**DRAFT FOR CONSULTATION**

# Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction

## Collection of Technical Notes on Data and Methodology

**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

# Purpose

On 2 February 2017, in adopting Resolution A/RES/71/276, the United Nations General Assembly endorsed the Report of the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction[1] (A/71/644), and the recommendations for indicators and terminology relating to disaster risk reduction contained therein.

In the Report of the OIEWG, Member States requested the United Nations Office for Disaster Risk Reduction (UNISDR) to undertake technical work and provide technical guidance inter alia to:

1. Develop minimum standards and metadata for disaster-related data, statistics and analysis with the engagement of national government focal points, national disaster risk reduction offices, national statistical offices, the Department of Economic and Social Affairs and other relevant partners.
2. Develop methodologies for the measurement of indicators and the processing of statistical data with relevant technical partners.

This document is a preliminary draft for consultation, developed in response to the request of Member States. It builds on the recommendations and deliberations of Member States in the OIEWG, on the technical documentation produced by the Secretariat at the request of Members of the working group, on the deliberations of the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs)[2], and on technical consultations with Member States and experts since the submission of the Report of the OIEWG and the Report of the Inter-agency and Expert Group on Sustainable Development Goal Indicators (E/CN.3/2017/2).

The document provides technical suggestions and considerations of Member States, relevant technical partners and the UNISDR in respect of applicable definitions and terminology, possible computation methodologies, data standards and critical issues.

The purpose of this document is to support the refinement and finalization of the technical guidance for countries reporting on the indicators to monitor achievement of the global targets of the Sendai Framework for Disaster Risk Reduction 2015-2030.

The refinement and finalization of the technical guidance will take place throughout 2017 together with Member States and relevant technical partners, for which dedicated events will be organised by UNISDR, including a technical working meeting that will take place at the 2017 Global Platform for Disaster Risk Reduction in Mexico on 26 May 2017.

The first cycle of monitoring using the online Sendai Framework Monitor will begin in January 2018, and will exceptionally cover the two biennia 2015-2016 and 2017-2018.

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[1] OIEWG

[2] created by the United Nations Statistical Commission to develop a global indicator framework for the SDGs

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# Technical Note on Data and Methodology to Estimate Global Disaster Mortality to Measure the Achievement of Target A of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target A of the Sendai Framework for Disaster Risk Reduction.

**Target A:** ***Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.***

This document outlines the data, indicators and methodologies required for estimating global mortality associated with disaster events. The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG) report, endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and metadata, and the methodologies for the measurement of the global indicators.

The methodology described here proposes the collection and use of **simple and uniform physical indicators of mortality (number of people)**.

## 2. Introduction

This note addresses important aspects of data collection that Member States should consider in order to develop a robust methodology to measure mortality.

Previous studies and the experiences of a large number of data providers show that disaster mortality has been assessed and reported by different actors using slightly diverging but generally similar approaches. Unlike other loss indicators, such as economic loss, there is a high degree of consistency in the figures provided by all sources.

Variations in the uniformity of approach manifest as relatively minor inconsistencies in the global disaster mortality data currently reported by both national and international data providers. However, where these estimates exist, it is possible to identify how they were calculated.

The Global Assessment Report on Disaster Risk Reduction (GAR) 2015 demonstrates differences in reported mortality were less than 15% among different data sources including national and global, and that the majority of variations in mortality were usually due to differences in the reporting thresholds of some databases.

Another source of variation is that some disaster loss databases do not take into account the number of missing / presumed dead, and only count certified deaths.

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target A of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*.

| No. | Indicator |
|---|---|
| A-1 | Number of deaths and missing persons attributed to disasters, per 100,000 population. |
| A-2 | Number of deaths attributed to disasters, per 100,000 population. |
| A-3 | Number of missing persons attributed to disasters, per 100,000 population. |

Additionally, in its report E/CN.3/2017/2, the Inter-Agency and Expert Group on SDGs Indicators (IAEG-SDGs) proposed the use of these same indicators in measuring disaster-related global targets of the Sustainable Development Goals (SDGs) 1, 11 and 13.

At its 48th Session, in report E/2017/24-E/CN.3/2017/35 the UN Statistical Commission adopted the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development, developed by the IAEG-SDGs, and recommended the associated draft resolution[3] for adoption by the Economic and Social Council.

## 4. Applicable Definitions and Terminology

Unless stated otherwise, key terms are those defined in the "Recommendations of the open-ended intergovernmental expert working group on terminology relating to disaster risk reduction".

**Key terms**

**Death:** The number of people who died during the disaster, or directly after, as a direct result of the hazardous event

**Missing:** The number of people whose whereabouts is unknown since the hazardous event. It includes people who are presumed dead, for whom there is no physical evidence such as a body, and for which an official/legal report has been filed with competent authorities.

***Note from the Secretariat:*** *The data on number of deaths and number of missing/presumed dead are mutually exclusive.*

[3] Draft Resolution I - Work of the UN Statistical Commission pertaining to the 2030 Agenda for Sustainable Development

***Note from the Secretariat:*** *According to the definition of "Missing" the Secretariat suggests that the data is contingent upon the existence of legal reports or declarations. Such reports or declarations will ultimately result in those persons being legally declared dead ("declared death in absentia" or legal presumption of death) despite the absence of direct proof of the person's death, such as the identification of physical remains (e.g. a corpse or skeleton) attributable to that person. As a result, the indicator would use only official data, and not be dependent upon unofficial sources – such as mainstream media or humanitarian situation reports.*

## 5. Computation Methodology

**In the case of Target A, the formula for calculating the compound indicator is** a simple summation of related indicators from national disaster loss databases divided by the sum of represented population data (from national censuses, World Bank or UN Statistics information)**:**

$$\boldsymbol{A_1 \;=\; \frac{(A_{2a} + A_{3a})}{Population} * 100{,}000}$$

**Where:**

| | |
|---|---|
| *A-1*: | Number of deaths and missing persons attributed to disasters per 100,000 |
| *A-2a*: | Number of deaths attributed to disasters |
| *A-3a:* | Number of missing persons attributed to disasters |
| *Population*: | Represented population. |

Note that the above formula can be derived from:

$$\boldsymbol{A_2 \;=\; \frac{A_{2a}}{Population} * 100{,}000}$$

$$\boldsymbol{A_3 \;=\; \frac{A_{3a}}{Population} * 100{,}000}$$

$$\boldsymbol{A_1 \;=\; A_2 + A_3}$$

## 6. Minimum and Desirable Data Requirements

| Indicator No. | Indicator |
|---|---|
| A-1 | **<u>Number of deaths and missing persons attributed to disasters, per 100,000 population.</u>**<br><br>COMPOUND INDICATOR. See method |
| A-2 | **<u>Number of deaths attributed to disasters, per 100,000 population.</u>**<br><br>**[Minimum data requirements]:**<br>**Data to be collected by disaster**<br>**A-2a** Number of deaths attributed to disasters<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br>Sex<br>Age<br>Disability<br>Income<br><br>**METADATA**<br>**Additional demographic and socio-economic parameters needed**<br>**Population**:<br>Population of the country for each of the years of the reporting exercise.<br>The national indicator would be calculated using the population of the country.<br>The global indicator is the sum of the populations of all countries having reported. |
| A-3 | **<u>Number of missing persons attributed to disasters, per 100,000 population.</u>**<br><br>**[Minimum data Requirements]:**<br>**Data to be collected by disaster**<br>**A-3a** Number of deaths attributed to disasters<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br>Sex<br>Age<br>Disability<br>Income<br><br>**METADATA**<br>**Additional demographic and socio-economic parameters needed**<br>**Population**: see A-2 |

## 7. Specific issues

As stated in the Report of the OIEWG (A/71/644), Member States agreed that countries may choose to use a national methodology or other methods of measurement and calculation to measure the number of deaths and missing attributed to disasters, given the very significant differences among legal regimes around the world. The OIEWG also recommended that countries keep the metadata consistent if the methodology is changed.

However, countries will need to determine how a number of important challenges will be addressed, in a manner that is consistent throughout the entire process of data collection:

- **Attribution to an event**. With many data sources the cause of death is frequently not recorded as being associated with an event; for example, death as a result of a flood may only be registered as death from drowning in the medical or legal records. Therefore, it is necessary to understand the common causes of death associated with an event.
- **Temporal aspects for attribution and cut-off for data collection.** In *small-scale sudden-onset disasters*, finalizing data collection and declaring the data collected as final is commonly straightforward. However, some challenges may be encountered – for instance with regard to the definition of the period after which the death of an injured/ill person should be reflected in the data collected as attributed to the disaster. While some cases may never be reflected (for example someone in a coma for several months), in general, these cases represent a very small minority and will not affect the statistical strength of data that are collected within sensible cut-off time periods.
- **Temporal aspects for attribution and cut-off for data collection.** In *large-scale, slow-onset and long duration disasters* the issue is more problematic. Large-scale disasters usually require a much longer search and rescue phase, for example, or entail a more complex information management to determine the final number of fatalities that are attributed to disasters. Slow-onset disasters may span several years, with the corresponding challenge of compounding the information across the time span of the disaster, while still reporting data collected in an annual or biannual cycle.

For those countries that are starting loss data collection and are yet to establish a clear legal framework for these criteria, it is recommended that countries adopt an approach such as that presented overleaf.

| Hazard | Cause of death | Time-span or recommended cut-off period | Source of data |
|---|---|---|---|
| Drought | Malnutrition | 6 months after emergency state ceases, and Yearly cut-offs for multi-year events | Ministry of Health, Disaster risk management offices, Relief organizations, |
| Flood | Drowning, Trauma | 4 weeks after event | Ministry of Health, Disaster risk management offices, Relief organizations |
| ... | ... | ... | ... |

The most important recommendation to countries is to emphasise that **these criteria should be fixed for the entire time span of data collection (2005-2030).** While criteria are not predefined for any specific context, changes over time may introduce biases or measurement errors that could affect the detection of trends and patterns, negatively affecting the ability to reliably measure the achievement of the Target.

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# Technical Note on Data and Methodology to Estimate the Number of Affected People to Measure the Achievement of Target B of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target B of the Sendai Framework for Disaster Risk Reduction.

**Target B:** ***Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015***

This document outlines the data, indicators and methodologies required for the estimation of the number of people affected by disasters. The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG) report, endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and metadata, and the methodologies for the measurement of the global indicators.

This Technical Note proposes the collection and use of **simple and uniform indicators of affected (number of) people** as the point of departure for computation.

## 2. Introduction

The indicators, data and methodologies outlined here aim to produce an approximate value (a "proxy") that provides a verifiable, consistent and homogeneously calculated number of people directly affected by disasters.

The elements of 'people affected' are numerous and complex. People can be 'affected' with varying degrees of severity: from the loss or destruction of their primary residence, to the inconvenience of being unable to use household appliances as a result of an interruption in the electricity supply.

The Report of the OIEWG identifies that *"People can be affected directly or indirectly. Affected people may experience short-term or long-term consequences to their lives, livelihoods or health and in the economic, physical, social, cultural and environmental assets."*

The following two definitions are recommended in Section V. on Terminology of the Report of the OIEWG:

***Directly affected:*** *People who have suffered injury, illness or other health effects; who were evacuated, displaced, relocated; or have suffered direct damage to their livelihoods, economic, physical, social, cultural and environmental assets.*

***Indirectly affected**: People who have suffered consequences, other than or in addition to direct effects, over time due to disruption or changes in economy, critical infrastructures, basic services, commerce, work or social, health and physiological consequences.*

Given the large number of variables eligible for consideration in 'Affected', it is important to emphasize that no indicator will provide an absolutely precise, accurate and exhaustive measure of affected population. Even estimations of directly affected can be subjective, dependent on the methodology and criteria used to define 'affectation', as well as the exhaustiveness of data collection.

Recognising the difficulties of assessing the full range of all affected (direct and indirect), the OIEWG recommended the use of an indicator that would estimate "**directly affected**" as a proxy for the total number of affected. This indicator, while not perfect, uses widely available data and could be used consistently across countries and over time to measure the achievement of Target B.

From the perspective of data availability, feasibility of collection and measurability, the OIEWG recommended the use of a compound indicator based on:

- Number of people injured or ill as a direct result of disasters
- People whose houses were damaged or destroyed
- People who suffered direct damage to their livelihoods

The UNISDR proposes the measurement of the number who suffered **direct damage to their livelihoods or assets** based on:

- Number of people who work in, or own, productive assets (industries, services and commercial facilities, inter alia) affected
- Number of people who work on, or own, agricultural crops and livestock affected or lost

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target B of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*.

| No. | Indicator |
|---|---|
| B-1 | Number of directly affected people attributed to disasters, per 100,000 population. |
| B-2 | Number of injured or ill people attributed to disasters, per 100,000 population. |
| B-3 | Number of people whose damaged dwellings were attributed to disasters. |
| B-4 | Number of people whose destroyed dwellings were attributed to disasters. |
| B-5 | Number of people whose livelihoods were disrupted or destroyed, attributed to disasters. |

Additionally, in its report E/CN.3/2017/2, the Inter-Agency and Expert Group on SDGs Indicators (IAEG-SDGs) proposed the use of these same indicators in measuring disaster-related global targets of the Sustainable Development Goals (SDGs) 1, 11 and 13.

At its 48th Session, in report E/2017/24-E/CN.3/2017/35 the UN Statistical Commission adopted the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development, developed by the IAEG-SDGs, and recommended the associated draft resolution[4] for adoption by the Economic and Social Council.

## 4. Applicable Definitions and Terminology

For the purposes of this methodology, unless stated otherwise key terms are those defined in the "Recommendations of the open-ended intergovernmental expert working group on terminology relating to disaster risk reduction".

**Key terms**

The following working definitions are used throughout this document to define the data, methodologies and indicators:

**Injured or ill:** People suffering from a new or exacerbated physical or psychological harm, trauma or an illness as a result of a disaster.

**Livelihood:** The capacities, productive assets (both living and material) and activities required for securing a means of living, on a sustainable basis, with dignity.

**People whose damaged or destroyed dwellings were attributed to disasters:** The estimated number of inhabitants previously living in the dwellings (houses, or housing units) damaged or destroyed. These are considered affected by the fact that their dwellings were damaged (asset property damage), and because in many cases these inhabitants will be included in those *evacuated, displaced, or relocated*.

All inhabitants of these dwellings are assumed to be affected being in their dwelling or by direct consequence of the destruction/damage to their dwellings. If it is impossible for authorities to conduct a precise count of these people, an average number of inhabitants per dwelling (house, or housing unit) in the country can be used to estimate the value.

**Houses damaged:** Houses (housing units) with minor damage, not structural or architectural, and which may continue to be habitable, although they may require some repair or cleaning.

**Houses destroyed:** Houses (housing units) levelled, buried, collapsed, washed away or damaged to the extent that they are no longer habitable.

[4] Draft Resolution I - Work of the UN Statistical Commission pertaining to the 2030 Agenda for Sustainable Development

## 5. Computation Methodology

**In the case of Target B, the method of computation** is a simple summation of related indicators from national disaster loss databases divided by the sum of figures of global population data (from national censuses, World Bank or UN Statistics information).

$$\boldsymbol{B_1 \;=\; \frac{sum(B_2 \,..\, B_5)}{Population} * 100{,}000}$$

Indicators B4 and B5 shall be computed using the Average Number of Occupants per Household of the country, **AOH** where:

$$\boldsymbol{AOH = \frac{Population}{Number\ of\ Households}}$$

And

$$\boldsymbol{B_3 = \text{number of dwellings damaged} * AOH}$$
$$\boldsymbol{B_4 = \text{number of dwellings destroyed} * AOH}$$

Where the number of dwellings/houses damaged and destroyed are also to be used in Target C.

If countries have a national methodology to measure Indicator B-5 the indicator can be entered directly as measured in situ. If a methodology or measurement is not available, B-5 will be computed using several ratios such as number of workers per hectare, number of workers per livestock, average number of employees per commerce and per industrial facility:

$$\boldsymbol{B_{5a} = \text{hectares of crops affected} * \text{average workers per hectare}}$$
$$\boldsymbol{B_{5b} = \text{Livestock lost} * \text{average workers per livestock}}$$
$$\boldsymbol{B_{5c} = \text{Sum of productive assets and infrastructure facilities affected} * \text{average workers per facility}}$$

Data required will be collected for target C, therefore:

$$\boldsymbol{B_{5a} = C2_a * \text{average workers per hectare}}$$
$$\boldsymbol{B_{5b} = C2_b * \text{average workers per livestock}}$$
$$\boldsymbol{B_{5c} = C3_b * \text{average workers per facility} + C5_b * \text{average workers per infrastructure}}$$

$$B_{5c} = \sum_{i=1}^{n} C3_{bi} * Workers_i + \sum_{i=1}^{n} C5_{bi} * Workers_i$$

where i=1
....n are the types of productive assets and infrastructure declared in the Metadata

## 6. Minimum and Desirable Data Requirements

| Indicator No. | Indicator |
|---|---|
| B-1 | **Number of directly affected people attributed to disasters, per 100,000 population**<br><br>COMPOUND INDICATOR. See computation method<br><br>**Additional demographic and socio-economic parameters needed**<br>**Population**: Population of the country for each of the years of the reporting exercise. The national indicator would be calculated using the population of the country.<br>The global indicator is the sum of the populations of all countries having reported. |
| B-2 | **Number of injured or ill people attributed to disasters.**<br><br>**[Minimum Requirement]**<br>**Data to be collected by disaster**<br>**B-2** Number of injured or ill people attributed to disasters<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br>Sex<br>Age<br>Disability<br>Income |
| B-3 | **Number of people whose damaged dwellings were attributed to disasters.**<br><br>**[Minimum Requirement]**<br>**Data to be collected by disaster**<br>**B-3** Number of people whose damaged dwellings were attributed to disasters (calculated based on B-3a or directly measured in situ)<br>**B-3a** Number of damaged dwellings/houses attributed to disasters<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br><br>**The following disaggregation could be artificially calculated**<br>Sex<br>Age<br>Disability<br>Income |

| | |
|---|---|
| | **Additional demographic and socio-economic parameters needed**<br>**Population**: Population of the country and Number of Households in the country, OR the average number of people per household, for each of the years of the reporting exercise.<br>The national indicator would be calculated using the data of the country.<br>The global indicator is the sum of the indicators of all countries having reported. |
| B-4 | **<u>Number of people whose destroyed dwellings were attributed to disasters.</u>**<br><br>**[Minimum Requirement]**<br>**Data to be collected by disaster**<br>**B-4** Number of people whose destroyed dwellings were attributed to disasters (calculated based on B-3b or directly measured on the field)<br>**B-4b** Number of destroyed dwellings/houses attributed to disasters<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br><br>**The following disaggregation could be artificially calculated:**<br>Sex<br>Age<br>Disability<br>Income<br><br>**Additional demographic and socio-economic parameters needed**: see B-3 |
| B-5 | **<u>Number of people whose livelihoods were disrupted or destroyed, attributed to disasters.</u>**<br><br>**B-5** Number of people whose livelihoods were disrupted or destroyed, attributed to disasters (**directly measured in situ, or using a nationally defined methodology)**<br><br>**[Minimum Requirement]**<br>**NO OTHER DATA. Countries may opt not to enter B-5 and if socio-economic parameters are provided, require UNISDR to make the calculation.**<br>Please note that the UNISDR methodology requires the following data to be collected by disaster, related to the indicators for Target C:<br><br>- **C-2a** Number of hectares of crops damaged or destroyed by disasters. (to be used to establish the statistic of Number of Workers affected)<br>- **C-2b** Number of Livestock lost in disasters (to be used to establish the statistic of Number of Workers affected)<br>- **C-3a** Number of Productive Assets Facilities (such as Industrial, Commercial, Services, etc.) damaged or destroyed by disasters (to be used to establish the statistic of Number of Workers affected in all facilities type) |

| | |
|---|---|
| | [Note this data will be collected for Target C, so no additional data would be needed for this indicator]<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br><br>**The following disaggregation could be artificially calculated:**<br>Sex<br>Age<br>Disability<br>Income<br><br>**Additional demographic and socio-economic parameters needed**<br>**Population**: Population of the country and Number of Households in the country, OR the average number of people per household, for each of the years of the reporting exercise.<br>The national indicator would be calculated using the data of the country.<br>The global indicator with the sum of the indicators of all countries reporting. |

## 7. Specific issues

As stated in the Report of the OIEWG (A/71/644), Member States agreed that countries may choose to use a national methodology or other methods of measurement and calculation to measure the number of affected, including those injured or ill attributed to disasters, given the very significant differences among data collection processes around the world. The OIEWG also recommended that countries keep the metadata consistent if the methodology is changed.

However, countries will need to determine how a number of important challenges will be addressed, in a manner that is consistent throughout the entire process of data collection:

- **Attribution to an event.** With many data sources the cause of injury or illness is frequently not recorded as being associated with an event; for example, injuries as a result of an earthquake may only be registered as trauma in the medical or legal records. Therefore, it is necessary to understand the common causes of injuries of illness associated with an event.

- **Temporal aspects for attribution and cut-off for data collection.** In *small-scale sudden-onset disasters*, finalizing data collection and declaring the data collected as final is commonly straightforward. However, some challenges may be encountered – for instance with regard to the definition of the period after which the injury or illness of an affected person should be reflected in the data collected as attributed to the disaster. While some cases may never be reflected (for example someone suffering from mental health problems arising after several months), in general these cases represent a very small minority and will not affect the statistical strength of data that are collected within sensible cut-off time periods.

- **Temporal aspects for attribution and cut-off for data collection.** In *large-scale, slow-onset and long duration disasters* the issue is more problematic. Large-scale disasters usually require a much longer search and rescue phase, for example, or entail a more complex information management to determine the final number of injured or ill that are attributed to disasters. Slow onset disasters may span several years, with the corresponding challenge of compounding the information across the time span of the disaster, while still reporting data collected in an annual or bi-annual cycle.

- **Detailed statistical analysis.** Some types of event will require deeper statistical analysis in order to obtain the number of injured/ill attributed to a certain event. An example can be found in heat waves, where the number of deaths and ill must be calculated as excess mortality and excess morbidity, respectively. Similar studies may be needed in cases of epidemic outbreaks. Excess Mortality is that above what would be expected based on the non-crisis mortality rate in the population of interest. Excess mortality is thus mortality that is attributable to crisis conditions. It can be expressed as a rate (the difference between observed and non-crisis mortality rates), or as a total number of excess deaths[5]. In the case of the indicator the total number of excess deaths or ill should be used.

For those countries that are starting loss data collection and are yet to establish a clear legal framework for these criteria, it is recommended that countries adopt an approach such as the below.

| **Hazard** | **Causes of Illness** | **Time-span or recommended cut-off period** | **Sources of data** |
|---|---|---|---|
| Drought | Malnutrition | Yearly cut-offs, 6 months after emergency state ceases. | Relief organizations, Health ministry. |
| Heat wave | Pulmonary disease, heart disease | 4 weeks after event | Relief organizations, Health ministry. |
| ... | ... | ... | ... |

The most important recommendation to countries is to emphasise that **these criteria should be fixed for the entire time span of data collection (2005-2030).** While criteria are not predefined for any specific context, changes over time may introduce biases or measurement errors that could affect the detection of trends and patterns, negatively affecting the ability to reliably measure the achievement of the Target.

[5] (ODI/HPN paper 52, 2005, Checchi and Roberts)

**Other Special Considerations for Target B Indicators and Data**

**B-2, B-3, B-4, B-5**: double counting of affected people is unavoidable (for example, injured and living in a destroyed or damaged house). However, using the suggested methodology and indicators will provide a robust and verifiable proxy of total number of affected that will be suitable for measuring the achievement of the target. Although the sum of these indicators is greater or equal than the actual number of people in these three groups (as some are counted in more than one group), it can be also mathematically proven that the increase in numbers in these groups will mean an increase in the size of the actual group of affected. Conversely, double counting can compensate to some extent for many additional affected people that are not captured in these groups; particularly those indirectly affected.

**B-3 and B-4:** Housing damage and destruction affects both the lives and livelihoods of most urban and rural households. Data on housing damaged and destroyed is essential and will be collected for economic loss estimations, and so collecting and/or using these data for these indicators would not impose additional data collection burden. The average number of people living in a dwelling or housing unit in the country is required for the computation of these indicators, and UNISDR expects these data to be relatively stable over time.

**B-3 and B-4** are mutually exclusive.

**B-5:** This indicator is consistent with the people-centred approach of the SDGs, but its practical implementation faces some of the same challenges of the overall concept of 'Affected'. There is no definition of 'Livelihood' that can be used in a practical way. The concept of 'disruption' of livelihood is also difficult to define.

There are challenges to data collection for this indicator, including problems of subjective interpretation inter alia. So as to adhere to the principle of simplicity, some elements, for example business resilience, could be more appropriately addressed by relevant national indicators for the four priorities for action.

In order to measure this indicator, a large number of (subjective) sub-indicators would be required; this will impose a higher reporting burden on countries. However, and with the same spirit of providing a 'proxy' indicator that could reflect the number of people whose livelihoods are affected, the following definition proposed by Member States in the OIEWG could be used:

Livelihood**:** The capacities, **productive assets** (both living and material) and activities required for securing a **means of living**, on a sustainable basis, with dignity.

Some of the most important productive assets required to secure a means of living are those correlated with labour and sources of income; the current reporting requirements already ask Member States to report on the following:

- Housing unit, where many families host self-employment schemes
- Agricultural crops
- Livestock
- Workers in affected commercial or industrial facilities as part of Productive assets in indicator C-3

Indicators B-3 and B-4 **already contain** the use of the Number of People living in Houses Damaged and Affected as part of the number of people affected.

Therefore, in counting the following sub-indicators measuring those whose labour activity has been affected, a more complete picture of the number of people affected can be built:

- **B-5a** Number of workers in Agriculture with crops damaged or destroyed by disasters (use indicator C-2a, and require countries or UNISDR or other UN organization - such as FAO – to establish the statistic of Average Number of Workers per hectare)
- **B-5b** Number of owners of and workers responsible for Livestock lost in disasters (use indicator C-2b, and require countries or UNISDR or other UN organization - such as FAO – to establish the statistic of Average Number of Workers per livestock and/or number of livestock per owner)
- **B-5c** Number of workers employed in Productive Assets Facilities (such as Industrial, Commercial, Services, etc.) damaged or destroyed by disasters (use sub-indicators in C-4 and require countries, or UNISDR, or other UN organization - such as ILO – to establish the statistic of Average Number of Workers per facility type)

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# Technical Note on Data and Methodology to Estimate Direct Economic Loss to Measure the Achievement of Target C of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target C of the Sendai Framework for Disaster Risk Reduction.

**Target C:** ***Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030***

This document outlines the data, indicators and methodologies required for the estimation of direct economic costs attributed to disasters. The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG) report, endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and metadata, and the methodologies for the measurement of the global indicators.

## 2. Introduction

This Concept Note is based on previous efforts to estimate direct disaster economic loss published in the UN Global Assessment Report on Disaster Risk Reduction (GAR)[6] and mandates outlined in the Report of the OIEWG (A/71/644[,7]). This in turn is based on a simplified and adapted version of the UN Economic Commission for Latin America and the Caribbean methodology for disaster assessment (UN-ECLAC, 2014) developed with a number of scientific and private sector partners.

The methodology to assess economic losses of the agricultural sector has been developed by the Food and Agriculture Organization of the United Nations (FAO).

Given the very significant differences among data collection processes around the world, **the OIEWG Report and discussions gave countries freedom to select the methodologies by which direct economic loss attributed to disasters is determined.**

Detailed assessments of economic loss are regularly carried out by governments and multilateral organisations following large-scale disasters, using methodologies derived from the above-mentioned ECLAC methodology[8]. However, the economic losses associated with small and medium-scale disasters are rarely assessed or even documented. Furthermore, in the attribute *economic loss* of many disaster loss databases, it is often difficult to determine which methodology, criteria and parameters have been used for estimation of the economic value of losses, and which elements of economic loss have been considered.

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[6] See Global Assessment Report 2015. Annex 2. Loss Data and Extensive Risk Analysis. Geneva, Switzerland: UNISDR
See Global Assessment Report 2013. Annex 2. Loss Data and Extensive Risk Analysis. Geneva, Switzerland: UNISDR

[7] *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*, A/71/644 (1 December 2016) from http://www.preventionweb.net/files/50683_oiewgreportenglish.pdf

[8] https://www.gfdrr.org/damage-loss-and-needs-assessment-tools-and-methodology

These methodologies propose, whenever possible, the collection and use of **simple and uniform physical indicators of damage (counts of assets affected)** from official disaster loss and damage data, as the starting point for calculations to evaluate the economic value of direct losses. The original methodology was tested with datasets from 85 countries, in GAR15, using 347,000 reports of small, medium and large-scale disasters.

The existence of operational Sendai Framework compliant methodologies for the economic assessment of damages in one or more sectors was observed by many countries in the OIEWG. One example is the use of compensation mechanisms for the determination of damage in the housing sector, which provides very accurate assessment of the loss on a case by case basis.

In these situations, Member States will have the prerogative to continue using nationally determined methodologies, thereby assuring consistency throughout the duration of the exercise.

The economic evaluation methodology is presented for each of the indicators proposed by the OIEWG. Each section contains a brief explanation of the three steps (data collection, conversion of physical value into economic value, and conversion from national currency into US dollars) while identifying challenges and suggesting options for countries to consider. Where applicable, the methodology is accompanied by a proposal of metadata that countries will have to submit in order to specify what losses and data have been collected - notably for indicators C-3 and C-5.

As a first step, countries are suggested to collect information on the number of physical assets damaged or destroyed (for example, houses, or hectares of agriculture). The use of physical damage indicators makes the assessment of direct losses more transparent and verifiable, and will allow the incremental improvement of assessments, as improved methodologies are developed and better and more comprehensive baseline data are collected by countries (for example on productive assets).

As a second step, to estimate a significant proportion of direct economic loss, it is suggested that countries use a consistent pricing methodology for losses with respect to houses, agriculture, roads, schools, and other types of built facilities. Similar suggestions are also made in respect of economic valuations of industrial, commercial, and cultural heritage loss and damage.

The methodologies presented here for the economic assessment of direct losses of the built environment will in the majority of cases emanate from replacement values, or rehabilitation or reconstruction costs.

Agricultural economic loss is different as these concepts do not apply in their entirety and it is based on the concept of lost production.

In all cases, the Secretariat is proposing, as best practice, that **all of the physical damage indicators are collected and kept by countries as these are important information assets**, to feed Risk Assessments and to provide transparency as means of verification of the indicators. They can also play an important role in Quality Control of the data.

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target C of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*.

| No. | Indicator |
|---|---|
| C-1 | Direct economic loss attributed to disasters in relation to global gross domestic product. (compound indicator) |
| C-2 | Direct agricultural loss attributed to disasters<br><br>*Agriculture is understood to include the crops, livestock, fisheries, apiculture, aquaculture and forest sectors as well as associated facilities and infrastructure.* |
| C-3 | Direct economic loss to all other damaged or destroyed productive assets attributed to disasters.<br><br>*Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies. This would be described in the associated metadata.* |
| C-4 | Direct economic loss in the housing sector attributed to disasters.<br>*Data would be disaggregated according to damaged and destroyed dwellings.* |
| C-5 | Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters.<br><br>*The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant* |
| C-6 | Direct economic loss to cultural heritage damaged or destroyed attributed to disasters. |

Additionally, in its report E/CN.3/2017/2*, the Inter-Agency and Expert Group on SDGs Indicators (IAEG-SDGs) proposed the use of these same indicators in measuring the disaster-related global targets of Sustainable Development Goals (SDG) 1 and 11.

At its 48th Session, in report E/2017/24-E/CN.3/2017/35 the UN Statistical Commission adopted the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development, developed by the IAEG-SDGs, and recommended the associated draft resolution[9] for adoption by the Economic and Social Council.

[9] Draft Resolution I - Work of the UN Statistical Commission pertaining to the 2030 Agenda for Sustainable Development

## 4. Applicable Definitions and Terminology

Unless stated otherwise, key terms are those defined in the "Recommendations of the Open-ended Intergovernmental Expert Working Group on Terminology related to disaster risk reduction".

**Key terms**

**Economic Loss:**

Total economic impact that consists of direct economic loss and indirect economic loss.

**Direct economic loss**: the monetary value of total or partial destruction of physical assets existing in the affected area. Direct economic loss is nearly equivalent to physical damage.

**Indirect economic loss**: a decline in economic value added as a consequence of direct economic loss and/or human and environmental impacts.

***Annotations**:*
*Examples of physical assets that are the basis for calculating direct economic loss include homes, schools, hospitals, commercial and governmental buildings, transport, energy, telecommunications infrastructures and other infrastructure; business assets and industrial plants; production such as crops, livestock and production infrastructure. They may also encompass environmental assets and cultural heritage.*

***Direct economic losses** usually happen during the event or within the first few hours after the event and are often assessed soon after the event to estimate recovery cost and claim insurance payments. These are tangible and relatively easy to measure.*

***Indirect economic loss** includes micro-economic impacts (e.g. revenue declines owing to business interruption), mesoeconomic impacts (e.g. revenue declines owing to impacts on natural assets, interruptions to supply chains or temporary unemployment) and macroeconomic impacts (e.g. price increases, increases in government debt, negative impact on stock market prices, and decline in GDP). Indirect losses can occur inside or outside of the hazard area and often with a time lag. As a result they may be intangible or difficult to measure.*

**Replacement cost:** The cost of replacing damaged assets with materials of like kind and quality.

*Annotations: This includes both private and public assets. Replacement is not necessarily an exact duplicate of the subject but serves the same purpose or function as the original (not taking into account building back better.*

## 5. Computation Methodology

Two major groups of methods are developed in these guidelines to be used when estimating direct economic losses.

1. C-1 indicator is expressed as a simple sum of Indicators C-2 to C-6 in relation to GDP.
2. Estimation of Agricultural Sector losses (C-2): Jointly developed by FAO and UNISDR.
3. Assessment of built environment losses (C-3, C-4, C-5): Developed by UNISDR, based on ECLAC.[10]

*Note:* Loss expressed in national currency must be converted into USD, to enable global summation (rather than cross-country comparison). Recommended to use official exchange rate, without taking Purchasing Power Parities into consideration.

### 5.1 Computation of C1 – Direct Economic loss due to hazardous events in relation to global gross domestic product

Calculating equation: $\boldsymbol{C_1} = \frac{(\mathbf{C_2}+\mathbf{C_3}+\mathbf{C_4}+\mathbf{C_5}+\mathbf{C_6})}{\boldsymbol{GDP}}$

A first important challenge to take into account is the methodology for adding price adjustment (i.e. PPP). Possibilities are:

- **Option 1:** Proportion of loss to GDP allows an estimate of the possible impact of disaster loss on the global economy. Therefore, the nominal loss and GDP value is recommended to monitor progress.
- **Option 2:** Countries may also want to monitor trends of direct economic loss. In which case, UNISDR suggests comparing inflation-adjusted loss and GDP values by dividing nominal value by GDP deflator. [Recommended by UNISDR and technical consultation meetings]

### 5.2 Computation of C-2 – Direct agricultural loss attributed to disasters

From 347,000 records in the 85 national databases analysed in GAR 2015, 26% (91,686) register quantitative indicators (expressed as number of hectares of crops affected and livestock lost) or qualitative (yes/no indicator) about the existence of direct damages to the agricultural sector.

Most of agricultural damage (98.5%) is associated with weather-related hazards. Three disaster types, namely flood, drought and forest fire, represent 82% of the damage with a total of more than 209 million hectares affected. The importance of agricultural loss due to disasters is undeniable, especially when looking at accumulated impact of small-scale but frequent events.

[10] Economic Commission for Latin America and the Caribbean "Handbook for the for Estimating the Socio-economic and Environmental Effects of Disasters", as well as incorporating those developed by other partners and published and tested in GAR 2013 and 2015.

The computation method proposed for indicator C-2 is used to assess the direct loss which occurs in the agricultural sector as a result of disasters and takes into consideration the specificities of each sub-sector, i.e. crops, livestock, forestry, aquaculture and fisheries.

This indicator aims to measure the direct effects of a broad range of disasters of different types, duration and severity. Moreover, it applies to disasters of various scales – from large-scale shocks to small and medium-scale events with a cumulative impact.

This indicator is calculated based on five sub-indicators:

- C-2(C): Direct crop loss
- C-2(L): Direct livestock[11]loss
- C-2(FO): Direct forestry loss
- C-2(A): Direct aquaculture loss
- C-2(FI): Direct I fisheries loss

$$\boldsymbol{Impact\ to\ Agriculture}: \boldsymbol{C2} = C2(C) + C2(L) + C2(FO) + C2(A) + C2(FI)$$

Sub-indicator components:

- **Production** and **assets**

Each sub-sector is sub-divided into two main sub-components, namely **production** and **assets**. The production sub-component measures loss from disaster on both production inputs and outputs, while the assets sub-component measures loss of facilities, machinery, tools, and key infrastructure related to agricultural production.

In order to capture the direct impact of disasters on agriculture, it is important to take into account both:

- Losses, that is, changes in economic flows arising directly from the disaster (i.e. declines in output in crops, livestock, fisheries, aquaculture and forestry); and
- The replacement and/or recovery costs of totally or partially destroyed physical assets and stocks (stored inputs and production) in the disaster-affected area.

The table below describes the key elements of the methodology, including an indication of the items that should be considered in the assessment of each sub-sector, as well as the proposed calculation methods for assigning a monetary value to each component. For a detailed presentation of the computation methods and subsector-relevant formulas, please refer to Annex 1 below.

[11] May also include apiculture

| DISASTER IMPACT ON PRODUCTION | |
|---|---|
| **Items** | **Measurement** |
| **Stocks:**<br><br>**Stored inputs**<br>(Seeds, fertiliser, feed, fodder, etc.)<br>**Stored production**<br>(Crops, livestock produce, fishes, logs, etc.)<br>**Perennial trees**<br><br>**Production**<br><br>**Value of lost crops, livestock, forestry, aquaculture production and fisheries capture production** (excluding stored outputs) | 1.Pre-disaster value of destroyed stored production and inputs<br><br>1. Difference between expected and actual value of production (crops, livestock, forestry, aquaculture production and fisheries capture) in disaster year<br><br><u>For perennial crops and forestry</u>:<br><br>2. Pre-disaster value of fully destroyed standing crops and trees and Discounted expected value of crop production in fully affected harvested area until full recovery<br><br><u>For livestock and aquaculture</u>:<br><br>2. Discounted foregone value of livestock products from dead livestock until full recovery<br><br>3. Temporary costs incurred towards the maintaining of post-disaster agricultural and farming/fishing activities |
| **DISASTER IMPACT ON ASSETS** | |
| **Items** | **Measurement** |
| **Machinery, equipment and tools**[12]<br><br>used in crop and livestock farming, forestry, fisheries, aquaculture, apiculture | <u>Total destruction</u>: replacement cost of fully destroyed assets at pre-disaster price<br><br><u>Partial destruction</u>: repair/rehabilitation cost of partially destroyed assets at pre-disaster price |

[12] Includes (but is not limited to): tractors, balers, harvesters and threshers, fertilizer distributors, ploughs, root or tuber harvesting machines, seeders, soil machinery, irrigation facilities, tillage implements, track-laying tractors, milking machines, dairy machines, machinery for forestry, wheeled special machines, portable chain-saws, fishing vessels, fishing gears, aquaculture feeders, pumps and aerators, aquaculture support vessels, etc.

1. **C-2C - Direct Crop loss**

**C-2C** = Loss in *annual crop stocks* + *Loss in perennial crop stocks* + *Annual crop production loss* + *Perennial crop production loss* + *Crop assets loss (complete and partial)*

- *Loss of annual crop stocks* – 1) Pre-disaster value of destroyed stored annual crops and 2) Pre-disaster value of destroyed stored inputs
- *Loss of perennial crop stocks* – 1) Pre-disaster value of destroyed stored perennial crops; 2) Pre-disaster value of destroyed stored inputs; and 3 ) Replacement value of fully damaged perennial trees;
- *Annual crop production loss* – 1) Difference between expected and actual value of crop production in non-fully affected harvested area in disaster year; 2) Pre-disaster value of destroyed crops in fully-affected areas; 3) Short-run post-disaster maintenance costs (lump sum of expenses used to temporarily sustain production activities immediately post-disaster)
- *Perennial crop production loss* – 1) Difference between expected and actual value of crop production in non-fully affected harvested area in disaster year; 2) Pre-disaster value of destroyed standing crops in fully-affected areas and discounted expected value of crop production in fully affected harvested area until full recovery; 3) Short-run post-disaster maintenance costs (lump sum of expenses used to temporarily sustain production activities immediately post-disaster)
- *Crop assets loss* – Repair cost of partially destroyed assets and the replacement cost of fully destroyed assets at pre-disaster price.

2. **C-2L – Direct Livestock Loss**

**C-2L** = *Loss in livestock stocks* + *Livestock production loss* + *Livestock asset replacement and/or repair costs (complete and partial)*

- *Loss of livestock stocks* – 1) Pre-disaster value of destroyed stored inputs (fodder and forage); 2) Pre-disaster value of destroyed stored livestock products; 3) Pre-disaster net value of dead livestock (minus any obtained revenue from dead livestock sold)
- *Livestock production loss* – 1) Difference between expected and actual value of production (of livestock products) in disaster year; 2) Discounted foregone value of livestock products from dead livestock until full recovery; 3) Short-run post-disaster maintenance costs (lump sum of expenses used to temporarily sustain production activities immediately post-disaster)
- *Livestock assets loss* – Pre-disaster value of partially or fully destroyed assets (including machinery, equipment, storage, etc.).

3. **C-2FO – Direct Forestry Loss**

**C-2FO** = *Loss in forestry stocks + Forestry production loss + Forestry asset loss (complete and partial)*

- *Loss of forestry stocks* – 1) pre-disaster value of destroyed forestry primary and secondary stored inputs; 2) the pre-disaster value of destroyed forestry primary and secondary stored products; 3) Replacement value of fully damaged trees

- *Forestry production loss* – 1) Difference between expected and actual value of production in non-fully affected harvested area in disaster year; 2) Pre-disaster value of fully destroyed standing forest products; 3) Discounted expected value of production in fully affected harvested area until full recovery
- *Forestry assets loss* – Pre-disaster value of assets used for forestry production partially or fully destroyed by the disaster (pulp mills, sawmills, etc.)

4. **C-2A – Direct Aquaculture Loss**

**C-2A** = *Loss in aquaculture stocks* + A*quaculture production loss* + *Aquaculture asset loss (complete and partial)*

- *Loss of aquaculture stocks* – 1) Pre-disaster value of destroyed stored inputs (feeds); 2) Pre-disaster value of destroyed stored aquaculture products; 3) Pre-disaster net value of dead fishes (brood stock losses).
- *Aquaculture production loss* – 1) Difference between expected and actual value of aquaculture production in non-fully affected aquaculture areas disaster year; 2) Pre-disaster value of aquaculture production lost in fully affected aquaculture areas and discounted expected value of production in fully affected aquaculture area until full recovery; 3) Short-run post-disaster maintenance costs (lump sum of expenses used to temporarily sustain production activities immediately post-disaster)
- *Aquaculture assets loss* – Pre-disaster value of assets used for aquaculture production partially or fully destroyed by disaster (machinery, equipment, cold storage, etc.).

5. **C-2FI – Direct Fisheries Loss**

**C-2FI** = *Loss in fisheries stocks+ Fisheries production loss + Fisheries asset loss (complete and partial)*

- *Loss in fisheries stocks* – 1) Pre-disaster value of destroyed stored inputs and 2) Pre-disaster value of destroyed stored capture
- *Fisheries production loss* – Difference between expected and actual value of fisheries capture in disaster year
- *Fisheries assets loss* – Pre-disaster value of assets used for fisheries partially or fully destroyed by disaster (vessels, fishing boats, tools, equipment, cold storage, etc.).

The formulas proposed for the computation of the above loss estimations are described in Annex II of this note.

## 5.3 Computation of C-3 – Direct economic loss to all other damaged or destroyed productive assets attributed to disasters.

The methodology proposes the conversion of physical damage value into economic value using replacement cost to monitor direct economic loss. The methodology is consistent with DALA and PDNA methodology. Collection and calculation is described in 3 steps.
Proposed estimation will account for (based upon DALA/PDNA methodology):

- Area of affected premises
- Construction cost per square metre
- Estimated value of stored equipment and products (raw material & finished product)

**Direct Productive Asset Loss Method 1 – Affected Assets Reporting**

Calculating equation for economic loss due to affected (damaged or destroyed) productive assets is as follows, following steps outlined in **Option 1** and **Option 3** in calculation steps:

$$C_3 = C_{3a} * average\ asset\ size * construction\ cost\ per\ square\ meter * equipment\ ratio * infrastructure\ ratio * affected\ ratio$$

- Where
  - $C_{3a}$ is number of productive assets of each type, either damaged **OR** destroyed
  - $Average\ asset\ size$ is size established in the metadata category. In the case of only one category of a type of asset it can be:
    - Average size of that type of productive assets in the country
    - Median or mode of the sizes of productive assets of that type in the country.
    - Fixed value defined by expert criteria on the design of a very small and conservative productive asset of that type (for example 100 square metres)
  - $Construction\ cost\ per\ square\ meter$ is the average value of construction cost per square metre nationally (if reported)
    - Application of the formula for housing construction cost per square metres.
  - $Equipment\ ratio$
  - $Infrastructure\ ratio$
  - $Affected\ ratio$ is calculated from the estimated percentage of damaged productive assets out of total damaged/destroyed productive assets.
    - Assuming 20% of the industries reported are totally destroyed and the rest (80%) suffered some degree of damage (suggested to be estimated the same as in the housing sector, 25%), then the overall affected ratio would be the composite of 100% damage for 20% of premises plus 25% damage to 80% of premises, 40%:

**Direct Productive Asset Loss Method 2 – Damaged and Destroyed Assets Separate Reporting**

Calculating equation for economic loss due to affected (damaged or destroyed) productive assets is as follows, following steps outlined in **Option 2** and **Option 4** in calculation steps:

$$C_3 = (C_{3b} * average\ asset\ size * construction\ cost\ per\ square\ meter * equipment\ ratio * infrastructure\ ratio * damage\ ratio) + (C_{3c} * average\ asset\ size * construction\ cost\ per\ square\ meter * equipment\ ratio * infrastructure\ ratio)$$

- Where
  - $C_{3b}$ is number of productive assets damaged of each type
  - $C_{3c}$ is number of productive assets destroyed of each type
  - $Damage\ ratio$ is percentage of total value of asset represent the average damage, suggested to be 25% (same as housing sector).
  - **All other variables correspond to those in Method 1**

**Direct Productive Asset Loss – Calculation Steps**

**Step 1:** Collect good quality data, ideally disaggregated, on physical damage

- Type, size and level of damage of productive assets can have large variations in terms of reconstruction cost.
- Depending on availability of data countries can collect information on physical damage with increasing levels of detail.

Member states will need to define the level of disaggregation at which data will be collected, which will have a significant impact in the precision and accuracy of the estimations, and will define the extent of the effort for data collection.

The MINIMUM disaggregation recommended in the OIEWG report calls for Member States to report data according to the **different types of assets**.

Other disaggregation criteria will be the different size typologies (for example small, medium, large health facilities), and the different levels of damage (partial, fully destroyed).

The Metadata mechanism will allow countries to define the classes of items that will be used to report when no individual asset reporting will be done.

**Option 1:** No disaggregation – only total number of assets affected (damaged or destroyed) is collected and reported **per type of asset**. **(Minimum)**
**Option 2:** Number of assets **damaged** and **destroyed** are collected and reported separately per type of asset.
**Option 4:** Number of assets damaged and destroyed is collected and reported by size category, level of damage and type of asset.

As an example, a country may decide to report only on **Educational** and **Health** Facilities as follows:

- Elementary, High school, Universities and other Training Centres will be reported for education. A typical size will be assigned to each class of education facility.
- Health posts and centres, Clinic, Hospital and Other will be reported for Health. A typical size will be assigned to each of these.
- On each category, only damaged (25% average damage ratio) and fully destroyed categories will be collected.

The Metadata for this example would look like the following table:

| Type of Infrastructure | average size of facilities | construction cost per Unit USD $, by YEAR (b) USD of 2015 | Additional % Equipment, furniture & materials | Additional % associated infrastructure | UNIT | Formula | No. Workers |
|---|---|---|---|---|---|---|---|
| Small Health facility (C5) (Group Q, Human health and social work on ISIC) | 60 | 800 2017<br>809 2018<br>….. ….. | 40% | 25% | $Mt^2$ | ... | 8 |
| Medium Health facility(C5) (Group Q, Human health and social work on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 50% | 25% | $Mt^2$ | ... | 25 |
| Large health facility(C5)(Group Q, Human health and social work on ISIC) | 10,000 | 800 2017<br>809 2018<br>….. ….. | 80% | 25% | $Mt^2$ | ... | 800 |
| Education – Small school (C5) (Group P, Education on ISIC) | 100 | 800 2017<br>809 2018<br>….. ….. | 15% | 25% | $Mt^2$ | ... | 7 |
| Education – Medium Education facility (C5) (Group P, Education on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 25% | 25% | $Mt^2$ | ... | 25 |
| Education – Large education facility (C5) (Group P, Education on ISIC) | 10,000 | 800 2017<br>809 2018<br>….. ….. | 35% | 25% | $Mt^2$ | ... | 800 |

**Annex I of this note, describes the metadata tables based on whether data is collected with/without size classification.**

**Step 2:** Apply replacement cost per unit to estimate economic value of replacement cost.

- Countries therefore recommended to report information, **using the metadata facility in Annex I** (average size per type, construction cost per sq metre for size category, % content value, associated urban infrastructure)
- UNISDR will use statistical methods, national and international data sources and experience from previous methodological work to provide **default metadata**, including average sizes and price of construction, or rehabilitation in the case of roads. See Indicator C-4 for further information on construction costs.

*Challenge 2: Estimating value of equipment and stored assets, and associated urban infrastructure*

- As in the case of the Housing Sector (see Indicator C4) an additional loss has to be assigned corresponding to the value of equipment, associated urban infrastructure and products

stored in premises. An **overhead of 25% is proposed to be used as default in the case of productive assets, but it can be much higher or lower in different sectors.**

In order to assess the value of the additional urban infrastructure associated to loss of houses (such as connection to road networks, water, sewage, green areas, energy and communications infrastructure often subject to localised damage in disasters), an additional percentage % is proposed to be added to the replacement cost (CIMNE, 2012).

The UNISDR will use statistical methods, national and international data sources and experience from previous methodological work to provide **default metadata**, including these percentages usually attributed to stored equipment and urban infrastructure.

*Challenge 3: Ensuring proper comparison across time*

Construction cost per square metre (or average sizes) will change across time due to technical development and other market related factors (e.g. price increase of construction material in relation to other goods and services). Price level change such as inflation will also influence unit price.

**Suggested Methods**

- **Option 1:** The relative unit price increase of construction costs in relation to other goods and services indicates the increased influence of industrial facility loss on overall economy. Impact of general inflation will be considered in C1 if agreed. Suggested to use nominal per unit price in each moment of time.
- **Option 2:** Simply to observe affected volume trend, use the same unit price for all the moments from baseline period until 2030.

**Step 3:** Convert the value expressed in national currency into USD and derive global loss value

- It is recommended to use the official exchange rate in the year of event to convert the value expressed in national currency into USD (Data source: World Bank Development indicators).

## 5.4 Computation of C-4 - Direct economic loss in the housing sector attributed to disasters.

The methodology proposed is the conversion of physical damage value into economic value using replacement cost to monitor direct economic loss. The methodology is consistent with DALA and PDNA methodology. Collection and calculation is outlined in 3 steps.

Proposed estimation will account for (based upon DALA/PDNA methodology):

- Area of affect premises
- Construction cost per square metre
- Estimated value of stored equipment and associated urban infrastructure

**Calculating Equation:** $\boldsymbol{C_4 = C_{4a} + C_{4b}}$

- Where:
    - $\boldsymbol{C_{4a}}$ is the number of houses damaged by disaster
    - $\boldsymbol{C_{4b}}$ is the number of houses destroyed by disaster

**Direct Housing Loss – Method**

$$\boldsymbol{C_{4a}} = Number\ houses\ damaged * average\ size\ * \ construction\ cost\ per\ square\ metre * damage\ ratio$$

- Where $damage\ ratio$ is 25% of loss of completely destroyed house (based on suggestions from DALA/PDNA methods).

$$\boldsymbol{C_{4b}} = Number\ houses\ destroyed * average\ size\ * \ construction\ cost\ per\ square\ metre$$

**Direct Housing Loss – Data Collection**

**Step 1:** Collect good quality data, ideally disaggregated, on physical damage
*Challenge: Given the benefit and cost of collecting further data, the scope of loss data collection should be decided by countries.*

**Suggested methods**

- **Option 1:** Total number of houses damaged and destroyed collected separately **(minimum)**
    - However, housing can have large variations in terms of size and structure and therefore construction cost, although not as large as industrial and commercial facilities.
- **Option 2:** Total number of houses damaged and destroyed collected separately **and** disaggregated by other criteria such as urban/rural, income level, type of construction structure or other characteristics, when this criteria is relevant for the estimation of the loss.
    - Disaggregated data, for example housing loss by structural type, would provide a basis for building vulnerability assessment and evidence for strengthening enforcement of building codes or retrofitting policy. Disaggregated data collection can make estimation more accurate and more usable for policy making.

**Step 2:** Apply replacement cost per unit to estimate economic value

*Challenge 1: Determining the construction cost per square metre and size of housing affected is extremely difficult given the lack of sources of information and the diversity of housing structure (concrete to wooden)*

***In cases where no individual asset assessment is performed*** *several considerations are to be taken into account in the calculations of replacement costs for a number of items in a certain class:*

**Suggested methods**

- **Option 1:** Countries report the necessary construction cost per square metre and average size of housing. If disaggregated data by house type is collected, a weighted average of house size in the country taking into account distribution of each size segment (income,

structural type or range of size) and the average size of the houses on each segment would increase the reliability of the indicator and would solve to a large extent the issue of choosing a fixed house size. If it is difficult to obtain price information from private markets, construction cost of social housing might provide a useful benchmark. It is expected that ministries of housing will be able to supply the statistical data required for the Sendai Framework targets and indicators thereby enhancing accuracy of the estimate.

- **Option 2: When the housing construction cost per square metre is missing**, having reviewed options, UNISDR will utilize global data sources regarding unit cost information. Priority will be given to national sources of data, but if there is no alternative available, other sources, including private sector data can be included. An example of such a source is the "Global Construction Cost and Reference Yearbook" from Compass International, which can be used to determine the construction cost per square metre.

- **Option 3: When the average size is not reported,** it is suggested that a small 'social housing solution' be applied together with its associated equipment and urban infrastructure (furniture, water network, power, communications, etc.) as estimation methodology (based on GAR methodology).
    - *Note*: The concept of a "Social Interest Housing solution" has been used in many types of risk assessments (CIMNE, 2013). It is inspired by the fact that in many cases the state, acting as ultimate insurer of losses - especially for the poorest segments of the population - tends to provide homogeneously small housing solutions and/or compensation packages.
    - The concept and size of social housing varies by country. For the purpose of a homogeneous estimation across countries it is proposed the size of a social housing be set at 45 square metres – i.e. a very small housing solution.

*Challenge 2: How to assure proper comparison across time?*

- See Indicator C-3

**Step3:** Convert the value expressed in national currency into USD and derive global loss value

- See Indicator C-3

## 5.5 Computation of C-5 – Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters.

General Assembly Resolution A/71/644 noted that:

*The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.*

C-5 is recommended to be calculated based on the indicators that include at least the same critical infrastructure units and facilities as considered for D-2, D-3 and D-4.

$$\boldsymbol{C_5 = Sum\ of\ direct\ economic\ loss\ estimated\ for\ D_2,\ D_3,\ D_4}$$

Where:

- $D_2$ is number of destroyed or damaged health facilities attributed to disasters.
- $D_3$ is number of destroyed or damaged educational facilities attributed to disasters.
- $D_4$ is number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters.

**<u>Direct Critical Infrastructure Loss – Method 1</u>**

$$\boldsymbol{C_5} = Number\ of\ affected\ facilities\ *\ average\ size\ of\ the\ facilities\ *\ construction\ cost\ per\ Unit\ *\ equipment\ \ ratio\ *\ infrastructure\ ratio\ *\ affected\ ratio$$

Where

- $C_5$ is economic loss from affected infrastructure, either damaged or destroyed

**<u>Direct Critical Infrastructure Loss – Method 2</u>**

$$\boldsymbol{C_{5a}} = Number\ of\ damaged\ facilities\ *\ average\ size\ of\ the\ facilities\ *\ construction\ cost\ per\ Unit\ *\ infrastructure\ ratio\ *\ affected\ ratio$$

$$\boldsymbol{C_{5b}} = Number\ of\ destroyed\ facilities\ *\ average\ size\ of\ the\ facilities\ *\ construction\ cost\ per\ Unit\ *\ infrastructure\ ratio\ *\ affected\ ratio$$

Where

- $C_{5a}$ is economic loss from damaged infrastructure
- $C_{5b}$ is economic loss from destroyed infrastructure

**<u>Direct Critical Infrastructure Loss – Data Collection</u>**

UNISDR recommendation on Metadata (sample Metadata describing data to be collected for indicators C-5 and D-4 provided in **Annex IV** of this note):

- Indicator C-5 data should be described using the same Metadata Format as C3. ISIC classification already includes codes and groups for Health and Education facilities.
- For the purposes of the Sendai Framework, UNISDR will define an additional set of codes that may correspond to types of assets that are not productive and are not considered by the ISIC, such as roads, bridges, railroads, ports, airports, power generation facilities, water facilities, etc.
- Many of these infrastructure types can be assimilated to buildings the economic value of which can be assessed using similar and simple methodologies, but it has to be stressed

that not all types of infrastructures may have such simple and uniform methodologies. Examples are water facilities, airports, ports, etc.

- Countries will provide Metadata that should contain an indication that the valuation can be made using a standard methodology using size, value per unit, and other parameters, or must be calculated manually and specifically for each case, and the final economic value must be calculated by countries

*Challenge: Damage to transportation facilities can be extremely complex to record and evaluate.*

- Member States have requested that this methodology take into account the following elements of transportation networks:
    - Roads
    - Railways
    - Ports
    - Airports
- The data available in disaster loss databases, which is based on a very large number of disaster reports, suggests that roads are the infrastructure that experience the most frequent damage. Damage to these elements can possibly be assessed using a simple formula. **Large infrastructures like ports, airports and railways that are unlikely to be damaged by extensive events should be reported both as the number of facilities, or number of units (mt, km, mt$^2$) of damaged/destroyed as well as the assessed cost of damage.**
    - This is because the economic assessment of direct loss of these facilities cannot be easily expressed in terms of a unit cost (such as length of road or square metre of construction) and because these facilities can be of extremely high value.
    - For ports, airports and railways losses that should be reported also as direct economic costs, it is recommended to use assessed costs (as detailed in the ECLAC / DALA methodology), or produced by expert engineering teams with formal and rigorous methodologies.
    - Damage to roads should be reported, as suggested, in terms of physical damage, i.e. length of roads damaged.
- The following are examples of indicators, divided in two groups, one reporting Physical Damage, and the second, the reported estimated economic assessment of these damages, which could feed into an economic assessment of damages. There may be many others, as suggested by the OIEWG report, including Protective infrastructure and green infrastructure to be included where relevant.
    - For Indicator D-4:
        - Number of kilometres of road destroyed or damaged per hazardous event. **(MINIMUM REQUIREMENT)**
        - Number of bridges affected
        - Number of Kilometres of railway networks damaged
        - Number of Airports affected

        - Number of ports affected
    - For Indicator C-5:
        - Economic value of damages to road networks (calculated using formula)
        - Economic value of damages to railway networks (calculated using formula)
        - Economic value of damages to ports affected
        - Economic value of damages to airports affected
        - Economic value of damages to bridges affected

## 5.6 Computation of C-6 - Direct economic loss to cultural heritage damaged or destroyed attributed to disasters

Research conducted by UNISDR has shown that the value of cultural heritage assets cannot be assessed in simple economic terms, and even less in terms of Direct Economic Loss.

- Most losses associated with cultural heritage are intangible losses, i.e. associated with the historical and/or artistic value of cultural heritage assets. Also, most economic losses associated with cultural assets are indirect losses, mainly connected to tourism, culture, and recreation.

However, in order to calculate at least a portion of the direct economic loss, the following indicators are proposed.

- For the purpose of assigning **a direct economic loss value**, a simple division of assets lost in two groups is proposed: one composed of buildings, monuments and fixed infrastructure, and the second composed of 'mobile' elements such as art, historical artefacts:
    - $\boldsymbol{C_{6a}}$ is cost of Rehabilitation or Reconstruction of buildings, monuments and fixed infrastructure of cultural heritage assets
    - $\boldsymbol{C_{6b}}$ is cost of Rehabilitation or Reconstruction of mobile cultural heritage damaged
    - $\boldsymbol{C_{6c}}$ is acquisition value of mobile cultural heritage destroyed or totally lost.
- Along with these economic loss estimations, it is also recommended to record simple measures of physical damage:
    - $\boldsymbol{C_{6d}}$ is number of buildings, monuments and fixed infrastructures of cultural heritage assets
    - $\boldsymbol{C_{6e}}$ is number of mobile cultural heritage assets (such as artworks) damaged
    - $\boldsymbol{C_{6f}}$ is number of mobile cultural heritage assets destroyed

The proposed indicators do not measure physical damage (as is the case with other indicators in this technical note), rather they measure the economic costs to be evaluated by experts and on a per case basis.

- This is a function of the great variation in the value of cultural heritage assets. As with buildings and monuments, estimating the 'average' value per square metre of construction for e.g. the Colosseum in Rome, or Angkor Wat in Siem Riep, Cambodia, makes little sense.

- As for 'mobile' artefacts, the number damaged or destroyed is less relevant, given that the value of each artefact must be evaluated on a case by case basis. For example, the value of the Mona Lisa (one artefact) cannot be compared with the value of a painting of a similar size but from a relatively unknown painter.

## 6. Minimum and Desirable Data Requirements

**Source and data collection**

UNISDR recommends that reporting against these indicators uses official national data on disaster loss and damage.

The following table summarizes the recommendations of UNISDR for **data to be collected and reported for measuring the global target,** as well as for those national indicators that could potentially migrate to the global level:

| No. | Indicator |
|---|---|
| C-1 | **Direct economic loss attributed to disasters in relation to global gross domestic product.**<br>**COMPOUND INDICATOR. See computation methodology**<br>**Additional demographic and socio-economic parameters needed**<br>**GDP**: Gross Domestic Product of geographic units for which data has been collected for the year the disaster happened. At country level it would be the GDP of the country and at global level the sum of the GDP of all countries reporting. |
| C-2 | **Direct agricultural loss attributed to disasters**<br><br>**Data to be collected for each disaster [Minimum Requirement]:**<br>If a proper economic valuation of direct loss (compliant with SFDRR) is available, indicators C-2, C2-C, C2-L, C2-Fo, C2-Fi and C2-Ia it can be reported directly.<br>- **C-2:** Direct agricultural loss attributed to disaster.<br><br>- **C-2C:** Loss in crops damaged or destroyed by disasters<br>- **C-2L:** Loss in livestock dead or affected by disasters<br>- **C-2Fo**: Loss in of hectares of forests affected/destroyed by disasters<br>- **C-2A**: Loss in of hectares of Aquaculture production area affected<br>- **C-2Fi:** Loss in Fisheries production area affected<br>- **C-2Ia**: Loss in associated damaged/destroyed machinery and facilities. In the case of fishing sector this will include vessels<br>- **C-2Ib**: Pre-disaster value of Stock (stored inputs such as Seeds, fertiliser, feed, fodder, etc., and stored production such as crops, livestock produce, fishes, logs, etc.)<br><br>The following physical damage indicators will be required, and will be accepted in lieu of the corresponding estimated economic loss.<br>- **C-2Ca:** Number of Hectares of crops damaged or destroyed by disasters<br>- **C-2La:** Number of livestock dead or affected by disasters |

- **C-2Foa**: Number of hectares of forests affected/destroyed by disasters
- **C-2Aa**: Number of hectares of Aquaculture production area affected
- **C-2Fia:** Number of hectares of Fisheries production area affected
- **C-2Iaa**: Number of associated damaged/destroyed machinery and facilities. In the case of fishing sector this will include vessels.

Note that for sub-indicator C-2I damaged/destroyed machinery and facilities, which are clearly **Productive Assets**, the following annotation applies, and the data collection will follow the same pattern, definitions and methods: *Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies.*
***This would be described in the associated metadata.***
**Agricultural productive assets will be reported in C-2 and will not be duplicated in C-3. The classification and related metadata mechanism will allow this distinction.**
Metadata mechanism will also allow the standard definition of the different types of crops, livestock, forests, aquaculture and fisheries activities. Initial metadata will be assembled by UNISDR based on an international standard such as FAO classification.

To be Included based upon A/71/644:
- C-2d: Losses to apiculture

**Definition of Metadata Describing Assets and Infrastructure elements [Minimum Requirement]:**
For each type of productive asset that is reported:
- Code
- Description of type of asset
- Group or Economic Sector/Activity in ISIC or adopted FAO/UNISDR classification
- Measurement Units ($m^2$, mts, Hectare, Km, Tonne, etc.)
- Value per unit [Series per Year 2005… 2030]
- % of value for equipment, furniture, materials, product (if applicable)
- % of value for associated physical infrastructure (if applicable)
- Average number of workers per facility or infrastructure unit
- Formula to calculate economic value

*Please see ANNEX I for more information and examples of proposed Metadata schema.*

**Recommended disaggregation:**
- **ALL**: by Hazard
- **ALL**: by Geography
- **ALL**: by totally destroyed (lost, dead, destroyed) or damaged (affected)
- **C-2C**: by types of cultivated crops in the affected areas
- **C-2L**: by types of livestock
- **C-2Fo**: by types of forest
- **C-2A**: by types of aquaculture activities in affected areas
- **C-2Fi**: by types of fishing activities in the affected areas
- **C-2I**: by Sector (Crops, livestock, forest, aquaculture, fisheries)
  by Types of damaged machinery and facilities

| | |
|---|---|
| C-3 | **<u>Direct economic loss to all other damaged or destroyed productive assets attributed to disasters.</u>**<br><br>***Annotation from A/71/644:***<br>*Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies. This would be described in the associated metadata.*<br><br>**Please see note and brief description of Metadata in Indicator C-2 in this table.**<br>*Please see ANNEX I for more information and examples of proposed Metadata schema.*<br><br>**Data to be collected for each disaster [Minimum Requirement]:**<br>- **C-3:** Direct economic loss to all other damaged or destroyed productive assets attributed to disasters. If a proper economic valuation of direct loss (compliant with SFDRR) is available, it can be reported.<br>**For each of the asset types declared in Metadata that are affected in a disaster:**<br>- **C-3a:** Number of productive assets of each type, either damaged or destroyed<br>- **C-3b:** Number of productive assets damaged of each type<br>- **C-3c:** Number of productive assets destroyed of each type<br><br>**Recommended disaggregation:**<br>- by Hazard<br>- by Geography<br>- By type level of affectation (damaged/destroyed). This should be reflected in Metadata.<br>- By size of Facility (small/medium/large). This should be reflected in Metadata. |
| C-4 | **<u>Direct economic loss in the housing sector attributed to disasters.</u>**<br><br>**Data to be collected for each disaster [Minimum Requirement]:**<br>- **C-4:** Direct economic loss in the housing sector attributed to disasters: if a proper economic valuation of direct loss (compliant with SFDRR) is available, it can be reported.<br>- **C-4a:** Number of houses damaged by disasters<br>- **C-4b:** Number of houses destroyed by disasters<br><br>**Additional demographic and socio-economic parameters required**<br>- **Average size:** weighted average of house size in the country<br>- **Value per unit**: [Series per Year 2005.. 2030]<br><br>**Possible disaggregation:**<br>- by Hazard<br>- by Geography<br>- By size of House (small/medium/large)<br>- Criteria such as rural/urban<br>- Criteria such as material (wood, cardboard, masonry, etc.) |

| | |
|---|---|
| C-5 | **<u>Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters.</u>**<br><br>***Annotation from A/71/644:***<br>*The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.*<br><br>**Data to be collected for each disaster [Minimum Requirement]:**<br>- **C-5:** Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters. If a proper economic valuation of direct loss (compliant with SFDRR) is available, it can be reported.<br>**For each of the infrastructure types declared in Metadata that are affected in a disaster:**<br>- **C-5a**: Type of asset (Code, see metadata)<br>- **C-5b:** Number of Units or Number of these Infrastructure assets damaged/destroyed<br><br>**Please see note and brief description of Metadata in Indicator C-2 in this table.**<br>*Please see ANNEX I for more information and examples of proposed Metadata schema.*<br><br>**Recommended disaggregation:**<br>- By type level of affectation (damaged/destroyed)<br>- By size of Facility (small/medium/large or criteria such as unpaved, single paved, highway for roads) |
| C-6 | **<u>Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.</u>**<br><br>**Data to be collected [Minimum Requirement]:**<br>- **C-6a:** Number of buildings, monuments and fixed infrastructures of<br>- cultural heritage assets<br>- **C-6b:** Number of mobile cultural heritage assets (such as artworks)<br>- Damaged<br>- **C-6c:** Number of mobile cultural heritage assets destroyed<br>- **C-6d:** Cost of Rehabilitation or Reconstruction of C-6a<br>- **C-6e:** Cost of Rehabilitation of C-6b<br>- **C-6f:** Acquisition cost, if available, of C-6b |

## 7. Specific issues

***Given the very significant differences between data collection processes around the world, the OIEWG Report gave countries the freedom to select the methodologies by which direct economic loss attributed to disasters is determined.***

In case countries have no predetermined standard, the estimation of economic loss subject to levels of damage and destruction of assets, is expected by national bodies using one of four approaches – see below. This will be supported by data provided using the Sendai Framework monitoring system indicators.

- Affected Assets Reporting (**Minimum**)
  - Theory: Calculations based upon type and number of assets impacted in any fashion (damaged or destroyed) by a disaster.
  - Method: Overall level of impact will be estimated via the use of an "affected ratio" calculated from an estimated percentage of damaged assets out of the total affected assets.
- Assets Reporting disaggregated by Damaged and Destroyed
  - Theory: Calculations based upon separate counting for type and number of assets damaged and destroyed by a disaster.
  - Method: Individual calculations for damaged and destroyed assets per type will occur and a "damage ratio" value (suggested to be 25%) will be applied to infer the cost of damaged assets.
- Damage Class Reporting
  - Theory: Calculations based upon classes of damage for assets damaged or destroyed as defined by member states, each with an associated "affected ratio" (for example 10%, 30%, 60% corresponding to light, medium or heavy damage).
  - Method: Member States define a number of classes and group affected assets within these classes. Each is assigned a particular "affected ratio" which then is used to calculate costs of impact based on level of impact. **These Classes are to be defined using the Metadata mechanism.**
- Individual Asset Reporting
  - Theory: Calculations based upon individual asset damage loss values
  - Methods: Member States collect information on a case by case basis of the cost of reconstruction or repair necessary to assets due to damage/destruction resulting from disasters.

These categories of assessment have utility across all asset sectors.

**Temporal Aspects**

Another important challenge associated with data collection for the indicators, is the issue of the temporal aspects for attribution and cut-off for data collection. In small-scale, sudden onset

disasters it is often easy to finalize data collection and deem the data collected as final, but some challenges persist.

Existing data recording and disaster response processes outline methods for different temporal stages and it is noted that revisions to data reported can occur indefinitely, although the utility of information changes significantly over periods of time. Consequently, UNISDR recommends the use of two temporal frameworks for assessment in the aftermath of disasters:

- Rapid assessment
    - Timeframe – Usually completed within one month (28 days) of disaster taking place
    - Method –
    - Purpose – Appeal/Relief triggering mechanism. E.g. UN Flash Appeals, EU solidarity fund, other international aid mechanisms
- Detailed assessment
    - Timeframe – Completed within 6-12 months of disaster taking place
    - Method –
    - Purpose – Reconstruction planning, compensation payment.

- After 12 months has elapsed, further data recording could continue for research purposes etc., but it is expected that changes will NOT be significant and could be ignored for the purposes of global or national monitoring.

## ANNEX I: Definition and examples of Metadata

Metadata is defined in general as a set of data that describes and gives information or provides context about other data.

Metadata is defined differently by different practitioners such as computer scientists vs. statisticians. The definition of Metadata in this Technical Note needs to be consistent with the GA resolution, and for them to serve the different methodologies proposed needs to be expanded to include not only the description of the data, but also details about the data, such as source, ownership, units, format etc

In the case of this note, the definition of Metadata is as follows:

**Sendai Metadata: as a set of data that describe the productive assets and infrastructure items a country will collect, and which give information or provide context about the Indicators, the required data and external parameters needed to perform a semi automated economic loss calculation and support the calculation of the number of people affected.**

For each type of productive asset that is reported:

- Code
- Description of type of asset
- Information Source
- Group or Economic Sector/Activity in ISIC or adopted FAO/UNISDR classification
- Measurement Units ($m^2$, mts, Hectare, Km, Ton, etc.)
- Value per unit [Series per Year 2005… 2030]
- % of value for equipment, furniture, materials, product (if applicable)
- % of value for associated physical infrastructure (if applicable)
- Average number of workers per facility or infrastructure unit
- Formula to calculate economic value

Additionally, the metadata will contain a number of national level socio-economic parameters that will support the calculations of economic loss and the number of people affected. These parameters will be time-bound as a series of yearly values:

- Code
- Description of the parameter
- Information Source
- Measurement Units ($m^2$, mts, Hectare, Km, Ton, people, etc.)
- Value per unit [Series per Year 2005… 2030]

The following hypothetical exemplars illustrate these types of metadata*:

**Table: Example for Illustration of Suggested Metadata for Socio-economic parameters**

| Description of the parameter | Value, by YEAR | Measurement UNIT | Source |
|---|---|---|---|
| Population | 1,2m 2017<br>1,3m 2018<br>1,4m 2019<br>….. ….. | Persons | National Census |
| Number of Households | 250k 2017<br>254k 2018<br>259k 2019<br>….. ….. | Households | National Census |
| GDP | 5.1 b 2017<br>5.6 b 2018<br>5. 9b 2019<br>….. ….. | USD | Ministry of finances<br>World Bank |
| GDP Deflator | 1.0 2017<br>1.1 2018<br>1.12 2019<br>….. ….. | Multiplier | Ministry of finances<br>World Bank |
| … | …. ….<br>…. …. | | |
| … | …. ….<br>…. …. | | |
| … | …. …. | | |

**Table: Example for Illustration of Suggested Metadata for Productive Assets of C3, C4 and C5 indicators**

| Type of Infrastructure | average size of facilities | construction cost per Unit USD $, by YEAR (b) USD of 2015 | Additional % Equipment, furniture & materials | Additional % associated infrastructure | Measurment UNIT | Formula | No. Workers |
|---|---|---|---|---|---|---|---|
| Small Industrial Facility (Group C Manufacturing on ISIC) | 100 | 1,200 2017<br>1,220 2018<br>1,245 2019<br>….. ….. | 25% | 25% | $Mt^2$ | A*B*C*D*DR | 10 |
| Medium Industrial Facility (Group C Manufacturing on ISIC) | 600 | 1,200 2017<br>1,205 2018<br>1,215 2019<br>….. ….. | 40% | 25% | $Mt^2$ | … | 50 |
| Large Industrial Facility (Group C Manufacturing on ISIC) | 3,000 | 1,200 2017<br>1,220 2018<br>1,245 2019<br>….. ….. | 60% | 20% | $Mt^2$ | … | 1000 |
| Commercial – small shop (Group G Wholesale and retail trade on ISIC) | 60 | 800 2017<br>809 2018<br>….. ….. | 50% | 25% | $Mt^2$ | … | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Commercial – large shop (Group G Wholesale and retail trade on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 800 | 25% | $Mt^2$ | ... | 100. |
| Small tourism facility (Group I Accommodation and food service on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 25% | 25% | $Mt^2$ | ... | 15 |
| Large tourism facility (Group I Accommodation and food service on ISIC) | 10,000 | 1,200 2017<br>1,220 2018<br>1,245 2019<br>….. ….. | 25% | 25% | $Mt^2$ | ... | 300 |
| Housing (C4) | 55 | 500 2017<br>509 2018<br>….. ….. | 25% | 25% | $Mt^2$ | ... | 1 |
| Small Health facility (C5) (Group Q, Human health and social work on ISIC) | 60 | 800 2017<br>809 2018<br>….. ….. | 40% | 25% | $Mt^2$ | | 8 |
| Medium Health facility(C5) (Group Q, Human health and social work on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 50% | 25% | $Mt^2$ | | 25 |
| Large health facility(C5)(Group Q, Human health and social work on ISIC) | 10,000 | 800 2017<br>809 2018<br>….. ….. | 80% | 25% | $Mt^2$ | | 800 |
| Education – Small school (for C5) | 100 | 800 2017<br>809 2018<br>….. ….. | 15% | 25% | $Mt^2$ | | 7 |
| … | … | … | … | … | … | | |
| … | … | … | … | … | … | | |

* The number and data source are hypothetical values used simply to demonstrate how metadata could be reported.

Depending on data availability in each country, and on the level of detail of the actual physical damage data collected, these proxies could be disaggregated to enhance the quality of the estimates. For example, if a country collects disaggregated data on physical damage for housing sector in rural and urban categories, then countries are recommended to provide both sizes and prices corresponding to each category.

Metadata will be mandatory for two purposes:

1) Allowing countries to report losses and affectation on economic sectors and infrastructure that are relevant to each country in a flexible and meaningful way.
2) Allow for an automated and homogeneous calculation of economic loss, which meets objectives of transparency and verifiability of the data associated with indicators.

*The following fields of the Metadata are intended to support a possible semi-**automatic** calculation of the economic valuation. It is expected that for a very large number of disasters a proper economic assessment of economic losses will NOT be conducted. The Methodologies and fields of the metadata will allow the assessment of a good proxy of the economic loss in an automated fashion.*

- *GDP*
- *Average size of facilities (in $m^2$ or a suitable unit)*
- *Construction cost per $m^2$ (or per the specific Unit) in USD $, PER YEAR (b), expressed in USD of 2015*
- *The Percentage Ratio (%) expressing the average value of Equipment, furniture & materials in relation to the total value of the asset.*
- *The Percentage Ratio (%) expressing the average value of associated infrastructure in these types of assets*
- *A mathematical formula relating these parameters*

*The following fields of the Metadata are intended to support a possible semi-**automatic** calculation of Human Losses (people affected):*

- *Population*
- *Number of Households*
- *Number of Workers (in Productive Assets and Infrastructure tables)*

Changes to the Metadata, therefore, would affect a possible **semi-automatic** calculation of the economic valuation and should be carefully managed.

An important consideration is **that Metadata is a static data set**. It would contain only a time series for prices per unit, given the considerations stated below.

If a country decides to collect data without categorizing assets affected by size, it will be reflected in the Metadata. In this case the metadata for each type of productive asset would look like the following (showing only one entry, for Industrial facilities):

| Type of Infrastructure | average size of facilities | construction cost per Unit USD $, by YEAR (b) USD of 2015 | Additional % Equipment, furniture & materials | Additional % associated infrastructure | Measurement UNIT | Formula |
|---|---|---|---|---|---|---|
| Industrial Facility (Group C Manufacturing on ISIC) | 185 | 1,200 2017<br>1,220 2018<br>1,245 2019<br>….. ….. | 25% | 25% | $mt^2$ | A*B*C*D*DR |

If a country decides to collect data based on categorizing assets affected by size (as in **Option 3** and **Option 4**), it will be also reflected in the Metadata. In this case the metadata for each category size and type of productive asset would look like the following (showing only entries for three hypothetical categories for Industrial facilities):

| Type of Infrastructure | average size of facilities | construction cost per Unit USD $, by YEAR (b) USD of 2015 | Additional % Equipment, furniture & materials | Additional % associated infrastructure | Measurement UNIT | Formula | No. Workers |
|---|---|---|---|---|---|---|---|
| Small Industrial Facility (Group C Manufacturing on ISIC) | 100 | 1,200 2017<br>1,220 2018<br>1,245 2019<br>….. ….. | 25% | 25% | $Mt^2$ | A*B*C*D*DR | 10 |
| Medium Industrial Facility (Group C Manufacturing on ISIC) | 600 | 1,200 2017<br>1,205 2018<br>1,215 2019<br>….. ….. | 40% | 25% | $Mt^2$ | … | 50 |
| Large Industrial Facility (Group C Manufacturing on ISIC) | 3,000 | 1,200 2017<br>1,220 2018<br>1,245 2019<br>….. ….. | 60% | 20% | $Mt^2$ | … | 1000 |

**Example for Illustration of Metadata to describe data collected for indicators C-5 and D-4.**

| Type of Infrastructure | average size of facilities | construction cost per Unit USD $, by YEAR (b) USD of 2015 | Additional % Equipment, furniture & materials | Additional % associated infrastructure | UNIT | Formula | No. Workers |
|---|---|---|---|---|---|---|---|
| Small Health facility (C5) (Group Q, Human health and social work on ISIC) | 60 | 800 2017<br>809 2018<br>….. ….. | 40% | 25% | $Mt^2$ | … | 8 |
| Medium Health facility(C5) (Group Q, Human health and social work on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 50% | 25% | $Mt^2$ | … | 25 |
| Large health facility(C5)(Group Q, Human health and social work on ISIC) | 10,000 | 800 2017<br>809 2018<br>….. ….. | 80% | 25% | $Mt^2$ | … | 800 |
| Education – Small school (C5) (Group P, Education on ISIC) | 100 | 800 2017<br>809 2018<br>….. ….. | 15% | 25% | $Mt^2$ | … | 7 |
| Education – Medium Education facility (C5) (Group P, Education on ISIC) | 1,000 | 800 2017<br>809 2018<br>….. ….. | 25% | 25% | $Mt^2$ | … | 25 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Education – Large education facility (C5) (Group P, Education on ISIC) | 10,000 | 800 2017<br>809 2018<br>….. ….. | 35% | 25% | $Mt^2$ | ... | 800 |
| Unpaved Road | 1 | 205 | 0% | 0% | Mt | ... | |
| Paved Road, single | 1 | 405 | 0% | 0% | Mt | ... | |
| Highway, single | 1 | 2,000 | 0% | 0% | Mt | ... | |
| Highway, Double | 1 | 5,000 | 0% | 0% | Mt | ... | |
| Bridge, single small | 10-20 mts | 250,000 | 0% | 0% | Unit | ... | |
| Bridge, single medium | 20-40 mts | 600,000 | 0% | 0% | Unit | ... | |
| Bridge, large, single or double | 40 + mts | 1'000,000 | 0% | 0% | Unit | | |
| Railway, single | 1 | 5,000 | 0% | 0% | Mt | | |
| Railway, double | 1 | 10,000 | 0% | 0% | Mt | | |
| Airport | - | - | 0% | 0% | Unit | | 1200 |
| Fishing port | - | - | 0% | 0% | Unit | | 20 |
| Freight Port | - | - | 0% | 0% | Unit | | 2000 |
| Water treatment plant | - | - | 0% | 0% | Unit | | 10 |
| Power Generation plant | - | - | 0% | 0% | Unit | | 20 |
| … | … | … | … | … | … | | |
| … | … | … | … | … | … | | |

## ANNEX II: Classification of facilities according to Economic activity.

The following tables summarizes UNISDR's suggestions for the determination of the indicator to which any facility could be reported and observing the main Indicators - for which the methodology of economic valuation is provided in this note.

The table contains all headers of the International Standard Industrial Classification of All Economic (ISIC) Activities, Rev.4.

| Indicators | Methodology |
|---|---|
| C-2 | Agricultural |
| C-3 | Industrial, Commercial, Services |
| C-4 | Housing |
| C-6 | Cultural Heritage |
| C-5 and D-2 | Health |
| C-5 and D3-3 | Education |

Those recording damage must exercise judgment in interpreting this summary table. Facilities in some of these activity lines may belong to different indicators dependent on: whether the facility is public or private (e.g. Entertainment); the type of facility (e.g. Aquaculture in fisheries is assimilated to Agricultural crops, while land based fisheries installations are considered industrial facilities).

This methodology also suggests that plant installations in public service networks (water and sewerage treatment plants, electric generation, stations and substations, communication stations, etc.) should be assimilated to industrial facilities. It is worth reiterating that losses in the neighbourhood networks of public services are factored as part of the housing sector.

## International Standard Industrial Classification ISIC

| | | |
|---|---|---|
| A | | **Agriculture, forestry and fishing** |
| | 01 | Crop and animal production, hunting and related service activities |
| | 02 | Forestry and logging |
| | 03 | Aquaculture Fishing |
| B | | **Mining and quarrying** |
| | 05 | Mining of coal and lignite |
| | 06 | Extraction of crude petroleum and natural gas |
| | 07 | Mining of metal ores |
| | 08 | Other mining and quarrying |
| | 09 | Mining support service activities |
| C | | **Manufacturing** |
| | 10 | Manufacture of food products |
| | 11 | Manufacture of beverages |
| | 12 | Manufacture of tobacco products |
| | 13 | Manufacture of textiles |
| | 14 | Manufacture of wearing apparel |
| | 15 | Manufacture of leather and related products |
| | 16 | Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials |
| | 17 | Manufacture of paper and paper products |
| | 18 | Printing and reproduction of recorded media |
| | 19 | Manufacture of coke and refined petroleum products |
| | 20 | Manufacture of chemicals and chemical products |
| | 21 | Manufacture of basic pharmaceutical products and pharmaceutical preparations |
| | 22 | Manufacture of rubber and plastics products |
| | 23 | Manufacture of other non metallic mineral products |
| | 24 | Manufacture of basic metals |
| | 25 | Manufacture of fabricated metal products, except machinery and equipment |
| | 26 | Manufacture of computer, electronic and optical products |
| | 27 | Manufacture of electrical equipment |
| | 28 | Manufacture of machinery and equipment n.e.c. |
| | 29 | Manufacture of motor vehicles, trailers and semi trailers |
| | 30 | Manufacture of other transport equipment |
| | 31 | Manufacture of furniture |
| | 32 | Other manufacturing |
| | 33 | Repair and installation of machinery and equipment |
| D | | **Electricity, gas, steam and air conditioning supply** |
| | 35 | Electricity, gas, steam and air conditioning supply |
| E | | **Water supply; sewerage, waste management and remediation activities** |
| | 36 | Water collection, treatment and supply |
| | 37 | Sewerage |
| | 38 | Waste collection, treatment and disposal activities; materials recovery |
| | 39 | Remediation activities and other waste management services |
| F | | **Construction** |
| | 41 | Construction of buildings |
| | 42 | Civil engineering |
| | 43 | Specialized construction activities |
| G | | **Wholesale and retail trade; repair of motor vehicles and motorcycles** |
| | 45 | Wholesale and retail trade and repair of motor vehicles and motorcycles |
| | 46 | Wholesale trade, except of motor vehicles and motorcycles |
| | 47 | Retail trade, except of motor vehicles and motorcycles |
| H | | **Transportation and storage** |
| | 49 | Land transport and transport via pipelines |
| | 50 | Water transport |
| | 51 | Air transport |
| | 52 | Warehousing and support activities for transportation |
| | 53 | Postal and courier activities |
| I | | **Accommodation and food service activities** |
| | 55 | Accommodation |
| | 56 | Food and beverage service activities |
| J | | **Information and communication** |

| | | |
|---|---|---|
| | 58 | Publishing activities |
| | 59 | Motion picture, video and television programme production, sound recording and music publishing activities |
| | 60 | Programming and broadcasting activities |
| | 61 | Telecommunications |
| | 62 | Computer programming, consultancy and related activities |
| | 63 | Information service activities |
| **K** | | **Financial and insurance activities** |
| | 64 | Financial service activities, except insurance and pension funding |
| | 65 | Insurance, reinsurance and pension funding, except compulsory social security |
| | 66 | Activities auxiliary to financial service and insurance activities |
| **L** | | **Real estate activities** |
| | 68 | Real estate activities |
| **M** | | **Professional, scientific and technical activities** |
| | 69 | Legal and accounting activities |
| | 70 | Activities of head offices; management consultancy activities |
| | 71 | Architectural and engineering activities; technical testing and analysis |
| | 72 | Scientific research and development |
| | 73 | Advertising and market research |
| | 74 | Other professional, scientific and technical activities |
| | 75 | Veterinary activities |
| **N** | | **Administrative and support service activities** |
| | 77 | Rental and leasing activities |
| | 78 | Employment activities |
| | 79 | Travel agency, tour operator, reservation service and related activities |
| | 80 | Security and investigation activities |
| | 81 | Services to buildings and landscape activities |
| | 82 | Office administrative, office support and other business support activities |
| **O** | | **Public administration and defence; compulsory social security** |
| | 84 | Public administration and defence; compulsory social security |
| **P** | | **Education** |
| | 85 | Education |
| **Q** | | **Human health and social work activities** |
| | 86 | Human health activities |
| | 87 | Residential care activities |
| | 88 | Social work activities without accommodation |
| **R** | | **Arts, entertainment and recreation** |
| | 90 | Creative, arts and entertainment activities |
| | 91 | Libraries, archives, museums and other cultural activities |
| | 92 | Gambling and betting activities |
| | 93 | Sports activities and amusement and recreation activities |
| **S** | | **Other service activities** |
| | 94 | Activities of membership organizations |
| | 95 | Repair of computers and personal and household goods |
| | 96 | Other personal service activities |
| **T** | | **Activities of households as employers; undifferentiated goods and services producing activities of households for own use** |
| | 97 | Activities of households as employers of domestic personnel |
| | 98 | Undifferentiated goods and services producing activities of private households for own use |
| **U** | | **Activities of extraterritorial organizations and bodies** |
| | 99 | Activities of extraterritorial organizations and bodies |

## ANNEX III – Computation Methods for Agricultural Loss (C-2)

The methodology to assess economic losses of the agricultural sector has been developed by the Food and Agriculture Organization of the United Nations (FAO).

The detailed computation formulas for the assessment of disaster loss to the agriculture sector are presented below by sub-component (production loss, assets loss and loss of stocks) for each sub-sector (crops, livestock, fisheries, aquaculture and forestry). In order to ensure comparability across countries, all prices used in the below computations are farm gate / producer prices, expressed in PPP international dollars.

**Notation:**

$i \text{ is output}$

$j \text{ is geographical units affected by the disaster}$

$k \text{ is asset (equipment, machinery, tool, facilities) used to produce an agricultural output}$

$x \text{ is input used for agricultural production}$

$h \text{ is trees (perennial crop trees and forest trees)}$

$t \text{ is the first time unit when post} - \text{disaster data are available}$

$t - 1 \text{ is the first time unit when pre} - \text{disaster data are available}$

$y_{i\ (or\ z)j,t} \text{ is the yield of item } i \text{ in zone } j \text{ at time } t$

$p_{x(or\ i\ or\ h),j,t-1} \text{is the price of input } x \text{ (or product } i \text{ or tree } h\text{) in zone } j \text{ at time } t - 1$

$p_{kj,t} \text{ is the price (or repair cost) of one unit of asset } k \text{ in zone } j \text{ at time } t$

$q_{xj} \text{ is the quantity of input } x \text{ in zone } j \text{ needed for (one hectare of) production}$

$q_{i\ ,j} \text{ is the quantity of item } i \text{ in zone } j$

$q_{i\ (or\ x)(stored)j\ tj} \text{ is the stored quantity of item } i \text{ (or input } x\text{) in zone } j \text{ at time } t$

$q_{kj,t} \text{ is the number of assets used for item } i \text{ in zone } j \text{ at time } t$

$l_{ij,t-1} \text{ is the cost of labour per unit of time for one hectar of item } i \text{ production in zone } j$

## Formulas

**PRODUCTION LOSS**

- **Loss of Annual Crop Stocks:**

1) Pre-disaster value of destroyed stored inputs: $\Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$
2) Pre-disaster value of destroyed stored annual crops: $\Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$

$$\mathrm{PD(AC)_{ij}} = \Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1} + \Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$$

- **Loss of Perennial Crop Stocks:**

1) Pre-disaster value of destroyed stored inputs: $\Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$
2) Pre-disaster value of destroyed stored perennial crops: $\Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$
3) Replacement value of fully damaged trees: $\Delta ha_{ij,t} \cdot h_{ij} \cdot p_{h\ j,t-1}$

$$PD(PC)_{ij} = \Delta q_{i\ (stored)j,t} \cdot p_{i(stored)j,t-1} + \Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1}) + \Delta ha_{ij,t} \cdot h_{ij} \cdot p_{h\ j,t-1}$$

- **Loss of Livestock Stocks:**

1) Pre-disaster value of destroyed stored inputs (fodder and forage): $\Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$
2) Pre-disaster value of destroyed stored livestock products: $\Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$
3) Pre-disaster net value of dead livestock: $(\Delta q_{ij,t} \cdot \overline{w}_i) \cdot (p_{ij,t-1} - \alpha \cdot p_{ij,t})$

$$PD(L)_{ij} = \Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1}) + \Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1} + (\Delta q_{ij,t} \cdot \overline{w}_i) \cdot (p_{ij,t-1} - \alpha \cdot p_{ij,t})$$

- **Loss of Forestry Stocks:**

1) Pre-disaster value of destroyed stored inputs: $\Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$
2) Pre-disaster value of destroyed stored products: $\Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$
3) Replacement value of fully damaged trees: $\Delta ha_{ij,t} \cdot h_{ij} \cdot p_{h\ j,t-1}$

$$PD(FO)_{ij} = \Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1}) + \Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1} + \Delta ha_{ij,t} \cdot h_{ij} \cdot p_{h\ j,t-1}$$

- **Loss of Aquaculture Stocks:**

1) Pre-disaster value of destroyed stored inputs: $\Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$:
2) Pre-disaster value of destroyed stored aquaculture products: $\Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$
3) Pre-disaster net value of dead fishes (brood stock losses): $(\Delta q_{ij,t} \cdot \overline{w}_i)$

$$PD(AQ)_{ij} = \Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1}) + \Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1} + (\Delta q_{ij,t} \cdot \overline{w}_i)$$

- **Loss of Fisheries Stocks:**

1) Pre-disaster value of destroyed stored inputs: $\Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1})$
2) Pre-disaster value of destroyed stored capture: $\Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$

$$PD(FI)_{ij} = \Sigma(\Delta q_{x(stored)j,t} \cdot p_{x(stored)j,t-1}) + \Delta q_{i(stored)j,t} \cdot p_{i(stored)j,t-1}$$

- **Annual Crop Production Loss:**

1) Difference between expected and actual value of crop production in non-fully affected harvested areas: $p_{ij,t-1} \cdot \Delta y_{ij,t} \cdot ha_{ij,t} \cdot 1(\Delta y_{ij,t} > 0)$
2) Pre-disaster value of destroyed standing crops in fully-affected areas: $p_{ij,t-1} \cdot y_{ij,t-1} \cdot \Delta ha_{ij,t}$
3) Short-run post-disaster maintenance costs (expenses used to temporarily sustain production activities immediately post-disaster): $P_{\text{short-run}}$ (lump-sum)

$$PL(AC)_{ij} = p_{ij,t-1} \cdot \Delta y_{ij,t} \cdot ha_{ij,t} \cdot 1(\Delta y_{ij,t} > 0) + p_{ij,t-1} \cdot y_{ij,t-1} \cdot \Delta ha_{ij,t} + P_{\text{short-run}}$$

- **Perennial Crop Production Loss:**

1) Difference between expected and actual value of crop production in non-fully affected harvested areas: $p_{ij,t-1} \cdot \Delta y_{ij,t} \cdot ha_{ij,t}$
2) Pre-disaster value of destroyed standing crops in fully-affected areas and discounted expected value of crop production in fully affected area until full recovery: $\Sigma\rho \cdot E_{t-1}[p_{ij,t-1} \cdot y_{ij,t-1}]$
3) Short-run post-disaster maintenance costs (expenses used to temporarily sustain production activities immediately post-disaster): $P_{\text{short-run}}$ (lump-sum)

$$PL(PC)_{ij} = \Sigma\rho \cdot E_{t-1}[p_{ij,t-1} \cdot y_{ij,t-1}] \cdot \Delta ha_{ij,t} + p_{ij,t-1} \cdot \Delta y_{ij,t} \cdot ha_{ij,t} + P_{\text{short-run}}$$

- **Livestock Production Loss:**

1) Difference between expected and actual value of production (of livestock products): $\Sigma(q_{ij,t} \cdot p_{zj,t-1} \cdot \Delta y_{zj,t})$
2) Discounted foregone value of livestock products from dead livestock until full recovery: $\Sigma\rho \cdot \{\Sigma(\Delta q_{ij,t} \cdot p_{zj,t-1} \cdot y_{zj,t-1})$
3) Short-run post-disaster maintenance costs (expenses used to temporarily sustain production activities immediately post-disaster): $P_{\text{short-run}}$ (lump-sum)

$$PL(L)_{ij} = \Sigma\rho \cdot \{\Sigma(\Delta q_{ij,t} \cdot p_{zj,t-1} \cdot y_{zj,t-1}) + \Sigma(q_{ij,t} \cdot p_{zj,t-1} \cdot \Delta y_{zj,t}) + P_{\text{short-run}}$$

- **Forestry Production Loss:**

1) Difference between expected and actual value of production in non-fully affected harvested area: $ha_{ij,t} \cdot p_{xj,t-1} \cdot \Delta y_{xj,t}$
2) Pre-disaster value of fully destroyed standing forest products and discounted expected value of production in fully affected area until full recovery: $\Sigma\rho \cdot \Delta ha_{ij,t} \cdot p_{xj,t-1} \cdot y_{xj,t-1}$

$$PL(FO)_{ij} = \Sigma\rho \cdot \Delta ha_{ij,t} \cdot p_{xj,t-1} \cdot y_{xj,t-1} + ha_{ij,t} \cdot p_{xj,t-1} \cdot \Delta y_{xj,t}$$

- **Aquaculture Production Loss:**

1) Difference between expected and actual value of aquaculture production in non-fully affected aquaculture areas: $area_{ij,t} \cdot p_{ij,t-1} \cdot \Delta y_{ij,t-1}$
2) Pre-disaster value of aquaculture production lost in fully affected aquaculture areas and discounted expected value of production in fully affected aquaculture area until full recovery: $\Sigma\rho.\ \Delta area_{ij,t} \cdot p_{ij,t-1} \cdot y_{ij,t-1}$
3) Short-run post-disaster maintenance costs (expenses used to temporarily sustain production activities immediately post-disaster): $P_{\text{short-run}}$ (lump-sum)

$$PL(AQ)_{ij} = \Sigma\rho.\ \Delta area_{ij,t} \cdot p_{ij,t-1} \cdot y_{ij,t-1} + area_{ij,t} \cdot p_{ij,t-1} \cdot \Delta y_{ij,t-1} + P_{\text{short-run}}$$

- **Fisheries Production Loss:**

1) Difference between expected and actual value of fisheries capture in disaster year: $area_{ij,t} \cdot p_{ij,t-1} \cdot \Delta y_{ij,t}$

$$PL(FI)_{ij} = area_{ij,t} \cdot p_{ij,t-1} \cdot \Delta y_{ij,t}$$

**ASSETS LOSS**

- **Crops Assets Loss:**

1) Repair / replacement cost of partially / fully destroyed assets at pre-disaster price: $\Sigma(p_{kj,t-1} \cdot \Delta q_{kj,t})$

- **Livestock Asset Loss:**

1) Repair / replacement cost of partially / fully destroyed assets at pre-disaster price: $\Sigma(p_{kj,t-1} \cdot \Delta q_{kj,t})$

- **Forestry Assets Loss:**

1) Repair / replacement cost of partially / fully destroyed assets at pre-disaster price: $\Sigma(p_{kj,t-1} \cdot \Delta q_{kj,t})$

- **Aquaculture Assets Loss:**

1) Repair / replacement cost of partially / fully destroyed assets at pre-disaster price: $\Sigma(p_{kj,t-1} \cdot \Delta q_{kj,t})$

- **Fisheries Assets Loss:**

1) Repair / replacement cost of partially / fully destroyed assets at pre-disaster price: $\Sigma\left(p_{kj,t-1} \cdot \Delta q_{kj,t}\right)$

$$AD(ALL)_{ij} = \Sigma(p_{kj,t-1} \cdot \Delta q_{kj,t})$$

**Note:** Disaster impact on the **apiculture sub-sector** is to be calculated using the livestock-relevant formulas for direct loss, where:

- Loss of apiculture stocks is estimated based on the 1) pre-disaster value of stored inputs and 2) stored apiculture products destroyed by the disaster
- Production loss is calculated based on the 1) difference between expected and actual value of apiculture production in disaster year, and 2) discounted foregone value of apiculture products until full recovery
- Assets loss is calculated as the pre-disaster value of partially or fully destroyed apiculture assets (beehives, equipment, storage, etc.)

## Error Analysis and Margin of Error

The proposed computation methods are based on a set of assumptions and exogenous knowledge-based parameters, which are oriented towards a conservative approach. Results however might be biased for a variety of reasons.

First, the lack of data (both pre and post-disaster) and the impossibility to relax the assumptions implies the utilization of estimation procedures. Second, errors may occur due to distortions and simultaneous causes of changes in the agricultural outputs, other than the natural hazard. Third, lack of sensitivity in the measurement may be a significant source of bias. Finally, the knowledge-based features of the computation method may modify the output depending on the source of knowledge.

In order to mirror this variability in the statistics provided for loss values from disasters, a two-step error analysis could be proposed. The first step considers the variability in the definition of the exogenous parameters; the second may be used to test the robustness of the average disaster impact in agriculture across levels of the climatic stressors.

If necessary, the following proposed error interval procedures may be applied in order to represent at least part of the variability in the outcome measurements.

1. **Min-Max Interval.** The computation method presents a set of exogenous (estimated) data in each sub-component for loss.

- An *average*, *minimum* and a *maximum* value is defined for each of the data estimations. All three values are primarily based on the existing literature and available expert judgment.
- The outcome values for loss are calculated three times for each sub-component, using the *average* values of the exogenous data, the values that *minimize* the outcome, and the values that *maximize* the outcome.

2. **Confidence interval per level of geophysical stressor.** In order to identify the magnitude of a disaster, climatic and geophysical stressors information should be collected at the most cost-efficient available level of granularity.

- Categories of intensity of the stressors should be defined. For instance, in the case of Typhoons, wind speed (in accordance with the topography of the area) is a strong determinant of the magnitude of the natural hazard, and four categories can be identified.
- For each cluster (i.e. category of stressor's intensity), the mean of loss in zones *j* falling under that precise cluster should be calculated.
- Each mean should be provided with a 90% or 95% confidence interval.
- Hypothesis test of difference between means should then be calculated. The T test tests overall internal validity.

**Working Definitions Specific for Agricultural Loss Methodology**

| Term | Definition |
|---|---|
| **Area affected** | The area of land (cultivated, pastoral and forest) damaged or destroyed due to hazardous event (unit: hectare). This also includes water used for fishing and water used for aquaculture (ponds, pens, cages) impacted due to hazardous events (unit: hectare or km2). |
| **Livestock killed** | The number of domestic productive animals lost as a result of a hazardous event. |
| **Livestock injured** | The number of domestic productive animals injured as a result of a hazardous event. |
| **Area harvested** | The total hectares of land from which a crop is gathered. Area harvested, therefore, excludes the area from which, although sown or planted, there was no harvest due to various factors. If the crop under consideration is harvested more than once during the year as a consequence of successive cropping (i.e., the same crop is sown or planted more than once in the same field during the year), the area is counted as many times as harvested. On the contrary, area harvested will be recorded only once in the case of successive gathering of the crop during the year from the same standing crops.<br>**"Area harvested" refers to crop and forest land as well as water used for aquaculture and fishing.** |
| **Area fully destroyed - not harvested** | The total hectares of land where no yield is anticipated compared to a 'normal year'. These fully destroyed areas consist of the total hectares of land where cultivated crops were destroyed by the hazardous event and no production is possible.<br>**"Area fully destroyed - not harvested" refers to crop and forest land as well as water used for aquaculture and fishing.** |
| **Area partially destroyed** | The total hectares of land where a reduction in yields is anticipated by at least 30% compared to a 'normal year'. These partially destroyed areas consist of the total hectares of land where cultivated crops were affected by the hazardous event and production was compromised.<br>**"Area partially destroyed" refers to crop and forest land as well as water used for aquaculture and fishing.** |
| **Short run post-disaster maintenance costs** | Costs incurred to maintain agricultural activity in the aftermath of the hazardous event (including, but not limited to: purchasing and rental of electric generators, water pumps, temporary facilities as well as agricultural loans, etc.). Does not include the value of production, facilities and machinery directly damaged by the disaster. |
| **Destroyed stored inputs** | The volume of stored inputs (seeds, fertiliser, pesticides, feed, fodder, fishing bait, etc.) lost and destroyed as a result of a hazardous event in a given area. |
| **Production loss / lost** | **Declines in the volume of crop, livestock, forestry, aquaculture and fisheries production** resulting from the hazardous event, **as compared to pre-disaster expectations**. This term covers the decline in output in crop, livestock, forestry, aquaculture and fisheries production. It also includes declines in catches in fisheries with respect to expected or average volumes. |
| **Stored production destroyed** | The volume of stored production (crops, livestock produce, harvested fish, stored wood, etc.) lost and destroyed as a result of a hazardous event in a given area. This excludes crops and fish meal stored as agricultural / aquaculture inputs. |

| | |
|---|---|
| **Yield** | The volume of harvested production per unit of harvested area; expressed as quantity in tonnes (t) per unit of area (ha), and derived by deducting harvesting and other losses from the biological yield. |
| **Yield loss** | **Reduction in the crop yield** resulting from the hazardous event, **as compared to pre-disaster expectations**. Expressed as the difference between the expected yield and the actual yield (after the hazardous event). |
| **Terms - Assets** | **Definition** |
| **Fishing vessels** | Mobile floating objects of any kind and size, operating in freshwater, brackish water and marine waters which are used for catching, harvesting, searching, transporting, landing, preserving and/or processing fish, shellfish and other aquatic organisms, residues and plants |
| **Machinery** | Machinery and equipment used in crop and livestock farming, forestry, aquaculture and fisheries. Includes (but is not limited to): tractors, balers, combine harvesters - threshers, harvesters and threshers, fertilizer distributors, ploughs, root or tuber harvesting machines, seeders, soil machinery, irrigation facilities, tillage implements, track-laying tractors, milking machines, dairy machines, machinery for forestry, wheeled special machines, portable chain-saws, fishing vessels, fishing gears, aquaculture feeders, pumps and aerators, aquaculture support vessels, etc. |
| **Primary processing facilities** | Facilities and machinery used for the initial processing of primary crop, livestock, fish and forest products, to prepare them for further processing, for the market or for export shipment. |
| **Storage facilities** | Facilities where production is kept during post-harvest periods. Includes: warehouses, silos, grain handling facilities, conveyor bridges, livestock housing, fertilizer storage, post-frame construction, cold/chill and dried/smoked fish stores, etc. |

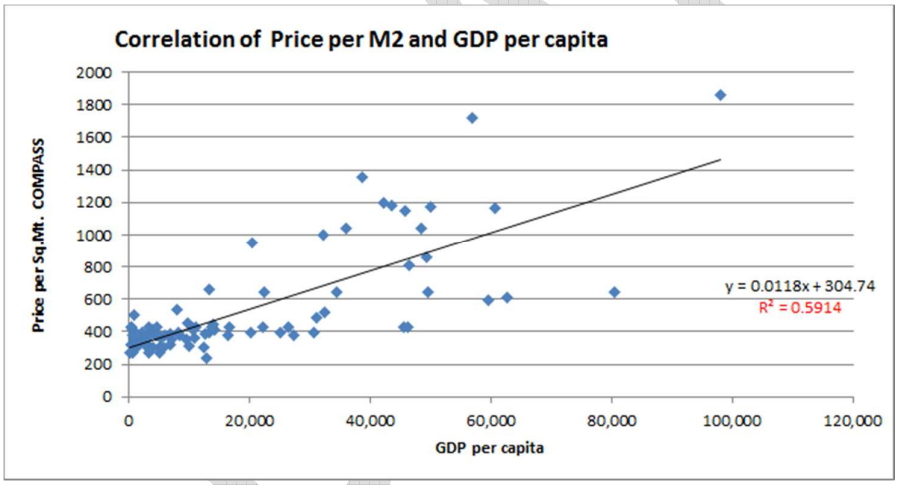
## ANNEX IV: Method to derive a proxy for average construction cost

Reporting construction cost for each type of sector is difficult, and so the instances where countries do not have access to cost information are many. This section describes how to derive a proxy for the national average construction cost per square metre for all sectors.

UNISDR and scientific partners devised a methodology aimed at obtaining a ***national*** **proxy construction cost per square metre** that could be used *as approximation* to be applied for each of these sectors that the cost information is missing.

The data culled for this method is based on data analysis of the global housing construction cost database "Global Construction Cost and Reference Yearbook 2012" (Compass International, 2012)[13]. The housing construction cost per square metre for more than 90 countries in Compass and GDP per capita showed a moderate but sufficiently high correlation factor (about 60%). (See Figure below)

Figure: Correlation between housing construction cost per square metre and GDP per capita




The statistical regression produced the following formula to assess the construction cost per square metre in the 85 countries of the GAR sample:

**Construction cost per square metre = 304 + 0.0118*GDP per capita.**

This formula is suggested to be applied to all facilities in case construction cost for each sector cannot be obtained.

[13] This is the only source that contains multiple country information with a documented and consistent methodology. This publication is used worldwide by consulting engineering firms to estimate initial budgets of construction projects.

## ANNEX V: Methodology to derive costs of losses due to road damage

In order to assess the value of damages to roads the following methodology is proposed to countries, based on data that took as a base the average costs of rehabilitation of roads from a comprehensive study conducted by the World Bank, the ROad Costs Knowledge System (ROCKS) developed by the Transport Unit – TUDTR of the World Bank. This study arose from the need of public works agencies, contractors, consultants and financial institutions of having road costs information, which in general is locally available, but many times this information is scattered, and collected in unsystematic and unstructured ways.

The ROCKS Worldwide Database was created with data collected primarily from World Bank financed projects and has more than 1,500 records from 65 developing countries. All data was compiled into a single file that is available for public access at http://www.worldbank.org/transport/roads/tools.htm

ROCKS produced estimates for preservation work (renovation, rehabilitation and improvement) and for development work (construction of new roads). It also summarized the results by World Bank regions. Roads in turn were categorized as paved and unpaved.

For the effects of this exercise the cost of road rehabilitation was taken as a proxy to measure the value of the impact of disasters, as most of the work on roads after disasters must be considered as rehabilitation, despite a full reconstruction of the roads being required in some instances. Rehabilitation cost figures are much more conservative than development work.

While the averages per region were slightly different, the number of records per region per type of work was not deemed to be statistically representative enough in certain regions with very few projects; therefore a decision was made to use global averages instead of the regional averages of rehabilitation costs.

It was also noted that the figures in ROCKS were expressed in US dollars of year 2002. The results were thus brought to present value using the GDP deflator.

In order to introduce in the calculation the difference in cost between paved and unpaved roads, which was significant, it was assumed that distribution of road damage on each category would roughly follow the same pattern as the national distribution of roads on each class. To this effect the calculations used the data published by World Bank for the percentage of the road network of the country that are paved, on a per year basis (see http://data.worldbank.org/indicator/IS.ROD.PAVE.ZS ) . The latest indicator for each country was taken. This calculation could be improved using differential percentages by year, however it was noted that distribution in paved and unpaved does not change significantly over the years, and did not justify the additional complexity in the calculation engine.

The costs obtained for the Bank were:

| Average Works Costs per Km: | |
|---|---|
| **PAVED Roads** | UNPAVED Roads |
| Seals 20,000 $/km | Regravelling 11,000 $/km |
| Functional Overlays 56,000 $/km | Improvement 72,000 $/km |
| Structural Overlays 146,000 $/km | n/a |
| **Rehabilitation 214,000 $/km** | **Rehabilitation 31,000 $/km** |
| Construction 866,000 $/km | Paving 254,000 $/km |

**Table – Road costs per kilometre**

After bringing these costs to 2012 values (factor of 1.316) rehabilitation costs were USD$281,624 and USD$40,796 per kilometre respectively

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# Technical note on Data and Methodology to Estimate Damages to Infrastructure and Disruptions to Basic Services to Measure the Achievement of Target D of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target D of the Sendai Framework for Disaster Risk Reduction.

**Target D:** ***Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030***

This document outlines outlines a methodology to construct an indicator that will allow the measurement of damage to critical infrastructure and disruption of basic services associated with disasters. The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG) report, endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and metadata, and the methodologies for the measurement of the global indicators.

This methodology proposes the collection and use of a simple inventory of the **number of infrastructure facilities that were damaged or destroyed** by disasters and the **number of times in which the provision of a basic service was disrupted** to a noticeable degree attributed to disasters, including interruptions, partial interruptions, reduced coverage and reduced quality of service.

## 2. Introduction

Target D refers to two separate but interconnected situations. The first is the situation in which **critical infrastructure is damaged** (without services necessarily being disrupted or compromised in terms of quality) **or destroyed** and the second is when **basic services are disrupted** (which could potentially happen with or without damage).

Important aspects to be considered include: the length of time of the disruption; the number of times a service is interrupted as a consequence of a disaster; the number of users that suffer the interruption; or a lower quality of service provided.

However, measurement of the disruption that considers all of the aforementioned aspects would be extremely complex at global level and it is unlikely that data exist or can be collected in a practical and feasible way in most countries. **In particular, the construction of baseline data for the period 2005-2015 would be extremely challenging for most countries.**

The compound indicators endorsed by the UN General Assembly monitor the two elements of Target D: "**damage to critical infrastructure**" (D-1) and "**disruptions to basic services**" (D-5). Part

of the data required for the indicators of Target D will be collected under Targets B and C, thereby reducing the burden of data collection for Member States.

Indicators **D-2, D-3, and D-4** directly monitor the elements of "**damage to critical infrastructure**" by measuring the **number of facilities** which are damaged or destroyed.

Indicators **D-6, D-7 and D-8** directly monitor the elements of "**disruption to basic services**" of Target D by counting the **number of times** the provision of basic services are **disrupted as a consequence of a disaster**. These include interruptions (single or multiple) of the services, damage to the facilities that provide the service, or a measurable/noticeable reduction in the quality of the service or the population covered by the service – **or a combination of all the above**. Cascading disruptions of services (for example when the interruption of electricity causes disruption of water supply) can also be taken into account as they can be attributed to disasters.

The Secretariat has examined several options and is proposing to calculate indicator **D-1 as an Index of Critical Infrastructure Damage** and to calculate indicator **D-5 as an Index of Service Disruption.** The numbers of infrastructure facilities or services that were damaged or disrupted is counted and is taken relative to population expressing the indicator as the ratio per 100,000 population.

There is, however, a very important technical challenge related to the concepts of **Units and Facilities** in Indicator D-4. While in many infrastructural items the concept of a facility is clear (for example an airport or an electricity generation plant), the concept of unit has to be defined and furthermore how the indicator will consolidate units and facilities in a coherent manner, so it is not confused with other *units of measurements*.

This is particularly challenging in respect of networks. Damage to networks is commonly measured in different units, such as linear units (for example as kilometres of roads or railroads). The concept of unit or facility, therefore may be difficult to establish.

In the case of Indicator D-4 the **units of a network would refer to the number of clearly identifiable segments of the network that were affected** (such as the number of roads damaged) rather than a linear or other measurement of the network elements (such as number of kilometres of roads damaged).

As both linear and other measuring units may be required for the economic assessment, the Secretariat encourages Member States to **collect data for both** the number of units as defined here (for example number of roads affected) and the measurement units of the damage (number of kilometres of roads damaged).

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target D of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*.

*See Appendix I of Technical Note for Target C for definition of Metadata - indicators D-4 and D-8 share the same format with related indicators for Target C (C-5 Economic value to damage of infrastructures).*

| No. | Indicator |
|---|---|
| D-1 | Damage to critical infrastructure attributed to disasters. (compound indicator) |
| D-2 | Number of destroyed or damaged health facilities attributed to disasters. |
| D-3 | Number of destroyed or damaged educational facilities attributed to disasters. |
| D-4 | Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters.<br><br>*The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.* |
| D-5 | Number of disruptions to basic services attributed to disasters. (compound indicator) |
| D-6 | Number of disruptions to educational services attributed to disasters. |
| D-7 | Number of disruptions to health services attributed to disasters. |
| D-8 | Number of disruptions to other basic services attributed to disasters.<br>*The decision regarding those elements of basic services to be included in the calculation will be left to the Member States and described in the accompanying metadata.* |

Additionally, in its report E/CN.3/2017/2*, the Inter-Agency and Expert Group on SDGs Indicators (IAEG-SDGs) proposed the use of these same indicators in measuring the disaster-related global target of the Sustainable Development Goal (SDG) 11.

At its 48th Session, in report E/2017/24-E/CN.3/2017/35 the UN Statistical Commission adopted the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development, developed by the IAEG-SDGs, and recommended the associated draft resolution[14] for adoption by the Economic and Social Council.

[14] Draft Resolution I - Work of the UN Statistical Commission pertaining to the 2030 Agenda for Sustainable Development

## 4. Applicable Definitions and Terminology

Unless stated otherwise, key terms are those defined in the "Recommendations of the Open-ended Intergovernmental Expert Working Group on Terminology related to disaster risk reduction".

**Critical infrastructure**
*The physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society*

**Key terms**

**Protective Infrastructure:** The set of build elements designed to protect human life and societal assets from different hazards**,** including inter alia floods, flash floods, landslides, tsunamis, earthquakes, wind and storm surges.

Examples of protective infrastructure include:

- Flood protection walls and river defences
- Drainage systems and ground reinforcement elements for landslide prevention
- Canals, dams, dykes and other water regulation mechanisms
- Coastal defenses for storm surge and tsunami
- Cyclone and tornado shelter systems
- Hazard monitoring and early warning systems infrastructure

**Green Infrastructure:** Green infrastructure is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation, and management of wet weather impacts that provides many community benefits.

While single-purpose gray storm water infrastructure—conventional piped drainage and water treatment systems—is designed to move urban storm water away from the built environment, green infrastructure reduces and treats storm water at its source while delivering environmental, social, and economic benefits.

Some of the elements that constitute Green Infrastructure are:

- Parks and green areas
- Rain gardens
- Underground water infiltration trenches and storage systems
- Regional storm water reservoirs
- Coastal protection mangrove systems
- Urban tree canopy

**Basic services:** Services that are needed for all of society to function effectively or appropriately.

Examples of basic services include water supply, sanitation, health care, and education. They also include services provided by critical infrastructure such as electricity, telecommunications, transport, and waste management that are needed for all of society to function.

*For this indicator, disruption, interruption or lower quality of basic services is proposed to be measured for the following public services:*

*Educational facilities*: play schools, kindergartens, primary, secondary or middle schools, technical-vocational schools, colleges, universities, training centres, adult education, military schools and prison schools

*Healthcare facilities*: health centres, clinics, local and regional hospitals, outpatient centres and in general facilities used by primary health providers

*Power/energy system*: generation facilities, transmission and distribution system and dispatch centres and other works

*Sewerage system*: sanitation and sanitary sewage systems and collection and treatment of solid waste.

*Solid waste management*: collection and treatment of solid waste.

*Transport system*: road networks, railways (including stations), airports and ports

*Water supply*: drinking water supply system (water outlets, water treatment plants, aqueducts and canals which carry drinking water, storage tanks.)

*Information and Communication Technology (ICT) system*: plants and telephone networks (telecommunication network), radio and television stations, post offices and public information offices, internet services, radio telephones and mobile phones

*Emergency Response*: disaster management office, fire management service, police, army and emergency operation centres.

## 5. Computation Methodology

The proposed method for calculating compound indicators D-1 and D-5 suggests the construction of an index based on a simple inventory of occurrences of damage and disruptions, related to the size of the population of each country, so as to reflect the relative importance of these disruptions and damages.

The method consists of three steps – the Secretariat highlights challenges in each step.

**Step 1**: Collect good quality data on physical damage and disruptions by disaster.

**Step 2** : Calculate the number of times a disruption happens and the number of facilities and units damaged, based on source data.

**Step 3**: Convert the number of disruptions relative to population, calculating the number of disruptions per 100,000.

The Secretariat proposes several options to calculate the index, all of which follow this general pattern:

**D-1 = Index of Critical Infrastructure Damage =**

**number of infrastructure units and facilities damaged/ population * 100,000**

**D-5 = Index of Service Disruptions =**

**number of times disruption occurred/ population * 100,000**

**The Number of times disruptions occur and the number of units of facilities damaged** is recommended to be collected and reported from national disaster loss databases.

This method will separately sum, for all disasters, the number of schools, health and infrastructure units and facilities affected. Situations in which more than one school, health or other facilities were affected will contribute more to the sum.

Cases that affect multiple services and multiple facilities of critical infrastructure will have more weight than cases where only one service/infrastructure was affected. Emphasis is made in collecting and recording Education and Health disruptions and damage.

It is important to note that the collection and reporting on data of the number of health, education and infrastructure facilities affected are required for Target C. Thus adoption of this option does not represent an additional data collection burden.

## 6. Minimum and Desirable Data Requirements

**UNISDR Recommendation:**

Indicators D-1 to D-4 should be calculated based on the same data and the same critical infrastructure units and facilities as considered for Indicator C-5

**UNISDR Recommendation:**

Indicators D-4 and C-5 data should be described using the same Metadata. Metadata format is also common to C-3 and D-8.

Is important to note that the ISIC classification already includes codes and groups for Health and Education facilities.

For the purposes of monitoring the global targets of the Sendai Framework, the Secretariat will define an additional set of codes that may correspond to types of assets that are not productive and are not considered by the ISIC. These may include assets such as roads, bridges, railroads, ports, airports, power generation facilities, water facilities, etc.

The Secretariat will provide an initial set of Metadata describing Basic Services for the purposes of Indicator D-8.

| Indicator No. | Indicator |
|---|---|
| **D-1** | **Damage to critical infrastructure attributed to disasters** (compound indicator) |
| D-2 | **Number of destroyed or damaged health facilities attributed to disasters.**<br><br>**[Minimum Requirement]**<br>**Data to be collected linked to C-5:**<br>D-2 Number of health facilities destroyed or damaged attributed to disasters<br><br>**[Desirable Disaggregation Requirements] (also for C-5):**<br>Hazard<br>Geography<br>Level of affectation (damaged/destroyed)<br>Size of Facility (small/medium/large). If Member States wish to report more detailed losses by disaggregating by size and type of asset, they should use the Metadata mechanism specified in indicator C-5 to declare this disaggregation. |
| D-3 | **Number of destroyed or damaged educational facilities attributed to disasters.**<br><br>**[Minimum Requirement]**<br>**Data to be collected linked to C-5:**<br>D-3 Number of educational facilities destroyed or damaged attributed to disasters |

| | |
|---|---|
| | **[Desirable Disaggregation Requirements] (also for C-5):**<br>Hazard<br>Geography<br>Level of affectation (damaged/destroyed)<br>Size of Facility (small/medium/large). If Member States wish to report more detailed losses by disaggregating by size and type of asset, they should use the Metadata mechanism specified in indicator C-5 to declare this disaggregation. |
| D-4 | **<u>Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters.</u>**<br><br>*The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.*<br><br>NOTE THAT THIS INDICATOR SHARES (OR SHOULD SHARE) DATA AND METADATA WITH INDICATOR C-5<br><br>**[Minimum Requirement]:**<br>**Data to be collected for each disaster:**<br><br>• **For each of the infrastructure types declared in the Metadata that are affected in a disaster:**<br><br>- **C-5a**: Type of asset (Code, see metadata)<br>- **C-5b:** Number of Units or Facilities of these Infrastructure assets damaged/destroyed<br>- **C-5c:** Measurement of the damage (in measurement units such as meters or kilometres)<br><br>**Definition of Metadata describing assets and Infrastructure elements**<br>For each type of productive asset that is reported:<br>- Code<br>- Description<br>- Group or Economic Sector/Activity in ISIC or adopted classification<br>- Measurement Units (M2, Mt, Hectare, Km, etc.)<br>- Value per measurement unit [Series per Year 2005.. 2030]<br>- % of value for equipment, furniture, materials, product<br>- % of value for associated physical infrastructure<br><br>*Please see ANNEX I of Technical Note for Target C for more information and examples of proposed Metadata schema*<br><br>**[Desirable Disaggregation Requirements]:**<br>**Recommended disaggregation:**<br>Hazard<br>Geography<br>Level of affectation (damaged/destroyed)<br>Size of Facility (small/medium/large or criteria such as unpaved, single paved, highway for roads) |

| D-5 | **Number of disruptions to basic services attributed to disasters.** (compound indicator) |
|---|---|
| D-6 | **<u>Number of disruptions to educational services attributed to disasters.</u>**<br><br>**[Minimum Requirement]:**<br>**Data to be collected:**<br>D-6 Number of disruptions to educational services attributed to disasters. (linked to D-3)<br><br>**[Desirable Disaggregation Requirements]:**<br>**Recommended disaggregation:**<br>Hazard<br>Geography<br><br>Disrupted means one or a combination of the following:<br>- Provision of the service was partially or totally interrupted one or more times as consequence of the disaster<br>- Level of quality of the service was degraded<br>- Coverage of the service was reduced |
| D-7 | **<u>Number of disruptions to health services attributed to disasters.</u>**<br><br>**[Minimum Requirement]:**<br>**Data to be collected:**<br>D-7 Number of disruptions to health services attributed to disasters. (linked to D-2)<br><br>**[Desirable Disaggregation Requirements]:**<br>**Recommended disaggregation:**<br>Hazard<br>Geography<br><br>Disrupted means one or a combination of the following:<br>- Provision of the service was partially or totally interrupted one or more times as consequence of the disaster<br>- Level of quality of the service was degraded<br>- Coverage of the service was reduced |
| D-8 | **<u>Number of disruptions to other basic services attributed to disasters.</u>**<br><br>*The decision regarding those elements of basic services to be included in the calculation will be left to the Member States and described in the accompanying metadata.*<br><br>**[Minimum Requirement]:**<br>**Data to be collected for each disaster:**<br><br>• **For each of the service types declared in Metadata that are affected in a disaster:**<br>- **D-8a**: Type of asset (Code, see metadata)<br>- **D-8b: Y/N** Service was disrupted (or Infrastructure was damaged/destroyed)<br><br>**Definition of Metadata describing services and infrastructure elements**<br>For each type of productive asset that is reported:<br>- Code<br>- Description<br>- Group or Economic Sector/Activity in ISIC or adopted classification |

| | |
|---|---|
| | *Please see ANNEX I of Technical Note for Target C for more information and examples of proposed Metadata schema.*<br><br>**[Minimum Requirement]:**<br>**Data recommended to be collected:**<br>Water services were disrupted, (linked to D-4)<br>Sewerage services were disrupted, (linked to D-4)<br>Transport services were disrupted. (linked to D-4)<br>Government services were disrupted. (linked to D-4)<br>Power and Energy services were disrupted. (linked to D-4)<br>Emergency services were disrupted. (linked to D-4)<br>Communications /ICT services were disrupted. (linked to D-4)<br>Solid Waste services were disrupted. (linked to D-4)<br><br>**These sectors will be integral part of default Metadata added by UNISDR Secretariat**<br><br>**[Desirable Disaggregation Requirements]:**<br>Hazard<br>Geography<br><br>Disrupted means one or a combination of the following:<br>- Provision of the service was partially or totally interrupted one or more times as consequence of the disaster<br>- Level of quality of the service was degraded<br>- Coverage of the service was reduced |

## 7. Specific issues

As stated in the Report of the OIEWG (A/71/644), Member States agreed that countries may choose to use a national methodology or other methods of measurement and calculation to measure the number of deaths and missing attributed to disasters, given the very significant differences among legal regimes around the world. The OIEWG also recommended that countries keep the metadata consistent if the methodology is changed.

However, countries will need to determine how a number of important challenges will be addressed, in a manner that is consistent throughout the entire process of data collection:

**Statistical processing:**
Disaster loss data is greatly influenced by large-scale catastrophic events, which represent important outliers in terms of damage to critical infrastructure. UNISDR recommends countries report the data by event, so that complementary analysis can be undertaken to obtain trends and patterns in which such catastrophic events (that can represent outliers in terms of damage) can be included or excluded.

**Temporal aspects of data collection:**

Clear definition of the time period for reporting is imperative. Some aspects that require attention include:

- Definition of the initiation time of the disaster
- Definition of the time duration of the hazardous event
- Definition of the time period in which the reporting should be undertaken (this may be dependent on the sector of infrastructure and on the type of hazard)

**Comments and limitations**:

Counting the number of facilities does not necessarily reflect the size of the facility and related impact on the communities.

For D-4, measuring the number of roads, railroads or even the length of roads and railways affected does not necessarily reflect the quality, volume and function of roads/railways and related impact on the communities.

For Member States that have been working with the DesInventar system, national disaster loss databases that have been developed do not necessarily include historical data on damage to railways, ports, airports and other infrastructures. Establishing baseline data is a challenge.

**Metadata:**

An initial classification of critical infrastructure is provided by UNISDR, which defines major categories and a list of proposed elements for each category. It is suggested that damage and disruptions data should be collected at the type-of-assets (element) level, rather than at the level of the major categories of infrastructure (e.g. transportation would be a major category of critical infrastructure, but it contains several types of roads).

Countries collecting data at a granular level will permit aggregation to major-categories level for comparisons and consistency between countries.

**Proposed UNISDR Classification of Infrastructure sector** (with examples):

| Sector | **Examples** of Infrastructure Facilities and Units |
|---|---|
| Healthcare and Public Health Sector | Hospitals<br>Clinics<br>Health Centres |
| Education Sector | Universities<br>High and middle schools<br>Elementary schools<br>Pre-school facilities<br>Other training centres |
| Energy Sector | Power grids<br>Transmission lines<br>Power generation plans |
| Transportation Systems Sector | Highways<br>Paved roads<br>Unpaved roads<br>Road Bridges<br>Surface railroads<br>Underground railroads<br>Railroad stations<br>Railroad bridges<br>International airports<br>National airports<br>Local airports and aerodromes<br>International ports<br>Fisheries ports<br>Other docks and piers |
| Information and Communications Sector | Telephone networks<br>Other communication networks<br>Communication facilities |
| Water Sector | Water distribution networks<br>Water treatment plants<br>Water reservoirs<br>Wells |
| Sewerage Sector | Sewerage collection networks<br>Waste water treatment plants |
| Waste management Sector | Waste management plants<br>Landfills |
| Government Facilities Sector | Government buildings |
| Emergency Services Sector | Fire fight facilities |
| Protective Infrastructure | Flood protection walls and river defenses<br>Drainage systems<br>Ground reinforcement for landslide prevention<br>Canals, dams, dykes and other water regulation mechanisms<br>Coastal defenses for storm surge and tsunami<br>Cyclone and tornado shelter systems |

| | |
|---|---|
| | Hazard monitoring and early warning systems infrastructure |
| Green Infrastructure | Parks and green areas<br>Rain gardens<br>Underground water infiltration trenches and storage systems<br>Regional storm water reservoirs<br>Rain harvesting systems<br>Coastal protection mangrove systems<br>Urban tree canopy<br>Permeable pavement areas |

The most important recommendation to countries is to emphasise that **these criteria should be fixed for the entire time span of data collection (2005-2030).** While criteria are not predefined for any specific context, changes over time may introduce biases or measurement errors that could affect the detection of trends and patterns, negatively affecting the ability to reliably measure the achievement of the Target.

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# Technical Note on Data and Methodology for Estimating Global Progress in the Number of Countries with National and Local DRR Strategies to Measure the Achievement of Target E of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target E of the Sendai Framework for Disaster Risk Reduction.

**Target E:** ***Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020***

This document outlines the core elements of national and local disaster risk reduction (DRR) strategies and computation methodologies required for estimating progress in the number of countries, and the percentage of local governments, that adopt and implement national and local strategies for disaster risk reduction. The Report of the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG), endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested UNISDR to finalize the Technical Guidance and methodologies for each indicator of the Sendai Framework for Disaster Risk Reduction 2015-2030 (henceforth referred to as the "Sendai Framework").

The methodology described herein proposes simple data collection easily generated through the Sendai Framework Monitor[15] with uniform scales of achievement.

## 2. Introduction

The methodology outlined here aims to quantify the quality of public policy, i.e. DRR strategies, that would quantify improvement of the policy over time.

This Note is based on analysis of the reports of 159 countries that undertook at least one cycle of self-assessment of progress in implementing the Hyogo Framework for Action 2005-2015 (HFA Monitor). It is also informed by deliberations of Members of both the OIEWG and the Inter-agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs). Members of both the OIEWG and the IAEG-SDGs have called for quantitative indicators to measure the level of global progress over time, rather than binary measurement (yes/no) as regards the existence of DRR strategies.

Through the deliberations of the OIEWG, UNISDR proposed computation methodologies of increment measurements for achievement that would capture the degree of consistency of national DRR strategies with the Sendai Framework and contribute to policy improvement.

Based on negotiations during Sessions of the OIEWG, the following definition was recommended in the Report by the OIEWG.

[15] The Sendai Framework Monitor is currently under development.

**Disaster risk reduction strategies and policies:** define goals and objectives across different timescales and with concrete targets, indicators and time frames. In line with the Sendai Framework for Disaster Risk Reduction 2015-2030, these should be aimed at preventing the creation of disaster risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience.

A global, agreed policy of disaster risk reduction is set out in the United Nations endorsed Sendai Framework for Disaster Risk Reduction 2015-2030, adopted in March 2015. The expected outcome of the framework over the next 15 years is: "The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries".

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target E of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk*.

| No. | Indicators for measurement at the global level |
|---|---|
| E-1 | Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030. |
| E-2 | Percentage of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies.<br><br>*Information should be provided on the appropriate levels of government below the national level with responsibility for disaster risk reduction.* |

Additionally, the Inter-Agency and Expert Group on SDGs Indicators (IAEG-SDGs) proposed the use of these same indicators in measuring disaster-related global targets of the Sustainable Development Goals (SDGs) 1, 11 and 13 in the report E/CN.3/2017/2.

At its 48th Session, the UN Statistical Commission adopted the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development, developed by the IAEG-SDGs, and recommended the associated draft resolution[16] for adoption by the Economic and Social Council in report E/2017/24-E/CN.3/2017/35.From the perspective of feasibility of data collection and measurability, the OIEWG has proposed two indicators; one is for the national DRR strategies and the other the local DRR strategies.

[16] Draft Resolution I - Work of the UN Statistical Commission pertaining to the 2030 Agenda for Sustainable Development

The most important aspect of these indicators should be that strategies must be "in line with the Sendai Framework for Disaster Risk Reduction 2015-2030". The Sendai Framework represents a significant shift from its predecessor, the Hyogo Framework for Action, with focus on preventing new risk, reducing existing risk and strengthening resilience, as opposed to managing disasters. National disaster risk reduction strategies should be based on, and aligned with, the scope, outcome, goal, guiding principles, and priorities for action of Sendai Framework, as briefly summarized in the last section.

***2030 Agenda for Sustainable Development.***

These two indicators are also used for the Sustainable Development Goal Indicators which are reported to DESA and used for an annual progress report on the Sustainable Development Goals for follow-up and review at the high-level political forum (HLPF):

*SDG Indicator: 1.5.3 (repeat of 11.b.1 and 13.1.2)*

> Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030

*SDG Indicator: 1.5.4 (repeat of 11.b.2 and 13.1.3)*

> Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.

## 4. Applicable Definitions and Terminology

Target E of the Sendai Framework specifically requires "the number of countries with ***national and local disaster risk reduction strategies***" to be estimated. For the purposes of this guideline, unless stated otherwise key terms are those defined in the "Recommendations of the open-ended intergovernmental expert working group on terminology relating to disaster risk reduction".

**Key Terms**

The following definition of local government was proposed as a Working Definition in the deliberations of the OIEWG:

**Local Government**: Form of sub-national public administration – to be determined by countries for the purposes of monitoring Target E and measuring progress in establishing local disaster risk reduction strategies – and which generally acts within delegated powers by legislative or regulatory frameworks of the higher level of government.

Please note that administrative reform in a country will influence the percentage by changing the number of local governments. Nevertheless, the percentage would provide a picture of the extent / achievement of implementation of the local DRR strategies.

## 5. Computation Methodology

In the case of Target E, the data will be collected through the Sendai Framework Monitor. Member States will report their status information and UNISDR will calculate the global figure.

The process of setting targets and indicators is expected to take time. By introducing quantitative indicators – including the core elements of a strategy – Member States will be able to monitor continuing and gradual improvement in strategy development and the level of alignment with the Sendai Framework over time. In identifying the core elements of a strategy, Member States can monitor the improvement in quality of national disaster risk reduction (DRR) strategies or individual components over time.

The Members of the OIEWG discussed the importance of measuring population coverage of local DRR strategies so as to ensure a people-centred approach. However, the Sendai Framework does not focus on population coverage, rather it stresses the penetration of local DRR strategies in every local authority. Members agreed that the indicator should use numbers of local governments with local DRR strategies, which is then divided by the total number of local governments.

Further to the deliberations of the OIEWG, UNISDR proposed the following computation methodologies for E-1 (National Strategies) and E-2 (Local Strategies) to monitor gradual progress at global and national as well as local levels, and quality improvement in national DRR strategies over time.

For the purposes of simple and uniform global monitoring of Target E, a summation of national data is proposed for E-1 and an arithmetic average of national data for E-2.

### E-1: Number of countries that adopt and implement national DRR strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030

UNISDR proposes quantitative indicators that can measure the quality of national DRR strategies, instead of using binary measurement of the existence, so that the indicator measures the degree to which national DRR strategies are in line with the Sendai Framework. To facilitate this, and drawing from the Sendai Framework, ten core requirements for national DRR strategies are proposed below:

- *Implementation is enforced by legislative or regulatory frameworks;*
- *Mainstream and integrate disaster risk reduction within and across all sectors;*
- *Promote policy coherence and compliance, notably with the SDGs and the Paris Agreement;*
- *Guide public and private sectors by defining roles and responsibilities;*
- *Have time frames, targets and indicators;*

- *Have objectives and measures aimed at preventing the creation of risk;*
- *Have objectives and measures aimed at reducing existing risk;*
- *Have objectives and measures aimed at strengthening economic, social, health and environmental resilience;*
- *Are based on risk assessment to identify risks at the local and national levels with financial and administrative disaster risk management capacity;*
- *Have mechanisms to follow-up, periodically assess and publicly report on progress.*

Member States assess the level of achievement for each core requirement and enter all information in the web-based Sendai Framework Monitor. UNISDR proposes that the ten core requirements are weighted equally by assigning 10% (or 0.1) to each requirement. It is then recommended that progress in each requirement is benchmarked according to the following weighting:

i. Comprehensive achievement (full score): 1.0,

ii. Substantial achievement, additional progress required: 0.75,

iii. Moderate achievement, neither comprehensive nor substantial: 0.50,

iv. Limited achievement: 0.25,

If there is no achievement or no existence, it will be 0.

The score / overall progress would then be calculated through the arithmetic average of the benchmarks across each of the ten core requirements components by the system. It will enable countries to assess gradual or partial progress in comparison with the baseline, and thereby monitor improvement in quality of the national DRR strategy over time.

$$\boldsymbol{Global\ Average} = \sum_{i=1}^{n} \sum_{j=1}^{10} WCRij \times 0.1 \Big/ n$$

***Where:***

*WCRij*: the level of achievement of the core requirement *j* (=1, .., 10) in country *i* (=1, .., n) , {0, 0.25, 0.50, 0.75, 1.0}

n: number of countries

*Example*

1. If a country has a DRR strategy satisfying the ten core requirements, it is evaluated as 1.
2. If a country reports the lack of DRR strategy, it is evaluated as 0.
3. If a country has a national DRR plan which only partially fulfils one of the core requirement - for example, the country has a strategy with a *time frame and targets but no indicators,* then it is calculated as follows: 0.1 for the one core requirement multiplied by 0.75 ("substantial achievement, additional progress required") then the total score is 0.075.
4. If a country has a national DRR plan which only partially fulfils one core requirement but fulfils the other 9 core requirements – for instance, the country has objectives and measures aiming at *reducing existing risk and strengthening of economic, social, health and environmental resilience but not preventing the creation of risk*, then it is calculated as follows: 0.1 for one core requirement multiplied by 0.75 ("substantial achievement, additional progress required") then the score for c) is 0.075.

The final Score will be 0.975 = 0.1*0.75 + 0.1*1

## E-2: Percentage of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies

UNISDR proposes that Member States count the number of local governments that adopt and implement local DRR strategies in line with the national strategy and express it as a percentage of the total number of local governments in the country.

Successful adoption and implementation of local disaster risk reduction strategies is greatly enhanced if enforced by Executive Order, Ministerial Decree or similar instrument with local legislation and regulations.

Local governments are determined by the reporting country for this indicator, considering sub-national public administrations that have been delegated powers to develop local disaster risk reduction strategies, supported by legislative or regulatory frameworks of the higher level of government.

It is recommended that countries report on progress made by the lowest level of government accorded the mandate for DRR, as the Sendai Framework encourages the adoption and implementation of local DRR strategies in every local authority.

$$\boldsymbol{Global\ Average} = \sum_{i=1}^{n} \frac{(\text{the number of local governments with local DRR strategies})}{(\text{the total number of local governments})} \Big/ n$$

***Where:***

n: number of countries

## 6. Specific issues

**Scope, outcome, and goal of national and local DRR strategies.**

The scope of disaster risk reduction has been broadened significantly and applied to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters caused by both natural and man-made hazards and related environmental, technological and biological hazards and risks.

The expected outcome is a substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. The scope and outcome(s) of national and local DRR strategies should allow for actions to be executed in the short, medium and long term and guide the multi-hazard management of disaster risk in development at all levels, as well as within and across all sectors.

National and local DRR strategies are to provide orientation to achieve the goal and outcome of the Sendai Framework by focusing on preventing the creation of new risks, reducing existing risks, and strengthening economic, social, health and environmental resilience. They may encompass sector-specific or hazard-specific considerations and permit geographical prioritisation (where appropriate), however, successfully realising the goal and outcome requires the commitment and involvement of political leadership across levels of governments and sectors in a multi-hazard approach.

**Responsibilities for implementation of the Sendai Framework and aligned national and local DRR strategies.**

The guiding principles of the Sendai Framework identify the primary responsibility to prevent and reduce disaster risk as being that of each State, and elaborate that implementation of the framework requires that responsibilities be shared by central Government and relevant national authorities, sectors and stakeholders, as appropriate to respective national circumstances and systems of governance.

**Strategic priorities of national and local DRR strategies.**

National and local strategic priorities should be informed by the four priorities of action of the Sendai Framework, be aligned with existing regional and national DRR strategies, and inform / be informed by regional and national development plans.

**Disaster risk governance.**

Strengthening disaster risk governance arrangements to manage disaster risk (Sendai Framework Priority 2), underpinned by the necessary resources for implementation, is of paramount importance in developing and **implementing** national and local DRR strategies. Paragraph 16 of the framework articulates the need for *Strengthening disaster risk governance and coordination across*

*relevant institutions and sectors and the full and meaningful participation of relevant stakeholders at appropriate levels*.

As a public policy tool, the development of a national or local DRR strategy should be based on a formal mandate or executive order by the relevant national and/or local authority and adhere to national and local laws and regulations. It will support an increased understanding of current (and ideally, future) levels of disaster loss, risk, and resilience, as well as cost-effective risk reduction options in critical sectors. The planning process should involve an all-of-society engagement - all State institutions, civil society, academic and private sector - and take into consideration a gender, age, disability and cultural perspective, as well as the needs of people living under particular conditions of vulnerability, in particular women and children.

As such, the establishment of a multi-sectoral, inter-disciplinary **national coordinating mechanism** - which can inter alia secure agreement and time-bound commitment of national and local stakeholders - is considered important in the development and implementation of national and local DRR strategies.

Coordination mechanisms, with a clear articulation of responsibilities of relevant stakeholders at all levels, and which are empowered (ideally by executive and/or legislative order) to drive integrated implementation within and across sectors, are identified as imperative and in need of enhancement if disaster risk reduction is to be realised.

**Investment in disaster risk reduction.**

Paragraph 30 (a) identifies the need to *allocate the **necessary resources**, including finance and logistics, as appropriate, at all levels of administration for the development and the implementation of disaster risk reduction strategies, policies, plans, laws and regulations in all relevant sectors.* It is also necessary to assign accountable lead entities and set targets and benchmarks for implementation.

**Local disaster risk reduction strategies.**

Compared to national strategies, **local disaster risk reduction strategies** are far more heterogeneous, vary across countries and local administrative units, and change over time. Local governments, again with highly heterogeneous characteristics and capabilities, are normally responsible for their development. In general, *national disaster risk reduction strategies* serve a normative function, providing inter alia guiding principles and an overarching framework for disaster risk reduction. Local strategies, aligned with the national strategy, are generally more specific, reflecting local context and hazard profile, and tend to focus on planning and implementation with clear roles and tasks assigned at local level.

Given these considerations, the alignment of **local disaster risk reduction strategies** with respective **national disaster risk reduction strategies** is considered imperative. Assessing the degree of alignment with national strategies would therefore be a national responsibility using nationally

appropriate targets and indicators. Member States may wish to draw from relevant sections of the Sendai Framework, as well as other guidance[17], when determining indicators appropriate to country context for national level monitoring of their local strategies.

**Adopt and implement national and local disaster risk reduction strategies**.

The Sendai Framework makes clear the relationship between the adoption and implementation of strategies with "national and local frameworks of laws, regulations and public policies". Although questionable as a proxy, for the purpose of computation, Member States may wish to determine whether strategies are adopted and implemented using a proxy that measures the *existence of legislative or regulatory frameworks.* Potentially unrepresentative, this requires further deliberation.



[17] For instance: the Ten Essentials (www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=1), the new Local-Urban Indicators for disaster risk reduction and resilience (www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=18)

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# Technical Note on Data and Methodology to Estimate the Enhancement of International Cooperation to Developing Countries to Complement National Actions to Measure the Achievement of Target F of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target F of the Sendai Framework for Disaster Risk Reduction.

**Target F:** ***Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.***

This note outlines possible data and methodologies for measuring the recommended indicators that will allow the measurement of the enhancement of international cooperation to developing countries to complement their national actions for implementation of the Sendai Framework. The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG) report, endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and metadata, and the methodologies for the measurement of the global indicators.

The OIEWG recommended the use of eight indicators – measured independently – to assess progress in achieving this Target. Where the indicators pertain to total official international support, the technical note suggests the counting of flows captured by the Creditor Reporting System (CRS) for ODA commitments of the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD). Other indicators propose the collection and use of an inventory of the number of programmes and initiatives for the transfer and exchange of science, technology and innovation (STI), and disaster risk reduction-related capacity building, as well as the number of developing countries supported in strengthening their disaster risk reduction-related statistical capacity.

## 2. Introduction

This note addresses important aspects of availability, development and capture of data that Member States will need to consider in order to develop computation methodologies that provide an effective and representative measure of progress in enhancing international cooperation to developing countries in support of national actions for disaster risk reduction.

This note draws from the deliberations of the OIEWG and inter-sessional consultations of the Chair, including the deliberations of Members of the group of 10 + 10 facilitated by the Friends of the Chair. It is informed by the deliberations and Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs)[18], and Member States' deliberations at the

[18] Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators - Note by the Secretary-General (E/CN.3/2017/2*) 15 December 2016

47th and 48th Sessions of the UN Statistical Commission on issues related to international cooperation and the means of implementation.

Member States recommended that the indicators for Target F should be organised using the three categories (or clusters) that are consistent with the acknowledged principles of global cooperation, the categorization used in the SDGs, and the Sendai Framework: (a) Financial Resources, (b) Technology Development and Transfer, and (c) Capacity Building.

**(a) Financial Resources:** includes indicators F-1, F-2, F-3, F-4 and F-6 which aim to measure different types and flows, in support of national actions for disaster risk reduction in developing countries.

**(b) Technology Development and Transfer:**
includes F-4, F-5 which aim to measure respectively flows and trends in activity, in support of the transfer and exchange of science, technology and innovation for disaster risk reduction for developing countries.

**(c) Capacity Building:** includes indicators F-6, F-7 and F-8 which aim to measure flows and trends in activity, in support of disaster risk reduction-related capacity, including statistical capacity, for developing countries.

Given the complexity of national disaster risk reduction actions, and relatively under-developed mechanisms for measuring international support to these actions, no indicator will provide an absolutely precise, accurate and exhaustive measure of the 'degree of enhancement'. In this sense, the proposed methodologies seek to capture approximate values of support, so as to allow an appraisal of changing trends in international cooperation over time to 2030. It is expected that further refinement of these methodologies will take place over time, as data availability and mechanisms for capture improve. However, in the absence of established computation methodologies and globally comparable data, measurement of some indicators will be challenging in the short term; this will have ramifications on the ability to establish baselines for reporting.

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target F of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*.

| No. | Indicator |
|---|---|
| F-1 | Total official international support, (official development assistance (ODA) plus other official flows), for national disaster risk reduction actions.<br><br>*Reporting of the provision or receipt of international cooperation for disaster risk reduction shall be done in accordance with the modalities applied in respective countries. Recipient countries are encouraged to provide information on the estimated amount of national disaster risk reduction expenditure.* |
| F-2 | Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided by multilateral agencies. |
| F-3 | Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided bilaterally. |
| F-4 | Total official international support (ODA plus other official flows) for the transfer and exchange of disaster risk reduction-related technology. |
| F-5 | Number of international, regional and bilateral programmes and initiatives for the transfer and exchange of science, technology and innovation in disaster risk reduction for developing countries. |
| F-6 | Total official international support (ODA plus other official flows) for disaster risk reduction capacity-building. |
| F-7 | Number of international, regional and bilateral programmes and initiatives for disaster risk reduction-related capacity-building in developing countries. |
| F-8 | Number of developing countries supported by international, regional and bilateral initiatives to strengthen their disaster risk reduction-related statistical capacity. |

## 4. Applicable Definitions and Terminology

Unless stated otherwise, key terms are those defined in the "Recommendations of the Open-ended Intergovernmental Expert Working Group on Terminology related to disaster risk reduction".

**Key Terms:**

**International cooperation:** principally concerns aid (some of it quantifiable) in the form of grants or loans by external support agencies. Thus in the context of these indicators, and until such time as more inclusive methodologies capturing the totality of flows are developed, the amount of ODA related to support for national disaster risk reduction actions can be used as a proxy for this.

**Official development assistance (ODA):** ODA is defined as flows of official financing (essentially grants or concessional loans) to countries and territories on the DAC List of ODA Recipients and to multilateral institutions which are: i) provided by official agencies, including state and local governments, or by their executive agencies; and ii) is administered with the promotion of the economic development and welfare of developing countries as the main objective, and which are concessional in character with a grant element of at least 25 per cent (using a fixed 10 per cent rate of discount)[19].

**Other official flows (OOF)**: other official flows (excluding officially supported export credits) are defined as transactions by the official sector which do not meet the conditions for eligibility as ODA, either because they are not primarily aimed at development, or because they are not sufficiently concessional[20].

**Capacity building**: is the process by which individuals, organizations, institutions and societies develop abilities to perform functions, solve problems and set and achieve objectives for disaster risk reduction. It needs to be addressed at two inter-related levels: individual and institutional. (Simplified adaptation of the definition of ECOSOC[21]).

**Developing countries:** A clear universally agreed concept of developing country is yet to be agreed. Analysis by the World Bank identified that the term is used in a number of different ways depending on the purpose[22]. Current practice is largely a mix of the (adapted) M49 statistical classification and the definition inherent in ODA. It is recommended that the DAC[23] list of ODA Recipients be used for this indicator. This list includes developing countries and territories eligible for receiving ODA; consists of all low and middle income countries based on gross national income (GNI) per capita as published by the World Bank, with the exception of G8 members, EU members, and countries with a firm date for entry into the EU. The list also includes all of the Least Developed Countries (LDCs).

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[19] See http://www.oecd.org/dac/stats/officialdevelopmentassistancedefinitionandcoverage.htm
[20] See http://www.oecd.org/dac/stats/documentupload/DCDDAC(2016)3FINAL.pdf Para 24
[21] ECOSOC, Definition of basic concepts and terminologies in governance and public administration, E/C.16/2006/4.
[22] *analytical* – e.g. the UN Statistical Division M49: 179 countries in 'developing regions'; *political* – e.g. UN G77 with 134 members; *resource monitoring and allocation* – e.g. OECD DAC list of ODA Recipients with 142 potential aid recipients.
[23] Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD)

**Donors:** refers to DAC donors, non-DAC donors and multilateral organisations.

**Transfer and exchange of science, technology and innovation (STI) in disaster risk reduction:** processes and activities that help the transmission of disaster risk reduction-related knowledge and technology that is developed and held in developed and developing countries, to developing countries.

## 5. Computation Methodology

**F-1: Total official international support, (official development assistance (ODA) plus other official flows), for national disaster risk reduction actions.**

This indicator is proposed to be calculated using the sum of ODA – and where available OOF – flows from all donors to developing countries in support of national disaster risk reduction actions. Data are compiled by the OECD DAC from returns submitted by its member countries and other aid providers, data can be disaggregated by provider and recipient, and are usually reported annually and expressed in US dollars at the average annual exchange rate.

ODA data are generally obtained at the activity level, and include numerous parameters. However, current data pertaining to disaster risk reduction in international cooperation are scarce, and where available, still more limited in terms of sectoral definition within development assistance. Net ODA to developing countries pertaining to disaster risk reduction, is currently collected using the following subsectors as explained in the list of Creditor Reporting System (CRS) purpose codes: 74010 Disaster prevention and preparedness[24]; 41050 Flood prevention / control; or 41010 Environmental policy and planning.

In its current configuration, the CRS does not provide a complete record of disaster risk reduction-related support to developing countries. Purpose code 74010, for example, is classified under Humanitarian Aid (700) which, by its definition, does not cover the wide spectrum of disaster risk management activities and considerations integrated into sectoral development aid, and which are identified as fundamentally important in the Sendai Framework. Identifying disaster risk reduction disbursements integrated within development and humanitarian projects <u>not</u> coded 74010, 41050 or 41010 is more challenging. By screening short and long project descriptions in the DAC CRS, using key disaster risk reduction terms, projects relevant to disaster risk reduction can be identified and included in the measurement of flows – but this method is subject to bias and omission as it depends entirely on the quality of the project description.

Consequently, a proposal is under consideration by the OECD DAC Working Party on Development Finance Statistics (WP-STAT) for the replacement of code 74010 with (i) a code solely dedicated to

[24] CRS Code 74010 covers "Disaster risk reduction activities (e.g. developing knowledge, natural risks cartography, legal norms for construction); early warning systems; emergency contingency stocks and contingency planning including preparations for forced displacement.

emergency preparedness (which remains a humanitarian concern), and (ii) a **policy marker for disaster risk reduction**.

If approved, the policy marker will provide an additional qualitative element to monitoring the Target by allowing the tracking of disaster risk reduction integrated in development assistance, which in turn is expected to provide an incentive to increase risk-informed development investments over time.

The marker would assess the donors' "policy objectives" (or investment intent) in relation to disaster risk reduction in each aid activity. The reporting agency would be requested to indicate for each aid activity whether or not it includes disaster risk reduction activities / considerations as a principal or significant objective – the criteria for which are detailed in the proposal under consideration by the WP-STAT. The proposal identifies existing sectoral DAC codes where aid flows with a principal or significant contribution to the disaster risk reduction may exist, including: education, health, water and sanitation, government and civil society, other social infrastructure and services, transport and storage, communication, energy generation and supply, banking and financial services, agriculture, forestry, fishing, construction, general environmental protection, or action relating to debt. It also provides a set of indicative aid activities that could be considered eligible for the disaster risk reduction marker (see Annex I of this note).

A policy marker does not require donor reporting agencies to quantify sectoral ODA and OOF flows to disaster risk reduction - this will only be captured through existing / new CRS codes. It will however, allow an additional, more inclusive measurement by proxy, of progress in achieving the Target through identifying the trend in the proportion of sectoral aid activities for which disaster risk reduction is a principal or significant policy objective, or none at all.

Although under-reporting of actual investments in disaster risk reduction will remain an issue - even if the proposal is approved by the OECD WP-STAT - there are currently no more representative methodologies, nor better sources of data, to measure international cooperation in support of national disaster risk reduction actions, than ODA statistics.

*It is expected that the OECD WP-STAT will announce its decision on the proposal for the disaster risk reduction policy marker in June 2017. If approved, data is unlikely to be available before December 2018 at the earliest.*

**Data sources:** The OECD/DAC has been collecting data on official and private resource flows from 1960 at an aggregate level and 1973 at an activity level through the Creditor Reporting System (CRS data are considered complete from 1995 for commitments at an activity level and 2002 for disbursements).

**Data collection:** Data are published on an annual basis in December for flows in the previous year, for example detailed 2017 flows will be published in December 2018.

**Data providers:** Data are reported on an annual calendar year basis by statistical reporters in national administrations (aid agencies, Ministries of Foreign Affairs or Finance, etc.). A statistical reporter (usually located in the national aid agency, Ministry of Foreign Affairs or Finance etc.) is responsible for the collection of DAC statistics in each providing country/agency. As discussed in this note, historically data pertaining to disaster risk reduction has not been produced systematically by all donors.

***Recipient country data*:**

The OIEWG recommended that '*Reporting of the provision or receipt of international cooperation for disaster risk reduction shall be done in accordance with the modalities applied in respective countries. Recipient countries are encouraged to provide information on the estimated amount of national disaster risk reduction expenditure'.*

By calculating national disaster risk reduction expenditure using data from national accounts, recipient countries can estimate the proportion of total expenditure on national disaster risk reduction actions that is accounted for by official international support. This responds to the observations of OIEWG members of the importance of demonstrating government policy leadership (of developing countries) in measuring the target. Such an estimation can serve to demonstrate the alignment of international cooperation with recipient country policy priorities.

The proposed policy marker provides a methodology that offers the possibility for greater sectoral and sub-sectoral specificity for both providers and recipients. Originally developed[25] to assist the definition of ODA in respect of disaster risk reduction, it has been applied in estimating national expenditure (of recipient countries) as part of a **risk-sensitive budget review (RSBR)**[26] - see Annex I. of the Concept Note.

A **RSBR** is a simple, systematic, quantitative analysis of a budget (or series of budgets) that enables countries to estimate and take credit for investment in disaster risk reduction (the budget review methodology is described in Annex A of each National Report[27]). If the RSBR is conducted by a national government, the findings typically track public investment and can include inward financial flows. An RSBR conducted on a series of annual budgets allows for the identification and tracking of temporal trends. An RSBR that also categorizes components of risk management, can point to trends in focus (i.e. increasing investment in prevention / risk reduction, as opposed to repeated response to disasters).

If the proposal for the DRR policy marker is adopted and the methodology applied by providers and recipients alike, further options for (sectoral and sub-sectoral) disaggregation may be possible. This is consistent with the approach proposed for Targets A to D, wherein disaggregated data can be collected at the national level.

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[25] by the UNISDR and the World Bank, together with OECD DAC Members

[26] http://www.preventionweb.net/english/professional/publications/v.php?id=43523

[27] for example: UNISDR working papers on public investment planning and financing strategy for disaster risk reduction: review of Mauritius. http://www.unisdr.org/we/inform/publications/43525

**F-2: Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided by multilateral agencies.**

As ODA data are generally obtained at the activity level, in addition to data for the provider and recipient, they can also be disaggregated by multilateral institution.

Therefore and notwithstanding current limitations on the availability of data specific to disaster risk reduction, this indicator can be calculated using the sum of ODA – and where available OOF – flows from all donors to developing countries using the same methodology as that proposed for indicator F-1, and then disaggregating the data to reveal flows provided in support of national disaster risk reduction actions to developing countries via multilateral agencies.

Data are compiled by the OECD DAC from returns submitted by its member countries and other aid providers, and are usually reported annually and expressed in US dollars at the average annual exchange rate.

It may ultimately be possible to include additional data on international support provided by multilateral organisations beyond ODA and that are not captured in the OECD DAC CRS. This is contingent upon the provision of data and the application of consistent methodology by the multilateral organisations, and requires additional work.

**F-3: Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided bilaterally.**

As ODA data are generally obtained at the activity level, data can be disaggregated by provider and recipient. Therefore, and notwithstanding current limitations on the availability of data specific to disaster risk reduction, this indicator can be calculated using the sum of ODA – and where available OOF – flows from all donors to developing countries using the same methodology as that proposed for indicator F-1, and then disaggregating the data to reveal bilateral flows.

Data are compiled by the OECD DAC from returns submitted by its member countries and other aid providers, and are usually reported annually and expressed in US dollars at the average annual exchange rate.

**F-4: Total official international support (ODA plus other official flows) for the transfer and exchange of disaster risk reduction-related technology.**

ODA data are generally obtained at the activity level, and thus flows can in principle be tracked with some degree of granularity. Purpose Codes 74010, 41050 or 41010 of the OECD DAC CRS contain little data at the activity level that is relevant to this indicator. Furthermore, specific coding or narrative in project descriptions (including in sectors) that would allow detailed quantitative accounting of international support for the transfer and exchange of disaster risk reduction-related technology using the OECD DAC CRS, are not currently available.

Additional work will therefore be undertaken with Member States and relevant partners to develop methodology and data for measuring this indicator. Following the adoption of the draft Resolution by the UN Statistical Commission in March 2017, it may be that the methodology and data being developed by the custodian agencies of SDG Indicator 17.7.1 can be harnessed to report on Indicator F-4.

> Indicator 17.7.1 - *Total amount of approved funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies* was endorsed by the UN Statistical Commission at its 48th Session to measure the **Sustainable Development Goal 17** - *Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development*.

Indicator 17.7.1 is currently categorised as Tier III by the IAEG-SDGs. UN Environment and the OECD are leading methodological development and the global compilation of data. This work will inter alia define the 'promotion of the *development, transfer, dissemination and diffusion of environmentally sound technologies'* in a way that allows the use of existing classification of the statistical database of the OECD CRS. UN Environment and the OECD have committed to **complete a preliminary methodology** (underpinned by the Development Finance Standards which are applied in international finance statistics) **by the end of 2017**, and expect methodological refinements to continue until 2020.

UNISDR has engaged with the custodian agencies to explore options for the inclusion of a component measuring the transfer and exchange of disaster risk reduction-related technology. If successful, additional work with Member States and relevant partners will need to be undertaken to define disaster risk reduction-related technology. Member States will also have the opportunity to explore this option in the IAEG-SDGs when the methodology is circulated for review and comment.

If approved, and donors provide relevant data, the **disaster risk reduction policy marker** may allow a qualitative assessment of the policy commitment of donors to the transfer and exchange of disaster risk reduction-related technology.

**Comments and limitations:**

As detailed in the Concept Note on Indicators for Global Target F, science, technology and innovation (STI) indicators that describe inputs (such as human capital and financial resources), outcomes and impact on social and economic development, are essential for effective policy formulation, implementation, monitoring and assessment[28]. However, the lack of useful and reliable indicators for STI in many developing countries is a challenge, leading to repeated calls for the development of better indicators to promote and measure technology transfer[29]. Despite the many provisions governing the transfer of technology in international agreements, conventions and protocols, and accompanying arrangements and mechanisms, the methodological challenges to developing comprehensive and consistent metrics for measuring disaster risk reduction-related technology transfer and cooperation, and enhanced capabilities in related science, technology and innovation, are considerable.

Science, technology, knowledge and expertise are often transferred without much intervention, and the ways in which knowledge can travel to a broader audience are many[30]. Existing mechanisms for technology transfer are fragmented and often ad-hoc in terms of objective, content and country coverage. There is no global framework, agreement, or mechanism that is comprehensive and all-encompassing for STI capacity building in the least developed countries.

Another option in developing methodology and data for this indicator could be for Member States to request such work to be undertaken by the international mechanisms and approaches available and employed to facilitate technology transfer and cooperation. Such mechanisms could include:

A. The Technology Facilitation Mechanism (TFM)
B. The Technology Bank for LDCs
C. The UNFCCC Technology Mechanism

A. Technology Facilitation Mechanism (TFM) – announced in Paragraph 70 of the 2030 Agenda for Sustainable Development in order to support the implementation of the SDGs. The TFM will inter alia stimulate technology cooperation; map STI initiatives, background research and reports in support of the TFM activities; and assist developing countries build or strengthen their capacity to prepare and implement technology projects and strategies that foster sustainable development.

B. Technology Bank for LDCs – designed to help build a robust STI base by improving access, acquisition and utilization of technology by LDCs, and in so doing, promote national actions by LDCs, mobilize international support and build on existing mechanisms.

C. UNFCCC Technology Mechanism - an agreed instrument, it seeks to promote technology transfer with the intent of building national innovation capacity and technological learning. The mechanism's Climate Technology Centre and Network facilitates the transfer of technologies inter alia through: providing technical assistance at the request of developing

[28] UNESCO, Division of Statistics on Science and Technology, Office of Statistics ST-84/WS/12
[29] Technology and Innovation Report. UNCTAD/TIR/2012
[30] European Commission's Expert Group on Knowledge Transfer Indicators (2011)

countries to accelerate the transfer of climate technologies; creating access to information and knowledge on climate technologies; and fostering collaboration among climate technology stakeholders.

Additional work is required to develop internationally acceptable methodology and globally comparable data for measuring total official international support for the transfer and exchange of disaster risk reduction-related technology.

This work could be undertaken in coordination with the UNISDR Science and Technology Partnership that was established at the UNISDR Science and Technology Conference on the Implementation of the Sendai Framework, which took place in January 2016 in Geneva.

**F-5: Number of international, regional and bilateral programmes and initiatives for the transfer and exchange of science, technology and innovation in disaster risk reduction for developing countries.**

Despite the existence of the STI-related facilities mentioned above, a mechanism that will enable the tracking and assessment of international, regional and bilateral programmes and initiatives supporting the transfer and exchange of STI in disaster risk reduction has yet to be developed. As with F-4, and related indicators under SDG 17, significant challenges to effectively measuring transfer and exchange of STI remain, and so additional work will need to be undertaken with Member States and relevant partners to develop an acceptable methodology and globally comparable data.

A coherent solution may exist if a component addressing disaster risk reduction can be integrated within the work being undertaken by UNESCO, as the custodian agency for SDG Indicator 17.6.1 – *Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation.*

The development of methodology and metadata for SDG Indicator 17.6.1 is part of UNESCO's Global Observatory of Science, Technology and Innovation Policy Instruments (GO-SPIN), which is a new tool for analysis and support to science, technology and innovation (STI) policy making. Through the GO-SPIN survey, UNESCO is inter alia establishing **an inventory that will map STI cooperation agreements and programmes between countries**, in addition to "acts, bills, regulations and international agreements on STI issues". The primary source for this information will be information units in Ministries responsible for Science, Technology and Innovation. UNESCO expects to have prepared a preliminary methodology for calculating this indicator by the end of 2017.

UNISDR has engaged with the custodian agency to explore options for the inclusion of a component that would enable this indicator to be measured at the global level. If successful, work will be undertaken to define programmes and initiatives for the transfer and exchange of science, technology and innovation in disaster risk reduction for developing countries. Member States will

also have the opportunity to explore this option in the IAEG-SDGs when the methodology is circulated for review and comment.

If approved, and donors provide relevant data, the **disaster risk reduction policy marker** may allow a qualitative assessment of the policy commitment of donors to the transfer and exchange of disaster risk reduction-related technology.

**F-6: Total official international support (ODA plus other official flows) for disaster risk reduction capacity-building.**

ODA data are generally obtained at the activity level, and thus flows can in principle be tracked with some degree of granularity. Purpose Codes 74010, 41050 or 41010 of the OECD DAC CRS do contain relevant data at the activity level. Notwithstanding current limitations on the availability of data specific to disaster risk reduction-related capacity building, this indicator can be calculated using the sum of ODA – and where available OOF – flows from all donors to developing countries by screening short and long project descriptions for relevant terms.

However, as mentioned in F-1 above, the quality of such data is dependent on the quality of the project description. Furthermore, data reported only through these codes do not capture disaster risk reduction-related capacity building that may be reported in sectoral data. Consequently, such data cannot be considered representative of the entirety of flows. Specific coding that would allow comprehensive, quantitative accounting of international support for disaster risk reduction-related capacity building across humanitarian and development sectors, using the OECD DAC CRS, are not currently available.

Additional work will be undertaken together with Member States and relevant partners, including the OECD, to further develop methodology and data for measuring this indicator. Following the adoption of the draft Resolution by the UN Statistical Commission in March 2017, it may be that the methodology developed and data compiled to measure capacity building within sustainable development under SDG 17, can be harnessed to support reporting on Indicator F-6.

> Target 17.9 seeks to *Enhance international support for implementing effective and targeted* ***capacity-building*** *in developing countries to* ***support national plans*** *to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation.* The metadata defines Indicator 17.9.1: *Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries*, as 'gross disbursements of total ODA and other official flows from all donors for capacity building and national planning'.

Data are compiled by the OECD DAC from returns submitted by its member countries and other aid providers, and are usually reported annually and expressed in US dollars at the average annual exchange rate.

**F-7: Number of international, regional and bilateral programmes and initiatives for disaster risk reduction-related capacity-building in developing countries.**

As identified in the methodology for F-6, some relevant data exist in the OECD DAC CRS. Consequently, it is recommended that initially this indicator be calculated by simply counting the number of programmes and initiatives supporting disaster risk reduction-related capacity building that were identified using the previous methodology.

This approach is subject to the same concerns of quality and lack of sectoral representation raised in previous indicators. Furthermore, it may fail to capture international, regional and bilateral programmes and initiatives supported by entities that do not report through the CRS.

Consequently, recipient countries may wish to consider strengthening the degree to which this approach is representative, by compiling a national inventory of programmes and initiatives for disaster risk reduction-related capacity-building, which can then be compared and/or combined with data generated from global reporting using the CRS. This would require inputs from multiple government institutions, and further analysis to avoid double counting.

If approved, and donors provide relevant data, the **disaster risk reduction policy marker** may provide a further opportunity to quantify the number of programmes and initiatives for disaster risk reduction-related capacity building in developing countries.

**F-8: Number of developing countries supported by international, regional and bilateral initiatives to strengthen their disaster risk reduction-related statistical capacity.**

Until such time as data describing support for strengthening disaster risk reduction-related statistical capacity are systematically collected and recorded through the DAC CRS, the Partner Report on Support to Statistics (PRESS), or other sources, it is recommended that developing countries simply count the number of international, regional and bilateral initiatives registered by relevant government institutions, including the National Statistical Office.

This requires the identification of the relevant government institutions that will report, and the definition of initiatives – stand alone or integrated – that qualify for inclusion. In respect of the latter, Member States are advised to consult the Methodological Annex of the PRESS report, which identifies the areas considered eligible for reporting on statistical capacity building.

A more complete picture may be possible in the medium term, if Member States are able to promote the integration of support to the strengthening of disaster risk reduction-related statistical capacity within the work of the Partnership in Statistics for Development in the 21st Century (PARIS21) and its PRESS report. The PRESS report measures financial support / activities provided by multilateral and bilateral donors reporting through the DAC CRS, and covers all areas of statistics ranging from national accounts to human resources and training (see Classification of Statistical

Activities in the Methodological Annex). It draws principally from purpose code 16062 – Statistical Capacity Building, as well as flows identified through keyword screening of project descriptions. The report is the data source for reporting on SDG Indicator 17.18.3: *Number of countries with a national statistical plan that is fully funded and under implementation, by source of funding*, and Indicator 17.19.1: *Dollar value of all resources made available to strengthen statistical capacity in developing countries*. The custodian agency for both indicators is the Secretariat of PARIS21.

Following the UN Statistical Commission endorsement of the IAEG-SDGs proposal to use key (disaster loss) indicators recommended by the OIEWG in the global indicator framework of the SDGs, countries are now expected to apply the Fundamental Principles of International Statistics in monitoring and reporting on global targets A to D of the Sendai Framework. In many developing countries, this will require significant support for the establishment or strengthening of statistical capacities for processing disaster risk reduction-related statistics.

It is therefore important that Member States, UNISDR and relevant partners work with the Secretariat of PARIS21 to ensure that disaster risk reduction-related statistical capacity building is integrated in National Strategies for the Development of Statistics (NSDS), and the necessary resources made available. In so doing, additional data may be made available to support monitoring and reporting on indicator F-8.

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Given the current paucity of data pertaining to disaster risk reduction within international cooperation, ongoing work to develop measurement capabilities that provide a more comprehensive representation of flows and providers is of particular interest. For example, scientific and technological co-operation activities that respond to the needs of developing countries are included in the new measurement framework, **Total Official Support for Sustainable Development (TOSSD)**. TOSSD proposes to measure various forms of international cooperation not currently captured in ODA, including **south-south and triangular co-operation** or indeed public-private and multi-stakeholder partnerships.

Therefore, as measurement frameworks able to capture data that are more representative of the totality of international flows and providers become operational, and statistical capacity deepens, there will be greater scope for capturing multiple components of complex financing arrangements. It is therefore expected that computation methodologies for these indicators will evolve over time so as to be able to exploit these developments.

## 6. Minimum and Desirable Data Requirements

| Indicator No. | Indicator |
|---|---|
| **F-1** | **<u>Total official international support, (official development assistance (ODA) plus other official flows), for national disaster risk reduction actions.</u>**<br><br>**[Minimum Disaggregation]**<br>**Donor**<br>**Recipient**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of finance<br>Type of international support<br>Sub-sector<br>Groups of countries (*global, regional / sub-regional)* |
| **F-2** | **<u>Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided by multilateral agencies.</u>**<br><br>**[Minimum Disaggregation]**<br>**Donor**<br>**Recipient**<br>**Multilateral institution**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of finance<br>Type of international support<br>Sub-sector |
| **F-3** | **<u>Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided bilaterally.</u>**<br><br>**[Minimum Disaggregation]**<br>**Donor**<br>**Recipient**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of finance<br>Type of international support<br>Sub-sector<br>Groups of countries (*global, regional / sub-regional)* |
| **F-4** | **<u>Total official international support (ODA plus other official flows) for the transfer and exchange of disaster risk reduction-related technology.</u>**<br><br>**[Minimum Disaggregation]**<br>**Donor**<br>**Recipient**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of finance<br>Type of international support<br>Sub-sector<br>Groups of countries (*global, regional / sub-regional)* |

| | |
|---|---|
| **F-5** | **<u>Number of international, regional and bilateral programmes and initiatives for the transfer and exchange of science, technology and innovation in disaster risk reduction for developing countries.</u>**<br><br>**[Minimum Disaggregation]**<br>**Programme / initiative**<br>**Partner developing country**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of programme / initiative |
| **F-6** | **<u>Total official international support (ODA plus other official flows) for disaster risk reduction capacity-building.</u>**<br><br>**[Minimum Disaggregation]**<br>**Donor**<br>**Recipient**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of finance<br>Type of international support<br>Sub-sector<br>Groups of countries (*global, regional / sub-regional)* |
| **F-7** | **<u>Number of international, regional and bilateral programmes and initiatives for disaster risk reduction-related capacity-building in developing countries.</u>**<br><br>**[Minimum Disaggregation]**<br>**Programme / initiative**<br>**Partner developing country**<br><br>**[Desirable Disaggregation Requirements]:**<br>Type of programme / initiative |
| **F-8** | **<u>Number of developing countries supported by international, regional and bilateral initiatives to strengthen their disaster risk reduction-related statistical capacity.</u>**<br><br>**[Minimum Disaggregation]**<br>**Recipient**<br><br>**[Desirable Disaggregation Requirements]:**<br>Donor<br>Type of international support |

## 7. Specific issues

As stated in the Report of the OIEWG (A/71/644), Member States agreed that reporting on the provision or receipt of international cooperation for disaster risk reduction be done in accordance with the modalities applied in respective countries. In the event that countries employ different methodologies the OIEWG recommended that the metadata remained consistent.

Countries will need to determine how a number of important challenges will be addressed, in a manner that is consistent throughout the entire process of data collection:

**Methodology and data:**

Measurement presents particular methodological challenges – this is particularly true when seeking to capture the financial aspects of international cooperation in support of the national disaster risk reduction actions of developing countries, which are largely limited to quantifying stand-alone or incremental budgets, investment and expenditure for disaster risk reduction. Current methodologies and data fail to capture integrated disaster risk reduction – this issue is discussed in greater detail in Annex I. of the Concept Note, as well as analysis carried out for the UN Global Assessment Report on Disaster Risk Reduction (GAR) 2013.

**Other official flows (OOF):**

If data availability of disaster risk reduction ODA is limited, it is still more so for OOF. The OECD collects data on development cooperation from the 29 DAC members, an additional 21 countries beyond the DAC, and 36 multilateral institutions and one foundation. Some of these also provide information on other official flows and data on amounts mobilised from the private sector. This does not include all provider countries – including South-South providers, such as Brazil and China – although estimates of the development cooperation programmes of emerging providers are available, data specific to disaster risk reduction is not.

The OECD and other organisations also collect data on broader financial flows to developing countries, including non-concessional official flows, foreign direct investment (FDI), bank lending, export credits and other flows. The World Bank makes estimates of remittance flows, and the IMF compiles balance-of-payments data. The sustainable development focus and concordance of these other categories of flows with national development plans is less clear, and substantial further work would be required to arrive at an agreed measure of non-ODA official and private flows. Non-ODA flows for disaster risk reduction have not featured to date in these efforts; there may be some prospect that in the medium term, data may become available through TOSSD.

**Comparators and alignment.**

Simply measuring the volume of support provided will not appropriately measure the progress in achieving the target – a comparator is required to qualify changing trends in support. As the target measures 'support to complement national actions', by comparing international support for disaster risk reduction provided against estimated developing country expenditure, an assessment

of the alignment of international cooperation with recipient country policy and investment priorities (or recipient country policy leadership), may be possible.

**Binary measurement:**

Indicators that measure the existence or not of an aspect of international cooperation – for example, an initiative or programme – do not necessarily allow assessment of the degree to which international cooperation has been enhanced. Additional work is required to determine how such indicators can support a qualitative assessment of progress.

**Statistical processing and baselines.**

Work will need to be undertaken to establish baselines to measure progress in achieving Target F, whilst recognising that that development of baselines for monitoring progress in achieving global targets will vary from country to country, subject to selected time frames and data availability. Where data does not exist or has low visibility – for example, financial flows to/from the non-governmental organisations or the private sector – significant work will be required to establish workable baselines. This may include the determination of data collection methodologies and tools at the global and national levels respectively, and the development of capacities and competencies for countries where baselines do not exist.

Constructing preliminary baselines may be possible for instance for F-1, by analysing existing, albeit limited, ODA statistics on disaster risk reduction. The measurement of all financial flows within international cooperation however, including those from private sources (mobilized through official interventions), will be a challenge. Nevertheless, the complex financing packages that will be required to support the implementation of the Addis Ababa Action Agenda (AAAA), the 2030 Agenda for Sustainable Development and the Sendia Framework, require tracking and measurement mechanisms within the international statistical system that are inclusive of the totality, and direction, of flows.

Work developing a new measurement framework to capture total official support for sustainable development (TOSSD)[31] is ongoing. Until such time as this, or other internationally agreed data and methodologies, are developed, the measurement of financial flows in respect of SDGs targets, and thus Sendai Framework targets, is restricted to ODA. Methodologies and datasets for measuring international support to national disaster risk reduction actions are expected to evolve, and with it, improvements to baseline data may be possible in the medium term (for example, to include other financial flows beyond ODA).

**Multi-annual support and double counting.**

While representing the sustainability of support to national disaster risk reduction actions in developing countries in annual reporting is desirable, there are technical challenges inherent to reporting of multi-annual contributions, while simultaneously eliminating double counting.

[31] Annex I. of the Concept Note on Indictors for Global Target F

## ANNEX I: Indicative Activities for Defining Disaster Risk Reduction Marker Coverage

The table below is taken from the 'Proposal for modernising CRS classifications of humanitarian assistance and disaster risk reduction' presented to the DAC Working Party on Development Finance Statistics. It identifies the DAC 5 codes where aid flows with principal or significant contribution to disaster risk reduction may exist. The eligible disaster risk reduction activities / considerations listed below should be viewed as indicative since additional activities addressing disaster risk reduction may exist within the sectoral programs.

| **Eligible disaster risk reduction activities/considerations under DAC Sectors** |
|---|
| EDUCATION (110) |
| The development or introduction of educational programs that promote resilience to natural hazards such as disaster resistant construction practices<br>Review of curricula to take account of disaster risk reduction aspects in basic education, vocational training, and other forms of training and education<br>Develop or introduce a disaster risk reduction curriculum in school education and training programs.<br>Retrofitting existing schools and any academic facilities for disaster-resistance<br>Integration of disaster resistant standards in academic infrastructure design and development<br>Support for the establishment of natural hazard safety plans and training drills in academic institutions<br>The development or strengthening of disaster response policies and plans for academic institutions.<br>Assistance for higher education in disaster risk reduction related fields |
| HEALTH (120) |
| The training of health care providers in disaster preparedness and response<br>Retrofitting existing health infrastructure such as health centres and hospitals with disaster resilient building codes<br>Assess changes in risk (exposure and sensitivity) to natural hazard related diseases for vulnerable groups<br>Incorporate natural hazard related health risks into clinical practice guidelines, and curricula for continuous medical education and training<br>Take preventive measures to counteract increased exposure to natural hazard related diseases<br>Strengthen health management information systems related to disaster risk reduction<br>Strategies that aim to improve the disaster risk management of the health and insurance system<br>Include disaster related diseases in basic benefits of insurance policies |
| WATER AND SANITATION (120) |
| Strengthening of hydro-meteorology capacity and early warning systems<br>Improve environmental conditions of rivers/canals to mitigate flood risk<br>The development of strategies and/or infrastructure to reduce the flood risks<br>The construction of evacuation routes and emergency shelters<br>Reduce the vulnerability to natural hazards of wastewater treatment and disposal designs<br>Integration of disaster risk reduction measures in river basin's development and management |

| GOVERNMENT AND CIVIL SOCIETY (150) |
| --- |
| Measures aimed at increasing government capacity to manage risks and respond effectively to disasters<br>Identify groups vulnerable to natural hazards and undertake measures to reduce their vulnerability<br>Strengthen civil participation in the development of policies and programs for disaster risk reduction |
| OTHER SOCIAL INFRASTRUCTURE AND SERVICES (160) |
| The development of social protection strategies/safety nets to respond to disasters<br>Mechanisms to scale up social protection programs in times of disasters<br>Social protection programs that promote resilience to natural hazards<br>Inclusion of vulnerability to natural hazards as a poverty indicator<br>Specific targeting of groups vulnerable to natural hazards for social protection programs<br>Strengthening institutional capacity of social protection programs to respond to a crises resulting from disasters<br>Public work programs or sub-projects that integrate disaster risk reduction measures or enhance resilience to natural hazards (building codes)<br>The construction of evacuation shelters for communities to use in times of disasters |
| TRANSPORT AND STORAGE (210) |
| Embedding disaster-resistant elements in the existing transportation network<br>Support for the incorporation of disaster risk reduction measures in transportation system planning<br>Assess economic, environmental, or social impacts of natural hazards on transportation<br>Introduce disaster resilient building codes in road construction projects<br>Developing storage capacities for pre-positioning of disaster preparedness equipment, material and supplies |
| COMMUNICATION (220) |
| Incorporate natural hazard considerations in information and communication policies and institutions<br>The development or strengthening of disaster response policies and plans<br>The establishment of a GIS database and other systems for risk assessments and decision support for risk management<br>Develop or strengthen emergency response systems for use during times of disasters.<br>The development of disaster helplines<br>Assistance in the establishment of disaster resistant connectivity<br>Development or strengthening of telecommunications infrastructure for use as part of an emergency response system during times of disasters |
| ENERGY GENERATION AND SUPPLY (230) |
| Supporting the increased production of climate smart sources of energy<br>Incorporate the potential impacts of natural hazards in the design standards of transmission and distribution lines and power system reliability assessments<br>Flood protection or irrigation from construction of dams or water storage systems that incorporate changes in the water cycle due to climate variability or natural hazards |

| BANKING AND FINANCIAL SERVICES (240) |
| --- |
| Assistance in the development of disaster risk transfer/insurance initiatives<br>Support for the integration of disaster risk reduction incentives within housing finance programs<br>Establish a risk management framework integrating natural hazard risk mitigation strategies<br>Disaster risk insurance schemes for productive sectors such as agriculture, fishing etc.<br>Fiscal policy and management measures in support of disaster risk reduction<br>Economic research, modelling, and policy making for disaster risk reduction |
| AGRICULTURE (311) |
| Develop, test or introduce practices or techniques that are more resilient to natural hazards and climate variability in farming systems or plant breeding<br>Research of existing and new threats to agriculture, fishing, and forestry from natural hazards.<br>Assist in the integration of hazard resilience into extension services and programs<br>Awareness raising of the disaster risks associated with promoting adaptive measures<br>The development of irrigation or drainage networks to reduce vulnerability to natural hazards<br>Reduce vulnerability of crop storage facilities to natural hazards<br>Develop or introduce strategies to intensify crop production to mitigate rising food prices that result from drought<br>Introduce or strengthen soil management practices to adapt to climate hazards |
| FORESTRY (312) |
| Introduce the use of or maintain resilience of forest systems to reduce vulnerability of landslides, flooding or other natural hazards<br>Reforestation with species less vulnerable to climate variability and natural hazards<br>Forest fire prevention measures<br>Mangrove preservation and afforestation to improve a coastal community's resilience to natural hazards |
| FISHING (313) |
| Reducing vulnerability to disasters through sustainable production alternatives, safeguard biodiversity, and Integrated zone management |
| CONSTRUCTION (323) |
| Include disaster resilient building codes/ design standards in infrastructure development<br>Incorporate new natural hazard resilient design standards<br>Land use and development planning and zoning that incorporates disaster risk reduction measures<br>The inclusion of natural hazard resilient measures in urban design and planning |

| |
|---|
| General environmental protection (410) |
| The establishment of database, inventories/accounts of physical and natural resources; environmental profiles and impact studies, specific to hazard zoning and risk assessment.<br>Development of Flood prevention/control measures: floods from rivers or the sea; including sea water intrusion control and sea level rise related activities<br>Establish flood warning and disaster assessment systems<br>Integration of disaster risk reduction measures in land use planning and/or policies<br>Development and/or strengthening of environmental protection measures related to coping natural hazards risks |
| Other multi-sector (430) |
| Integration of disaster risk reduction measures in urban development projects, urban planning and/or policies<br>Inform land information systems with disaster risk information<br>Integration of disaster risks in rural development projects |
| ACTION RELATING TO DEBT (600) |
| Debt forgiveness, relief of multilateral debt, rescheduling and refinancing carried out for risk reduction measure or necessitated due to a large-scale disaster |
| Developmental food aid/Food security assistance (520) |
| Food aid/Food security programs implemented in the aftermath of a disaster |
| Emergency Response (720) |
| **Note**: *To cover only the disaster related aid flows allocated for post-disaster material relief assistance and services, emergency food aid, relief co-ordination, protection and support services. Aid related to conflicts, HIV, Avian Influenza and other such non-disaster objectives to be excluded.* |
| Emergency Preparedness (740) |
| **Note**: *To cover only the disaster related aid flows principally allocated for "Disaster risk reduction activities (e.g. developing knowledge, natural risks cartography, legal norms for construction); early warning systems; emergency contingency stocks and contingency planning including preparations for forced displacement." Aid related to conflicts, HIV, Avian Influenza and other such non-disaster objectives to be excluded.* |
| REFUGEES IN DONOR COUNTRIES (930) |
| Refugees displaced due to severe disaster. |

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# Technical Note on Data and Methodology for Estimating the Availability of and Access to Multi-Hazard Early Warning Systems and Disaster Risk Information and Assessments to Measure the Achievement of Target G of the Sendai Framework for Disaster Risk Reduction



**26 April 2017**

**The United Nations Office for Disaster Risk Reduction**

## 1. Overview

The purpose of this document is to support Member States in the process of data collection and analysis of indicators to monitor progress and achievement against global Target G of the Sendai Framework for Disaster Risk Reduction.

**Target G:** ***Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030***

This document outlines computation methodologies for estimating progress in increasing availability of and access to multi-hazard early warning systems and disaster risk information and assessments. The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Related to Disaster Risk Reduction (OIEWG) report, endorsed by the United Nations General Assembly in Resolution A/RES/71/276, requested the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and metadata, and the methodologies for the measurement of the global indicators (henceforth referred to as the "Sendai Framework").

The methodology proposes simple and uniform data collection for the global indicators to measure the progress in increasing the availability of and access to multi-hazard early warning systems (MHEWS) and disaster risk information and assessments to the people, which will be easily generated through the Sendai Framework Monitor[32] with uniform scales of achievement.

## 2. Introduction

The methodologies outlined here are based on previous experience of a number of governments, academic and research institutions, private organizations and work of the United Nations to quantify the quality or improvement of public policy, i.e. MHEWS, risk assessment, and risk information. It was informed, inter alia, by experts from the World Meteorological Organization (WMO), the National Meteorological and Hydrological Services (NMHSs) of its Members, and partners of the International Network for Multi-Hazard Early Warning Systems (IN-MHEWS). The note also draws from the work that underpins the Global Assessment Reports on Disaster Risk Reduction (GAR) (UNISDR, 2009, 2011, 2013 and 2015), including experience gained in developing and employing a probabilistic global risk model. This note will be further developed and refined through collaborative consultations with inter alia the stakeholders of the forthcoming Early Warning Conference 2017.

Through the deliberations of the OIEWG, instead of eliciting binary responses on the existence of elements of the Target, **quantitative indicators to measure quality have been proposed.** UNISDR proposed computation methodologies of incremental measurements for achievement that would capture the level of progress in each key element of MHEWS and contribute to policy improvement.

[32] The Sendai Framework Monitor is currently under development.

## 3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target G of the Sendai Framework, and which were endorsed by the UN General Assembly in its Resolution A/RES/71/276, *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk*.

| No. | Indicators for measurement at the global level |
|---|---|
| G-1 | Number of countries that have multi-hazard early warning systems.<br>*(compound G2-G5)* |
| G-2 | Number of countries that have multi-hazard monitoring and forecasting systems. |
| G-3 | Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms. |
| G-4 | Percentage of local governments having a plan to act on early warnings. |
| G-5 | Number of countries that have accessible, understandable, usable and relevant disaster risk information and assessment available to the people at the national and local levels. |
| G-6 | Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning.<br>Member States in a position to do so are encouraged to provide information on the number of evacuated people. |

*Member States in a position to do so are encouraged to provide information on the number of evacuated people.*

Four of the six indicators recommended by the OIEWG correspond to each of the key elements of EWS described in the annotations of the OIEWG on DRR Terminology. These indicators can use widely available data that are consistent across countries as well as over time, and as such can be considered fit for purpose in measuring progress in achievement of Target G.

Given the complexity and wide variation between countries in the elements and conditions that give rise to effective MHEWS and accessible risk information and assessment – see section 7 – the following is proposed:

With regards to **MHEWS**, UNISDR suggests that the outcome of the MHEW Conference 2017 and the Third International Conference on Early Warning 2006 (EWCIII) be used as the basis for the development of global indicators, according to the ***four interrelated key elements*** of effective EWS, all of which need to be coordinated across many agencies at national to local levels.

The differing characteristics of MHEWS from country to country require a multi-faceted approach, therefore, to be able to measure the degree of achievement, incremental measurements - developed on the basis of the widely agreed and recognized EWS Checklist (UNISDR 2006) and updated EWS Checklist (forthcoming) - were proposed to measure progress in achieving the Target. In addition, the level of achievement in terms of "multi-hazard" as simultaneous, cascading or cumulative effects by multiple hazardous events should be considered.

As regards measuring **disaster risk information and assessments**, which is also a key element of MHEWS, simply counting the number of countries with an assessment or risk information is not technically recommended, instead a multi-faceted approach was proposed. UNISDR proposes a number of options beyond a simple binary consideration, that seek to measure the quality of the multi-hazard national disaster risk information and assessments by appraising overall levels of effectiveness. Additional options are provided to measure coverage in addition to quality. It is suggested that in measuring quality, countries assess the extent to which disaster risk information and assessments meet the five categories of Risk Knowledge of the MHEWS Checklist.

Each country should specify the major hazards to be included in a "multi-hazard" EWS, and indicators should be weighted accordingly when reporting, reflecting the extent of physical/ economic damage accorded to each hazard.

A complete and effective MHEWS **must meet all of the four key elements of MHEWS** and each of the indicators G-2 through G-5 corresponds to the key element:

| Four interrelated key elements | global indicators |
|---|---|
| (1) disaster risk knowledge based on the systematic collection of data and disaster risk assessments | G-5 |
| (2) detection, monitoring, analysis and forecasting of the hazards and possible consequences | G-2 |
| (3) dissemination and communication, by an official source, of authoritative, timely, accurate and actionable warnings and associated information on likelihood and impact | G-3 |
| (4) preparedness at all levels to respond to the warnings received | G-4 |

**G-1 is a compound indicator, which is computed based on** the sub-indicators G-2 through G-5 of the four interrelated key elements for **effective functioning MHEWS**. The table below summarizes sub-indicators that should be coordinated across sectors and multiple levels of governments.

**G-3:** This indicator can provide an indication of the degree of progress being made in communication, dissemination and outreach to populations. If a MHEWS covers a small area (e.g. small island), determining the percentage coverage of the population would be important.

**G-4**: A “plan to act on early warnings” could be a response plan, an emergency plan, a preparedness plan or any plans that describe who and how to react to the early warning information.

The OIEWG stated that EWS components should be underpinned by standard operating procedures, and/or determine how frequently these plans are tested. However, this entails detailed appraisal and may be better addressed in nationally determined, appropriate targets and indicators in national monitoring frameworks.

The Global Framework for Climate Services (GFCS) states that weather and hydrological services enable short term preparedness and response to hazard events, and describes climate information/services at the seasonal and decadal timescales as essential for long-term planning purposes.

In relation to Target E, national and local DRR strategies may include pre-disaster planning exercises such as contingency planning, which enable governments to react in a timely and effective manner to the impacts of hazardous events by providing the required support to the affected population; and in so doing, strengthen economic, social, health and environmental resilience of communities.

**G-5** : The measurement of progress in access to risk information and assessment at both the national and local level is advised, however, access, coverage and application can differ significantly at each level. Measurement of terms "understandable and usable" can be subjective, Member States are advised to determine their level of achievement.

This indicator is also related to Target E, since risk assessment at the local and national levels is placed as one of the five core requirements to measure the degree of alignment with the Sendai Framework.

**G-6**: This output indicator quantifies the impact and effectiveness of early warning information, and may only be possible at local level. This indicator could be interpreted as a proxy for success of an early warning systems and risk information accessibility in Target G. As evacuated addresses the people who were directly affected, being required to move *temporarily* from their place of residence, the indicator is also related to Target B. This indicator has two aspects: a) it can measure the degree to which the relevant authorities have been successful in avoiding human losses by evacuating populations pre-emptively, and b) it measures the degree to which populations' lives and assets are negatively affected due to evacuation.

This indicator may pose data collection problems; many authorities would be challenged in determining the means to collect data. It would entail collecting data on segments of the population that may not have been tracked or registered by the appropriate authority and there would be no measurement for verification. This was raised by a number of the Members of the OIEWG, and so it is recommended that *Member States in a position to do so are encouraged to provide information on the number of evacuated people*, as stipulated in the Report of the OIEWG.

Given the challenges in assessing all key elements of available and accessible MHEWS, risk information and assessment, UNISDR suggests that Members explore additional indicators that focus on evaluating the functional elements in nationally determined monitoring scheme.

## 4. Applicable Definitions and Terminology

Unless stated otherwise, key terms are those defined in the "Recommendations of the Open-ended Intergovernmental Expert Working Group on Terminology related to disaster risk reduction".

**Key terms**

**Early warning system**

An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events.

*Annotations: Effective "end-to-end" and "people-centred" early warning systems may include **four interrelated key elements**: (1) disaster risk knowledge based on the systematic collection of data and disaster risk assessments; (2) detection, monitoring, analysis and forecasting of the hazards and possible consequences; (3) dissemination and communication, by an official source, of authoritative, timely, accurate and actionable warnings and associated information on likelihood and impact; and (4) preparedness at all levels to respond to the warnings received. These four interrelated components need to be coordinated within and across sectors and multiple levels for the system to work effectively and to include a feedback mechanism for continuous improvement. Failure in one component or a lack of coordination across them could lead to the failure of the whole system.*

**Multi-hazard early warning systems** (MHEWS) address several hazards and/or impacts of similar or different type in contexts where hazardous events may occur alone, simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effects. A multi-hazard early warning system with the ability to warn of one or more hazards increases the efficiency and consistency of warnings through coordinated and compatible mechanisms and capacities, involving multiple disciplines for updated and accurate hazards identification and monitoring for multiple hazards.

**Multi-hazard** means (1) the selection of multiple major hazards that the country faces, and (2) the specific contexts where hazardous events may occur simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effects.

**Disaster risk assessment:**

A qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihoods and the environment on which they depend.

*Annotation: Disaster risk assessments include: the identification of hazards; a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of*

*exposure and vulnerability, including the physical, social, health, environmental and economic dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities with respect to likely risk scenarios.*

**Disaster risk information.**

Comprehensive information on all dimensions of disaster risk, including hazards, exposure, vulnerability and capacity, related to persons, communities, organizations and countries and their assets.

*Annotation: Disaster risk information includes all studies, information and mapping required to understand the disaster risk drivers and underlying risk factors.*

**Evacuation.**

Moving people and assets temporarily to safer places before, during or after the occurrence of a hazardous event in order to protect them.

* Evacuated people are categorized as directly affected.

## 5. Computation Methodology

Given the subjective nature of the proposed indicators, it will be important to strike a balance between precision and practicality. The OIEWG and relevant partners found that simply counting the number of countries (with MHEWS or risk assessment) was not technically recommended rather measuring global and national progress in each element was proposed; this is particularly relevant for such indicators which require a multi-faceted approach.

Member States are encouraged to consider population coverage in light of exposed population coverage so as to ensure a people-cantered approach. Additionally, the use of a **weighting for major hazards** that can reflect the extent of physical / economic damage accorded to **hazard types** by each country is suggested for use with all the following proposed methodologies; in so doing, a **weighted average** can be calculated for all multi-hazard indicators, particularly G-1 (compound), G2 and G-5, possibly G-3 and G-4 which depends on each system. G-6 should be calculated by each event.

Although Member States could choose any hazard classification for the purpose of weighting, they may wish to refer the classification by “Main Events” defined by IRDR (IRDR 2014), except for man-made hazards.

*Case 1*

A country has three major hazards; floods, tropical cyclones, and earthquakes, for which it determines a weighting of 5:4:1 respectively.

If MHEWS are available only for floods and cyclones and each element has a full score, the weighted average for the country's MHEWS is **0.9** (taking between 0 and 1).

*Case 2*

A country has two major hazards, earthquakes and floods, for which it determines a weighting of 70:30 respectively.

In the case of earthquakes, the MHEWS indicator scores 0.50,

While in the case of floods, the MHEWS indicator scores 0.75.

The weighted average for the country's MHEWS indicator is then calculated by:

(earthquakes) 0.70 x 0.50 + (floods) 0.3 x 0.75 = **0.575**

## G-1 Number of countries that have multi-hazard early warning systems.

G-1 is a compound indicator for MHEWS, calculated using indicators representing the aforementioned four key elements of MHEWS, namely G-2 through G-5. Member States may wish to consider a *compounding methodology* for G-1 that entails computing the arithmetic average of the scores of the four indicators, where each Member will report scores taking from 0 to 1 for each of the four indicators G-2 through G-5.

UNISDR will then calculate a global figure of G-1 through summation of each country's indices. In other words, each score of indicators is assigned 0.25, where clearer definitions are provided below under each sub-indicator. The index can reflect progress as the score of a global average will increase when (a) the number of countries report their MHEWS, and (b) the quality of MHEWS improve to satisfy key elements expected in the revised Checklist, which is expected to be updated and aligned with the Sendai Framework by stakeholders of the forthcoming Early Warning Conference.

Two options for computation are suggested as a compound indicator to consider the quality of the four key elements for effective EWS:

**Option 1** is a SIMPLE OPTION to calculate the arithmetic average of the scores of the indicators G-2 through G-5 which are already weighted according to major hazards in a country.

**Option 2** is a **RECOMMENDED OPTION**, evaluates the existence of a complete and effective MHEWS in a more strict way. Only considering major hazard types which the MHEWS can **meet all of the four key elements**, i.e. have scores greater than 0 in all indicators of G-2 through G-5, to calculate the arithmetic average of the scores of only these hazard types of indicators G-2 through G-5. Otherwise, excluding all scores by other hazard types which do not meet at least one key element, i.e. have 0 scores in any indicators of G-2 through G-5.

For example, a country has three major hazards, floods, tropical cyclones, and earthquakes, for which it determines a weighting of 5:4:1 respectively and the table below summarizes scores of each indicator.

| | Floods (0.5) | Tropical cyclones (0.4) | Earthquakes (0.1) | Total SCORE |
|---|---|---|---|---|
| G-2 | 0.75 | 0.75 | 0.25 | 0.7 |
| G-3 | 1.0 | | | 1.0 |
| G-4 | 1.0 | | 0.5 | 0.95 |
| G-5 | 0.75 | 0.5 | 0 | 0.575 |

Option 1: calculating the arithmetic average of the scores in the far right column of the indicators

(0.7 + 1.0 + 0.95 + 0.575) / 4 = 0.80625 ≈ **<u>0.81</u>**

G-2 G-3 G-4 G-5

Option 2: excluding earthquake because earthquake risk assessment is absent (i.e. 0 in G-5) and taking the arithmetic average of scores of floods and tropical cyclones (shaded numbers in the table above).

(0.75*0.5 + 0.75*0.4) + 1.0*0.9 + 1.0*0.9 + (0.75*0.5 + 0.5*0.4) = 0.7625 ≈ **<u>0.76</u>**

G-2 G-3 G-4 G-5

## G-2 Number of countries that have multi-hazard monitoring and forecasting systems.

G-2 is an indicator representing one of the aforementioned four key elements of MHEWS, *(2) detection, monitoring, analysis and forecasting of the hazards and possible consequences*.

Two options for computation are suggested, with **weighting for major hazards**. In either option, the index will be between 1 and 0.

***Option 1:*** MINIMUM REQUIREMENT

Simply count the number of countries with a multi-hazard monitoring and forecasting system. It is basically determined by each country and the data is binary, yes or no, 1 or 0, for hazard types in the system, then calculate the score with weighting for major hazards.

***Option 2:*** RECOMMENDED OPTION

This option suggests quantitative indicators to measure the quality of the multi-hazard monitoring and forecasting system, beyond simply existence.

UNISDR proposes the following scales with 4 levels of **overall effectiveness** of the multi-hazard monitoring and forecasting system, in addition to registering its absence.

| Level of achievement | Score |
|---|---|
| i. Comprehensive achievement (full score) | 1.00 |
| ii. Substantial achievement, additional progress required | 0.75 |
| iii. Moderate achievement, neither comprehensive nor substantial | 0.50 |
| iv. Limited achievement | 0.25 |
| v. No / poorly functioning MHEWS | 0 |

** These criteria are used in the previous exercise, the HFA Monitor.*

In order to measure quality, it is proposed that countries measure the extent to which the multi-hazard monitoring and forecasting system meets the **updated EWS Checklist (forthcoming),** which stipulates three major issues to be respected by the monitoring and forecasting system: 1) Institutional Mechanisms Established, 2) Monitoring Systems Developed, and 3) Forecasting and Warning Systems Established.

In this way, the quality of a MHEWS can be assessed for inter alia the density of observation networks, the number of hazard types covered, or spatial and temporal resolutions. This index is more complicated than Option 1, however, it enables monitoring the improvement in quality of the system.

$$\boldsymbol{country\ score} = \sum_{j=1}^{m}\sum_{i=1}^{n} INDij \times Wi \Big/ m$$

***Where:***

IND*ij*: the score of the major issues-j (=1, …m) of hazard I (=1, .., n)
*Wi*: weighted average of hazard type *i*; $\sum_{i=1}^{n} Wi = 1$
n: number of hazard types
m: number of the major issues in calculation

The indicator could be calculated by considering population or geographical coverage of the multi-hazard monitoring and forecasting system, however, due to its complexity UNISDR does not recommend it for the global indicators.

## G-3 Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms.

G-3 is an indicator representing one of the aforementioned four key elements of MHEWS, *(3) dissemination and communication, by an official source, of authoritative, timely, accurate and actionable warnings and associated information on likelihood and impact*.

G-3 may not require a weighted average of hazard types, as it may be that communication may not differ by hazard type. In measuring the population coverage, this indicator represents both inputs and outputs.

Two options for computation methodology are suggested.

***Option 1:*** MINIMUM REQUIREMENT

Simply determine any **primary media/mode** for early waning information through local governments or through national dissemination mechanisms, such as recognized authorities.

- mass media including radio, TV, internet - website, e-mail, SMS, social media, and app
- local communication system including siren, public board, and phone.

If any one of these information modes are available, those people are considered to be covered.

Then Member States are to simply count the number of people who are covered by the determined primary media/mode. As calculation of the exposed population is challenging, total population can be used as denominator to calculate the coverage. Thus, the penetration ratio (coverage) of the major information mode could be chosen as a proxy.

The index will be between 1 and 0.

***Option 2:*** RECOMMENDED OPTION

This option suggests quantitative indicators to measure the quality of **primary media/mode** of the MHEWS, rather than existence.

UNISDR proposes the following scales with 4 levels of **overall effectiveness** of the MHEWS.

| Level of achievement | Score |
|---|---|
| i. Comprehensive achievement (full score) | 1.00 |
| ii. Substantial achievement, additional progress required | 0.75 |
| iii. Moderate achievement, neither comprehensive nor substantial | 0.50 |
| iv. Limited achievement | 0.25 |
| v. No / poorly functioning MHEWS | 0 |

In order to measure quality, it is proposed that countries measure the extent to which the communication system meets the **updated EWS Checklist (forthcoming),** which stipulates three major issues to be respected by the *Monitoring and Warning Service Dissemination and Communication*: 1) Organizational and Decision-making Processes Institutionalized, 2) Effective Communication Systems and Equipment Installed, and 3) Warning Messages Recognized and Understood.

This index is more complicated than Option 1, however, it enables monitoring the improvement in quality of the system.

$$\boldsymbol{country\ score} = \left( {}^{\sum_{j=1}^{m} INDj}/_{m} \right) \times Coverage$$

***Where:***

IND*j* : the score of the major issues-j (=1, …m)
m: number of the major issues

The indicator could be calculated considering the weight of the major hazard types, if communication systems of the MHEWS are tailored for specific hazard types.

Instead of determining a single primary media/mode, **the degree of redundant coverage** by different warning dissemination channels could be considered in this indicator. However, is the methodology will be complex and not be straightforward to measure overlap of coverage by several modes – it is therefore not recommended for global indicators.

## G-4 Percentage of local governments having a plan to act on early warnings.

G-4 is an indicator representing one of the aforementioned four key elements of MHEWS, *(4) preparedness at all levels to respond to the warnings received*. "Plans to act on early warnings" may include preparedness plans, evacuation plans, response plans, or any other plans describing EWS response and evacuation. If these plans are hazard specific, countries can consider the weights of their major hazard types in the same way as G-2.

Two options for computation are suggested. The methodology of this indicator is similar to that of G-3; however, a weighted average of hazard types may be determined by country.

***Option 1:*** MINIMUM REQUIREMENT

Simply count the number of local governments which have a plan to act on early warnings. Member States may wish to consider if their major hazard types in the local areas are covered by the plan(s) and apply a **weighting.** For example, if local government X has a plan to act on any early warnings, it is counted. If local Government Y is prone to floods (0.8) and earthquakes (0.2) and has a plan to act on only flood early warnings without a plan for earthquakes, it is counted as 0.8.

***Option 2:*** RECOMMENDED OPTION

This option suggests quantitative indicators to measure the quality of a plan to act on early warnings, rather than existence.

UNISDR proposes the following scales with 4 levels of **overall effectiveness** of preparedness and a plan to act, in addition to registering its absence.

| Level of achievement | Score |
|---|---|
| i. Comprehensive achievement (full score) | 1.00 |
| ii. Substantial achievement, additional progress required | 0.75 |
| iii. Moderate achievement, neither comprehensive nor substantial | 0.50 |
| iv. Limited achievement | 0.25 |
| v. No / poorly functioning MHEWS | 0 |

In order to measure quality, it is proposed that countries measure the extent to which the plan can meet the **updated EWS Checklist (forthcoming),** which lists the major issues to be respected in *2) Disaster Preparedness and Response Plans Established, and 4) Response Capability.*

- The plan is empowered by law.
- The plan is targeted to the individual needs of vulnerable communities.
- Hazard and vulnerability maps were utilized to develop the plan.
- Up-to -date plan has been developed, disseminated to the community, and practiced.
- Previous disaster events and responses were analysed, and lessons learnt were incorporated into the plan.

- Strategies were stipulated in the plan and implemented to maintain preparedness for recurrent hazard events.
- The plan involves regular tests and drills undertaken to test the effectiveness of the early warning dissemination processes and responses.

$$\boldsymbol{country\ score} = \sum_{k=1}^{l} \quad \sum_{j=1}^{m} \sum_{i=1}^{n} INDijk \times Wi \Big/ m \times l$$

***Where:***

IND*ijk*: the score of the major issues-j (=1, …m) of hazard i (=1, .., n) in the local government k (= 1, …, l)
*Wi*: weighted average of hazard type *i*; $\sum_{i=1}^{n} Wi = 1$
If the plan is not hazard specific, *Wi* = 1
n: number of hazard types
m: number of major issues in calculation
l: the total number of local governments

## G-5 Number of countries that have accessible, understandable, usable and relevant disaster risk information and assessment available to the people at the national and local levels.

G-5 is an indicator representing one of the aforementioned four key elements of MHEWS, *(1) disaster risk knowledge based on the systematic collection of data and disaster risk assessments*. The methodology of this indicator is similar to that of G-2; a weighted average of hazard types determined by country.

Two options for computation are suggested, with **weighting for major hazards**. In either option, the index will be between 1 and 0.

***Option 1:*** MINIMUM REQUIREMENT

Simply count the number of countries with (accessible, understandable, usable and relevant) disaster risk information and assessment. It is basically determined by each country and the data is binary, yes or no, 1 or 0, for hazard types in the system, then calculate the score with weighting for major hazards.

***Option 2:*** Population Coverage

UNISDR suggests that this option should focus on risk information, as the result of risk assessment, and obtain the population coverage for it. For a proxy of the people who can access to understandable, usable and relevant disaster risk information, hazard maps might be considered as

understandable, usable and relevant disaster risk information. In this case, if every household can access to (integrated) hazard maps, i.e. delivered or on the web, for example, full score is given.***Option 3:*** **RECOMMENDED OPTION**

This option suggests quantitative indicators to measure the quality of risk information and assessment of the MHEWS, rather than existence. The following scales are proposed measuring 4 levels of **overall effectiveness** of the MHEWS, in addition to registering its absence.

| Level of achievement | Score |
|---|---|
| i. Comprehensive achievement (full score) | 1.00 |
| ii. Substantial achievement, additional progress required | 0.75 |
| iii. Moderate achievement, neither comprehensive nor substantial | 0.50 |
| iv. Limited achievement | 0.25 |
| v. No / poorly functioning MHEWS | 0 |

In order to measure quality, it is proposed that countries measure the extent to which the multi-hazard national risk assessment / risk information meets the **updated Checklist of *Key Element 1: Risk Knowledge*** which provides 5 major issues: 1) Organizational Arrangements Established, 2) Natural Hazards Identified, 3) Community Vulnerability Analyzed, 4) Risks Assessed, and 5) Information Stored and Accessible.

See the following examples of the elements required for multi-hazard national risk assessment / risk information (each level builds on the former):

i. Risk assessment uses a probabilistic approach and is shared and coordinated, and used by national institutions with clear responsibilities for decision making, planning, and storing data and information; 1.0.
ii. Risk assessment calculating possible losses and physical damage, as well as underlying risk drivers, of identified hazards, through vulnerability analysis with established organizational commitment; 0.75.
iii. Risk assessment calculating possible losses and physical damage of identified hazards through vulnerability analysis; 0.50.
iv. Evaluation of potential damage and loss scenarios with identification of: the main hazards to which the country is exposed, and the main exposed elements in prone areas; 0.25,
v. Risk assessment / information unavailable; 0.

$$\boldsymbol{country\ score} = \sum_{j=1}^{m}\sum_{i=1}^{n} INDij \times Wi \Big/ m$$

***Where:***

IND*ij*: the score of the major issues-j (=1, …m) of hazard I (=1, .., n)
*Wi*: weighted average of hazard type *i*; $\sum_{i=1}^{n} Wi = 1$
n: number of hazard types
m: number of the major issues in calculation

The indicator could be calculated by considering population or geographical coverage of the multi-hazard monitoring and forecasting system, however, this is extremely complex and is not recommended for global indicators.

### G-6 Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning.

Unlike other indicators for this Target, G-6 could quantify the impact and effectiveness of (MH)EWS. Since this indicator entails problems in data collection, as stipulated in the OIEWG Report, having considered feasibility and capacities, Member States in a position to do so are encouraged to provide information on the number of evacuated people, and determine which hazardous events and numbers to take. For a proxy of the number of evacuated people, it might be possible to collect data on those who moved to evacuation centres. However, it is unlikely that reliable data exist with regard to the number of people who left their houses and went to acquaintances' or who evacuated vertically .

If Member States are able to produce the data of "population exposed to or at risk" as a denominator for this indicator, the number of people targeted by the early warning could be a proxy for it; this could equate to the total population in the municipalities or districts or communities targeted by the official warning.

As evacuation patterns/situations vary greatly by hazardous event, it is suggested that Member States report data by event. Member States in a position to do so are also encouraged to develop further such indicators in nationally determined monitoring frameworks, so as to be able to measure policy impacts.

## 6. Minimum and Desirable Data Requirements

Further to the recommendations of both the OEIWG and the IAEG-SDGs, UNISDR recommends disaggregating data:

| Indicator No. | Indicators |
|---|---|
| G-1 | **Number of countries that have multi-hazard early warning systems.**<br><br>COMPOUND INDICATOR. See computation method |
| G-2 | **Number of countries that have multi-hazard monitoring and forecasting systems.**<br><br>**[Minimum Requirement for disaggregation]**<br>Hazard type (e.g. the IRDR classification "Main Events" (IRDR 2014)) |
| G-3 | **Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms.**<br><br>**[Desirable disaggregation]**<br>Hazard type (e.g. the IRDR classification "Main Events" (IRDR 2014))<br>Local government |
| G-4 | **Percentage of local governments having a plan to act on early warnings.**<br><br>**[Minimum Requirement for disaggregation]**<br>Local government<br><br>**[Possible disaggregation]**<br>Hazard type (e.g. the IRDR classification "Main Events" (IRDR 2014)) |
| G-5 | **Number of countries that have accessible, understandable, usable and relevant disaster risk information and assessment available to the people at the national and local levels.**<br><br>**[Minimum Requirement for disaggregation]**<br>Hazard type (e.g. the IRDR classification "Main Events" (IRDR 2014))<br>Local government |

| | |
|---|---|
| G-6 | **Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning.**<br><br>**[Minimum Requirement for disaggregation]**<br>Hazard type (e.g. the IRDR classification "Main Events" (IRDR 2014))<br>Local government (sub-national administrative unit)<br><br>**[Desirable Disaggregation**: note in the OIEWG Report**]**<br>Member States in a position to do so are encouraged to provide information on the number of evacuated people. |

## 7. Specific issues

The elements which make up effective MHEWS, and which give rise to accessible risk information and assessment, are numerous and complex. They involve, inter alia, aspects of systematic detection, monitoring and forecasting of hazards, vulnerability and exposure, detailed analysis of the risks involved, supported by appropriate and effective means of communicating and disseminating risk information, from accountable authorities to population exposed to or at risk at the local level, such that it prompts appropriate action coordinated within and across sectors and multiple levels, all of which accompanied by the capability to prepare and respond in a timely manner. As the measurement of this global target is again complex and challenging, in the OIEWG deliberations Members considered following important issues:

- As **MHEWS vary considerably from country to country**, instead of counting the number of the systems, UNISDR suggested a focus on functionality (e.g. the degree of achievement) to measure progress in each of *the four interrelated key element* of EWS.

- The **selection of major hazards** to be included in MHEWS remains a **national determination**, recognising that hazardous events differ significantly among countries in terms of both frequency and intensity (for example, from large-scale, often low-frequency events such as earthquakes, cyclonic winds, and tsunamis, to small-scale, high-frequency hazardous events such as floods). UNISDR suggests that each country specify the major hazards to be included in "multi-hazard" when reporting.

- MHEWS generally have a defined scope and coverage that is **specific to a particular geography or population** and the degree of population or geographical coverage was proposed by several countries. Determining **progress in coverage** could be an indicator that could assist the measurement of progress in achieving the global Target. When exploring measuring **coverage of early warning information**, Members may wish to examine proxies for the level of "information redundancy", that is, the number and kind of different warning dissemination channels providing the same authoritative warning information (e.g. mass media: radio access rate, television penetration rate, internet access rate for e-mail and warning website, population coverage of mobile phone networks for SMS; and local communication system (e.g. existence of community centres with access to these services such as siren, public board, and communication by telephone—land line or mobile)).

- In calculating coverage, Members will need to determine an appropriate **denominator** to be used in computation, notably with regard to population coverage. Ideally, the number of **exposed population** would be used; however, identification and calculation will be challenging, especially for small and medium-sized hazardous events and for such an event when not everyone exposed is affected. Therefore, UNISDR suggested the use of a **proxy**, for example, the total population in targeted sub-national administrative units.

- Identifying “the availability of and access to MHEWS and disaster risk information and assessments to the people” will be challenging, in particular, defining whether this is reaching the most exposed or vulnerable populations will be extremely challenging.

- As more than one **MHEWS could cover the same geography or population**, Members should consider double counting and the consistency of information.

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