involve the communities at risk, such that public education and awareness of the potential risk is raised and that there is a constant state of preparedness. A further objective is to assess how well equipped the municipality is to enable a quick and effective response through the testing and evaluation of the level of awareness and response. Protocols to activate and mobilize emergency response services (e.g., local police, firefighters, health care workers, etc.) need to be established and implemented. Knowledge and awareness campaign programmes also need to be undertaken and processes need to be in place to ensure the level of the response and awareness activities are tested and evaluated in terms of their effectiveness.
Reliability	A measure of how reliable or accurate forecasts are and whether or not the warnings reach the affected areas. Also assesses if the warnings had clear messages to prompt stakeholder response and were released in a timely manner. These indicators provide a measure of the success or failure of the EWS for a particular event/ period.
Warning and dissemination	The provision of warnings to those at risk is a key activity in preparation for a disaster or as part of a disaster response to ensure that people and communities receive warnings in advance of impending hazard events. Effective dissemination of severe weather early warnings needs to be included as part of the disaster management information management system for the relevant area.

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