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

December 2017

UNISDR
United Nations Office for Disaster Risk Reduction

Purpose

The purpose of this note is to support Member States in the operationalization of the global indicators to measure progress towards the achievement of the global targets of the Sendai Framework and relevant targets of the Sustainable Development Goals.

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 (OIEWG) on Indicators and Terminology Related to Disaster Risk Reduction (A/71/644)[1], 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 note is a first version of the Technical Guidance 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 objective of this technical guidance is to allow for consistent measurement of progress towards the global targets across countries and over the duration of the Sendai Framework and Sustainable Development Goals, by sharing **minimum standards** which describe a common and detailed international understanding of indicators, data required, and providing standard methodologies for countries which may want to voluntarily use them.

However, it is important to remind that as per the OIEWG report, countries may choose to use a national methodology or other methods of measurement and calculation as far as they are compliant with the specifications of the report.

The refinement and finalization of this technical guidance took place after the Third Session of the OIEWG. Throughout 2017, together with Member States and relevant technical partners, dedicated events were organized by UNISDR, including several technical working meetings and a number of events that took place in May during the 2017 Global Platform for Disaster Risk Reduction in Mexico.

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

1 Available at http://www.preventionweb.net/drr-framework/open-ended-working-group
2 created by the United Nations Statistical Commission to develop a global indicator framework for the SDGs

Contents

Target A **5**

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

Target B **18**

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

Target C **36**

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

Target D **92**

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

Target E **112**

Technical Note on Data and Methodology to Estimate the 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

Target F **129**

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

Target G **154**

Technical Note on Data and Methodology to Estimate 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

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

United Nations Office
for Disaster Risk Reduction

1. Overview

The purpose of this note 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 note outlines the data, indicators and methodologies required for estimating global mortality 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.

The methodology described here proposes the collection and use of **simple and uniform 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. Due to the absence of death registries in many countries, estimation rather than measurement is sometimes used, especially in large scale disasters which account for a significant proportion of global mortality. 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 that 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, which reinforces the importance of the Sendai Framework Targets and Indicators.

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, so no-one should be double counted.*

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 country data, and not be dependent upon unofficial sources – such as mainstream media or reports from international sources*

3 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 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):

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

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:

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

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

$$A_1 = A_2 + A_3$$

6. Minimum and Desirable Data Requirements

Indicator No.	Indicator
A-1	**Number of deaths and missing persons attributed to disasters, per 100,000 population.** COMPOUND INDICATOR. See method
A-2	**Number of deaths attributed to disasters, per 100,000 population.** **[Minimum data requirements]:** **Data to be collected for each disaster** **A-2a** Number of deaths attributed to disasters **[Desirable Disaggregation]:** Hazard Geography (Administrative Unit) Sex Age Disability Income **METADATA** **Additional demographic and socio-economic parameters needed** **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. The global indicator is the sum of the populations of all countries having reported.
A-3	**Number of missing persons attributed to disasters, per 100,000 population.** **[Minimum data requirements]:** **Data to be collected for each disaster** **A-3a** Number of missing persons attributed to disasters **[Desirable Disaggregation]:** Hazard Geography (Administrative Unit) Sex Age Disability Income **METADATA** **Additional demographic and socio-economic parameters needed** **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 :

- **Location :** Each death should be counted in the country where the death occurred, regardless of the nationality of the dead person.

- **Disaggregation by Disability** refers (within all of the indicators of Targets A and B) to "pre-event disability" as there will be people who develop disabilities during the course or as consequence of the event.

- **Attribution to a disaster**. Given that there are many data sources, the cause of death is frequently not recorded as being associated with a disaster 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 whether each death is attributed to a disaster.

- **The type of hazard associated to a disaster** will affect the method of attribution of deaths to the event. Each type of hazard has a pattern of mortality and morbidity. For example, deaths due to heatwave are often estimated by calculating excess mortality across a population, in which cases, deaths due to heat stress, cardiovascular and other chronic diseases are usually included. For the purposes of monitoring and reporting deaths for Target A of the Sendai Framework, it is recommended to focus on the direct causes of death that are more feasible to attribute, collect and report.

- **Temporal aspects for attribution and cut-off for data collection.**
  Countries may choose to have different timeframes for each type of hazard, because they have different epidemiology. If so decided, timeframes for each hazard should be based on the epidemiology of survival rates during the event and the feasibility of recording deaths.

- In *small-scale sudden-onset disasters*, where most deaths occur close to the time of initial onset of the event, finalizing data collection and declaring the data collected as final is relatively 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. In these cases, the decision of a cut-off period will be made by each Member state, based on its own legal system and data collection objectives.

  On the one hand, some cases may never be reflected (for example someone in a coma for several years), and other cases may take a long time before they can be registered. In general, it is assumed these cases represent a small minority and will not affect the statistical strength, **from a global perspective**, of data that are collected within sensible and consistently applied cut-off time periods.

  However, other Member States may decide to be fully sensitive about the number of deaths, meaning that even the death of one-person long time after the event should be also counted and respected in statistics, regardless of the impact on the overall data. In both cases the recommendation is to keep a consistent treatment of these data.

In *large-scale, slow-onset and long duration disasters,* where deaths accumulate over time, the issue is more problematic. Large-scale disasters usually require a much longer response phase, for example, or entail a more complex information management to determine the final number of fatalities that are attributed to disasters. Slow-onset and long duration disasters (e.g. droughts, epidemics) may span several years, with the corresponding challenge of compounding the information across the time span of the disaster. However, the data should be reported as the number of deaths in the year when the death occurred, without waiting for the complete cessation or end date of the long duration disaster.

- **In the case of biological hazards**, an "event" is determined when the number of cases exceeds the agreed threshold of cases for the hazard, which is often context specific. Deaths must meet the case definition for the disease, and the end date is when the outbreak is declared over. This will depend on the characteristics of the disease. Infectious disease outbreaks are dynamic events dependent on a number of factors that can propagate or contain the spread of new cases. Each epidemic prone disease has a threshold which is often context specific. A single case is only considered an "outbreak" if it is an eliminated or eradicated disease in that location, e.g. measles or polio in a previously certified-free zone.

- **Set of hazards:** Given the vast number of different types of biological hazards (i.e. pathogenic bacteria, viruses and other hazards of organic origin), countries will have to define which biological hazards should be included, focusing on those biological hazards which have the potential to cause emergencies and disasters. From a public health perspective, the International Health Regulations (2005) offer some guidance in this respect for the assessment and notification of events that may constitute a public health emergency of international concern, as well as those that are of specific national or regional concern. It is recommended to consult with the Ministry of Health to determine which biological hazards should be considered for Sendai Framework reporting. It is proposed that countries give consideration to those biological hazards for which data is regularly collected (e.g. list of notifiable diseases). In general there is stronger global and national data available for vaccine-preventable diseases. Some of the following diseases may be considered for inclusion in the indicator framework for measurement of Global Targets:

  Diseases which are unusual or unexpected and may have serious public impact and thus shall be notified: smallpox, poliomyelitis (due to wild-type poliovirus), human influenza caused by a new subtype, severe acute respiratory syndrome (SARS).

  Diseases which have demonstrated the ability to cause serious public health impact and to spread rapidly internationally: cholera, pneumonic plague, yellow fever, viral haemorrhagic fevers (Ebola, Lassa, Marburg), West Nile Fever, and other diseases of special national or regional concerns, .e.g. dengue fever, Rift Valley fever, meningococcal disease.

  Any event of potential international public health concern, including those of unknown courses or sources (other than those already listed) where criteria are assessed: is the public health impact of the event serious; is the event unusual or unexpected; and is there a significant risk of (national or) international spread.

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

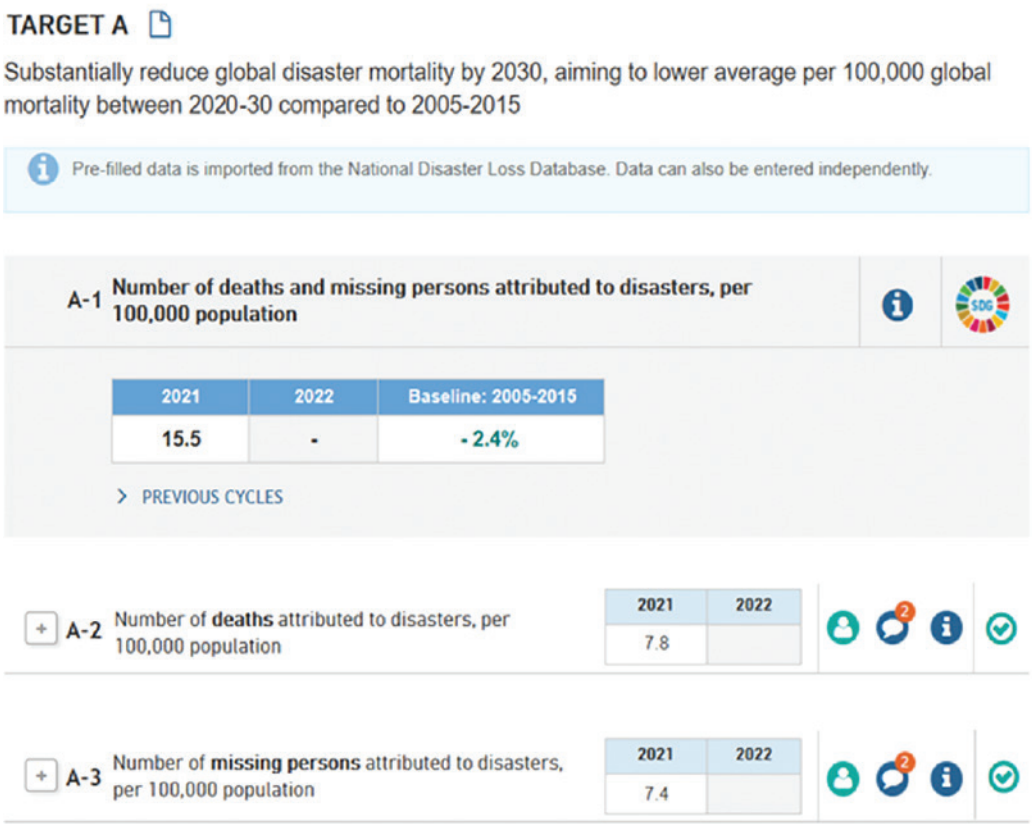
Hazard	Cause of death	Time-span or recommended cut-off period	Source of data
Drought	Infectious diseases, malnutrition	6 months after emergency state ceases, and Yearly cut-offs for multi-year events	Ministry of Health, Disaster management offices, Relief organizations,
Flood	Drowning, trauma	4 weeks after event	Ministry of Health, Disaster management offices, Relief organizations
Earthquake	Trauma, fire	4 weeks after event	Ministry of Health, Disaster management offices, Relief organizations
Epidemic	Infectious disease	Period when no new cases are recorded (disease specific e.g. Ebola 42 days based on incubation period)	Ministry of Health or health authority
...	...	...	...

The most important recommendation to countries is to emphasise that **these criteria should be fixed, or if changed should provide consistent results 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. **If a change in methodology or data collection process is deemed to introduce a bias in the measurements it is recommended a retroactive review of data in previous periods and disasters in order to obtain data that is consistent over the reporting period.**

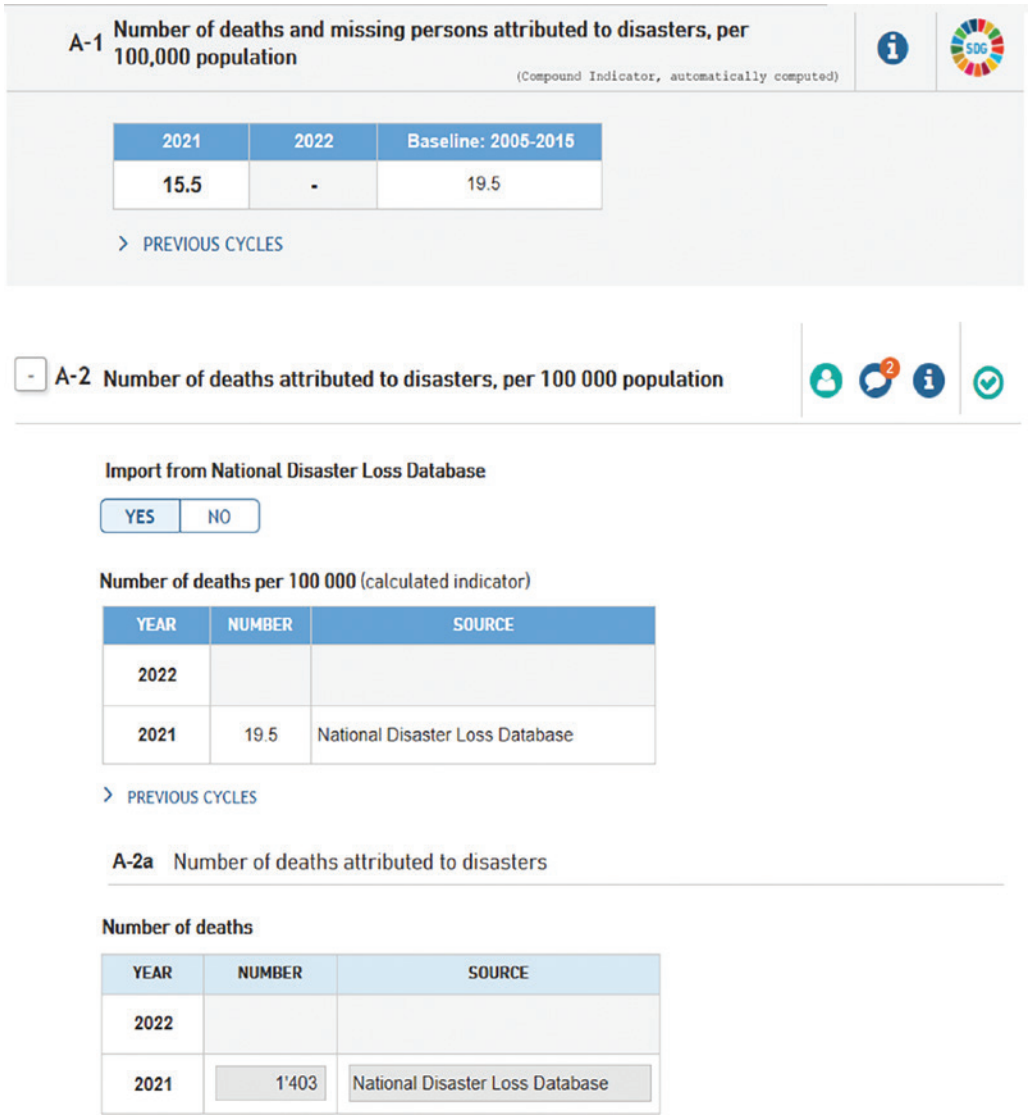
8. Sample Data Entry Screens

The following are illustrative screen captures taken from the Sendai Framework Monitor Prototype system. Actual implementation may vary.

1. Main Summary of Target A :



2. Expansion of Indicator A-2



A-1 Number of deaths and missing persons attributed to disasters, per 100,000 population

(Compound Indicator, automatically computed)

2021	2022	Baseline: 2005-2015
15.5	-	19.5

› PREVIOUS CYCLES

A-2 Number of deaths attributed to disasters, per 100 000 population

Import from National Disaster Loss Database

YES | NO

Number of deaths per 100 000 (calculated indicator)

YEAR	NUMBER	SOURCE
2022		
2021	19.5	National Disaster Loss Database

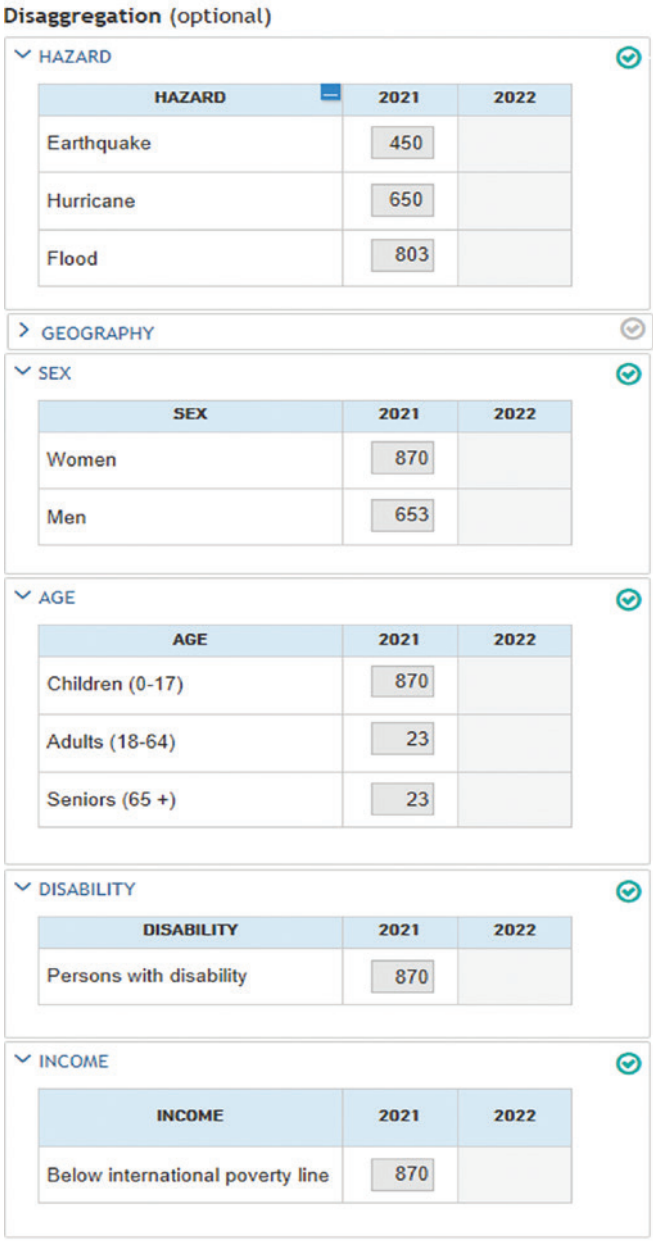
› PREVIOUS CYCLES

A-2a Number of deaths attributed to disasters

Number of deaths

YEAR	NUMBER	SOURCE
2022		
2021	1'403	National Disaster Loss Database

3. Disaggregation of Indicator A-2



Disaggregation (optional)

HAZARD

HAZARD	2021	2022
Earthquake	450	
Hurricane	650	
Flood	803	

GEOGRAPHY

SEX

SEX	2021	2022
Women	870	
Men	653	

AGE

AGE	2021	2022
Children (0-17)	870	
Adults (18-64)	23	
Seniors (65 +)	23	

DISABILITY

DISABILITY	2021	2022
Persons with disability	870	

INCOME

INCOME	2021	2022
Below international poverty line	870	

In this screen Geography is not expanded. It would show subtotals per Administrative level 1

REFERENCES

United Nations. 2016a. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c) Sustainable development : disaster risk reduction. 1 December 2016.

United Nations. 2016b. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. Note by the Secretary-General. E/CN.3/2017/2. United Nations Economic and Social Council. Statistical Commission. Forty-eighth session. Item 3 (a) of the provisional agenda. 15 December 2016.

United Nations. 2017. *Resolution adopted by the General Assembly on 2 February 2017*. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. A/RES/71/276. United Nations General Assembly, Seventy-first session Agenda item 19 (*c*). 2 February 2017.

United Nations Economic and Social Council. 2017. *Draft report subject to editing.* Report on the forty-eighth session (7-10 March 2017). Statistical Commission. E/2017/24-E/CN.3/2017/35. Economic and Social Council. Official Records 2017. Supplement No. 4.

JRC, Tom De Groeve, Karmen Poljansek, Daniele Ehrlich, 2013. Recording Disaster Losses : Recommendations for a European approach. European Commission, 2013. EUR 26111 EN. – Joint Research Centre – Institute for the Protection and the Security of the Citizen.

Integrated Research on Disaster Risk (IRDR). 2015. Guidelines on measuring losses from disasters. Human and Economic Impact Indicators. Integrated Research on Disaster Risk (IRDR), Data Project Report No. 2. 2015.

Université Catholique de Louvain. EM-DAT - The OFDA/CRED international disaster database—www.emdat.net. Université Catholique de Louvain, Brussels, Belgium. http://www.emdat.be

DesInventar - UNISDR Open Source Loss Data Platform, Geneva, Switzerland. http://www.desinventar.net

OSSO Desinventar.org—DesInventar Project for Latin America. Corporación OSSO, Cali, Colombia.
http://desinventar.org/en/

United Nations Development Programme (UNDP). 2013. A comparative review of country-level and regional disaster loss and damage databases. UNDP, Bureau for Crisis Prevention and Recovery. New York. 2013.

United Nations Office for Disaster Risk Reduction (UNISDR). 2009. Global Assessment Report on Disaster Risk Reduction : Risk and Poverty in a Changing Climate. Geneva, Switzerland : UNISDR.

UNISDR. 2011a. Global Assessment Report on Disaster Risk Reduction : Revealing Risk, Redefining Development. Geneva, Switzerland : UNISDR.

UNISDR. 2011b. *Desinventar.net database global disaster inventory.* United Nations International Strategy for Disaster Reduction, Geneva.

UNISDR. 2013. Global Assessment Report on Disaster Risk Reduction: From Shared Risk to Shared Value: the Business Case for Disaster Risk Reduction. Geneva, Switzerland: UNISDR. http://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2015a. GAR 2015. Annex 2: Loss Data and Extensive Risk Analysis. UNISDR. Geneva, 2015. http://www.preventionweb.net/english/hyogo/gar/2015/en/gar-pdf/Annex2-Loss_Data_and_Extensive_Risk_Analysis.pdf

UNISDR. 2015b. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2015c. Technical Collection of Issue Papers on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2016. Technical Collection of Concept Notes on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 10 June 2016.

Working Text on Terminology. Based on negotiations during the Second Session of the Open-ended Intergovernmental Expert Working Group on Terminology and Indicators Relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Working Text on Indicators. Based on negotiations during the Second Session of the Open-ended Inter-governmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016

WHO, ed. (2015). Global Status Report on Road Safety 2015 (PDF) (official report). Geneva, Switzerland.

WHO (2015). Global Reference List of 100 Core Health Indicators. Geneva, Switzerland.

WHO (2016). International Health Regulations (2005), 3rd Edition. Geneva, Switzerland

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

United Nations Office
for Disaster Risk Reduction

B

1. Overview

The purpose of this note 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 note 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, making the best effort, given the difficulty of calculating a relatively abstract and fuzzy indicator.

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 single 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.

Historically, there have been significant variations in the uniformity of approach in disaster data currently reported by both national and international data providers. Estimation rather than measurement is used in most cases, especially in large scale disasters.

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 more feasible than collecting data on indirectly 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 (B-2)
- People whose houses were damaged or destroyed (B-3, B-4)
- People whose livelihoods were disrupted or destroyed (B-5)

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

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 note 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 inhabitants are considered affected by the fact that their dwellings were damaged (asset property damage), and because in many cases they would be included in those *evacuated, displaced, or relocated.* The categories of evacuated, displaced, or relocated should not be included in the indicators of this Target as per the conclusions of the OIEWG.

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

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

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).

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

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

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

And

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

Thus:

$$B_3 = B_{3a} * AOH$$
$$B_4 = B_{4a} * AOH$$

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.

$$B_{5a} = \text{hectares of crops affected} * \text{average workers per hectare}$$

$$B_{5b} = \text{Livestock lost} * \text{average workers per livestock}$$

$$B_{5c} = \text{Sum of productive assets and infrastructure facilities affected} * \text{average workers per facility}$$

Data required will be collected for target C, therefore:

$$B_{5a} = C2C_a * \text{average workers per hectare}$$

$$B_{5b} = C2L_a * \text{average workers per livestock}$$

$$B_{5c} = C3_b * \text{average workers per facility} + C5_b * \text{average workers per infrastructure}$$

Which expressed in compact form is:

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

where i=1

....n are the types of productive assets and infrastructure declared in the Metadata

Please see section 7 with more information about the methodologies, challenges and issues of these computation methodologies, especially those related to required additional statistics and metadata.

6. Minimum and Desirable Data Requirements

Indicator No.	Indicator
B-1	**Number of directly affected people attributed to disasters, per 100,000 population** COMPOUND INDICATOR. See computation method. **Additional demographic and socio-economic parameters needed** **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. 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.** **[Minimum data requirements]:** **Data to be collected for each disaster** **B-2** Number of injured or ill people attributed to disasters **[Desirable Disaggregation]:** Hazard Geography (Administrative Unit) Sex Age Disability Income

B-3	**Number of people whose damaged dwellings were attributed to disasters.** **[Minimum data requirements]:** **Data to be collected for each disaster** **B-3** Number of people whose damaged dwellings were attributed to disasters **B-3a:** Number of dwellings/houses damaged attributed to disasters Indicator B-3 can be directly measured in situ, estimated using a nationally defined methodology, or left blank and estimated by UNISDR based on B-3a using the methodology suggested in this Guidance, if the corresponding data, metadata and socio-economic parameters are provided. Note that sub-indicator B-3a is also a data requirement for Indicator C-4 as defined in Target C **[Desirable Disaggregation]:** Hazard Geography (Administrative unit) **The following disaggregation to be made if B-3 is measured in situ, or it could be artificially calculated if B-3a is used to estimate the indicator:** Sex Age Disability Income **[Metadata]** **Additional demographic and socio-economic parameters needed** **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. The national indicator would be calculated using the data of the country. The global indicator is the sum of the indicators of all countries having reported.
B-4	**Number of people whose destroyed dwellings were attributed to disasters.** **[Minimum data requirements]:** **Data to be collected for each disaster** **B-4** Number of people whose destroyed dwellings were attributed to disasters **B-4a:** Number of dwellings/houses destroyed attributed to disasters Indicator B-4 can be directly measured in situ, estimated using a nationally defined methodology, or left blank and estimated by UNISDR based on B-4a using the methodology suggested in this Guidance, if the corresponding data, metadata and socio-economic parameters are provided. Note that sub-indicator B-4a is also a data requirement for Indicator C-4 as defined in Target C **[Desirable Disaggregation]:** Hazard Geography (Administrative Unit) **The following disaggregation to be made if B-4 is measured in situ, or it could be artificially calculated if B-4a is used to estimate the indicator:** Sex Age Disability Income **[Metadata]** **Additional demographic and socio-economic parameters needed**: see B-3

B-5

Number of people whose livelihoods were disrupted or destroyed, attributed to disasters.

[Minimum data requirements]:

Data to be collected for each disaster
B-5 Number of people whose livelihoods were disrupted or destroyed, attributed to disaster

Indicator B-5 can be directly measured in situ, estimated using a nationally defined methodology, or left blank and estimated by UNISDR using the methodology suggested in this Guidance, if the corresponding sub-indicators, data, metadata and socio-economic parameters are provided.

Please note that this methodology requires the following data and metadata to be collected by disaster, related to the indicators for Target C:

- **C-2Ca** Number of hectares of crops damaged or destroyed by disasters. (to be used to establish the statistic of Number of Workers affected)
- **C-2La** Number of Livestock lost in disasters (to be used to establish the statistic of Number of Workers affected)
- **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, if this methodology is chosen].

[Desirable Disaggregation]:
Hazard
Geography (Administrative Unit)

The following disaggregation to be made if B-5 is measured in situ, or it could be artificially calculated if the UNISDR proposed methodology and required data is used to estimate the indicator:
Sex
Age
Disability
Income

Additional demographic and socio-economic parameters needed
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.
The national indicator would be calculated using the data of the country.
The global indicator with the sum of the indicators of all countries reporting.

6. 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 :

- **Location :** Each injured or ill person should be counted in the country where the injury or illness case occurred, regardless of the nationality of the affected person.

- **Disaggregation by Disability** refers (in all of the indicators of Targets A and B) to "pre-event disability" as there will be people who develop disabilities during the course or as consequence of the event.

- **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, pulmonary illness as a result of a cold wave may not be registered as associated to the cold wave itself in the medical or legal records. Therefore, it is necessary to understand whether each illness case or injury is attributed to a disaster.

- **The type of hazard associated to the disaster** will affect the method of attribution of injury and illness to the event. For example, illness due to heatwave are often estimated by calculating excess presentations to health facilities across a population, in which cases, illnesses due to heat stress, and exacerbation of cardiovascular and other chronic diseases are usually included. Therefore, for the purposes of monitoring and reporting injury and illness for Target B of the Sendai Framework, it is recommended to focus on the direct causes of injury and illness cases which are more feasible to attribute, collect and report.

- **Temporal aspects for attribution and cut-off for data collection.**

  Countries may choose to have different timeframes for each type of hazard, because they have different epidemiology. If so decided, timeframes for each hazard should be based on the epidemiology of injury and illness rates during the event and the feasibility of recording those injuries and cases of illness.

  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 in statistics (for example someone suffering from mental health problems arising after several months), in general these cases represent a minority and will not affect the statistical strength, **from a global perspective**, of data that are collected within sensible cut-off time periods. The degree of accuracy that each country desires for its indicators is to be nationally determined, but it is recommended that Member States keep a consistent treatment of these criteria.

  In *large-scale, slow-onset and long duration disasters*, where impacts accumulate over time, the issue is more problematic. Large-scale disasters usually require a much longer response 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 and long duration disasters (e.g. droughts, epidemics) 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. However, the data should be reported as the number of injured or ill in the year when the injury or illness is confirmed, without waiting without waiting for the complete cessation or end date of events of long duration.

- **In the case of biological hazards**, an "event" is determined when the number of cases exceeds the agreed threshold of cases for a hazard. Illnesses must meet the case definition for the disease, and the end date is when the outbreak is declared over. This will depend on the characteristics of the disease. Infectious disease outbreaks are dynamic events dependent on a number of factors that can propagate or contain the spread of new cases. Each epidemic prone disease has a threshold which is often context specific. A single case is only considered an "outbreak" if it is an eliminated or eradicated disease in that location, e.g. measles or polio in a previously certified-free zone.

- **Set of biological hazards:** Given the vast number of different types of biological hazards (i.e. pathogenic bacteria, viruses and other hazards of organic origin), countries will have to define which biological hazards should be included, focusing on those biological hazards which have the potential to cause emergencies and disasters. From a public health perspective, the International Health Regulations (2005) offer some guidance in this respect for the assessment and notification of events that may constitute a public health emergency of international concern, as well as those that are of specific national or regional concern. It is recommended to consult with the Ministry of Health to determine which biological hazards should be considered for Sendai Framework reporting. It is recommended that countries give consideration to those biological hazards for which data is regularly collected (e.g. list of notifiable diseases). In general there is stronger global and national data available for vaccine-preventable diseases. Some of the following diseases may be considered for inclusion in the indicator framework for measurement of Global Targets:

  Diseases which are unusual or unexpected and may have serious public impact and thus shall be notified: smallpox, poliomyelitis (due to wild-type poliovirus), human influenza caused by a new subtype, severe acute respiratory syndrome (SARS).

  Diseases which have demonstrated the ability to cause serious public health impact and to spread rapidly internationally: cholera, pneumonic plague, yellow fever, viral haemorrhagic fevers (Ebola, Lassa, Marburg), West Nile Fever, and other diseases of special national or regional concerns, .e.g. dengue fever, Rift Valley fever, meningococcal disease.

  Any event of potential international public health concern, including those of unknown courses or sources (other than those already listed) where criteria are assessed: is the public health impact of the event serious; is the event unusual or unexpected; and is there a significant risk of (national or) international spread.

- **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 d*eaths and ill must be calculated as excess mortalit*y and excess morbidity, respectively. Similar studies may be needed in cases of epidemic outbreaks. Excess Morbidity is that above what would be expected based on the non-crisis morbidity rate in the population of interest. Excess morbidity is thus morbidity

ill that is attributable to crisis conditions. It can be expressed as a rate (the difference between observed and non-crisis morbidity rates), or as a total number of excess illness[5]. In the case of the indicator the total number of excess **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, infectious diseases	Yearly cut-offs, 6 months after emergency state ceases.	Relief organizations, Health ministry.
Heat wave	Pulmonary disease, heart disease, heat stress, …	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

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 could be 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.

The separation in the data between deaths and people who are injured and ill should be decided by countries, and should be clear and kept consistent by Member States, whatever their decision is. In general, the secretariat recommends that mortality figures are not counted in this category (i.e. that deaths and injured/ill are mutually exclusive). However, it should be noted that in epidemics, the number of cases usually includes the number of deaths.

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

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 must be recognized that 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 and estimation for this indicator, including problems of subjective interpretation inter alia.

In order to measure this indicator using a nationally defined methodology, a large number of (possibly subjective) sub-indicators would be required; this will impose a higher reporting burden on countries.

So as to adhere to the principle of simplicity it is recommended that if countries develop a national methodology, the most robust and objective indicators should be used, and some elements, for example business resilience, could be more appropriately addressed by relevant custom national indicators for the four priorities for action.

However, and with the same spirit of providing a 'proxy' indicator that could reflect the number of people whose livelihoods are affected, this Guidance note proposes the usage of data already collected in combination with a number of socio-economic statistics for the estimation of Indicator B-5.

The proposed sub-indicators have been designed following the definition of Livelihoods proposed by Member States in the OIEWG:

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 units, where many families host self-employment schemes
- Agricultural crops
- Livestock
- Workers in affected commercial, services or industrial facilities as part of Productive assets reported in indicators C-2 and C-3

For the effects of the hereby proposed simplified methodology, Indicators B-3 and B-4 **already contain** the use of the Number of People living in Houses Damaged and Destroyed as part of the number of people affected.

Therefore, in order to calculate B-5 without introducing additional double counting, the following sub-indicators and methodology are proposed for measuring the number of people whose activities required for securing a **means of living or as** their source of income has been affected:

- **B-5a** Number of workers in Agriculture with crops damaged or destroyed by disasters (estimated using sub-indicator C-2Ca, described in the Technical Guidance for Target C, and requiring 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 workers responsible for, and owners of livestock lost attributed to disasters (estimated using indicator C-2La, and requiring countries or UNISDR or other UN organization - such as FAO – to establish the statistics of Average Number of Workers per livestock and Average 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 suggest the expert criteria of statistic of Average Number of Workers per facility type).

The average number of workers for these sub-indicators need to be constructed using either **expert criteria** or **available statistics** in each country. In the case of Productive Assets, if a country decides to disaggregate types of assets by size (for example small, medium and large enterprises) the number of workers per facility could be one of the criteria to define the size of each of the productive assets and therefore an average can be also designed for a category.

In many countries National Statistic offices produce several types of statistics that can be used to produce these averages.

The following are examples of useful, statistics of employment by occupation and the number of establishments of each type that can be used to establish these averages :

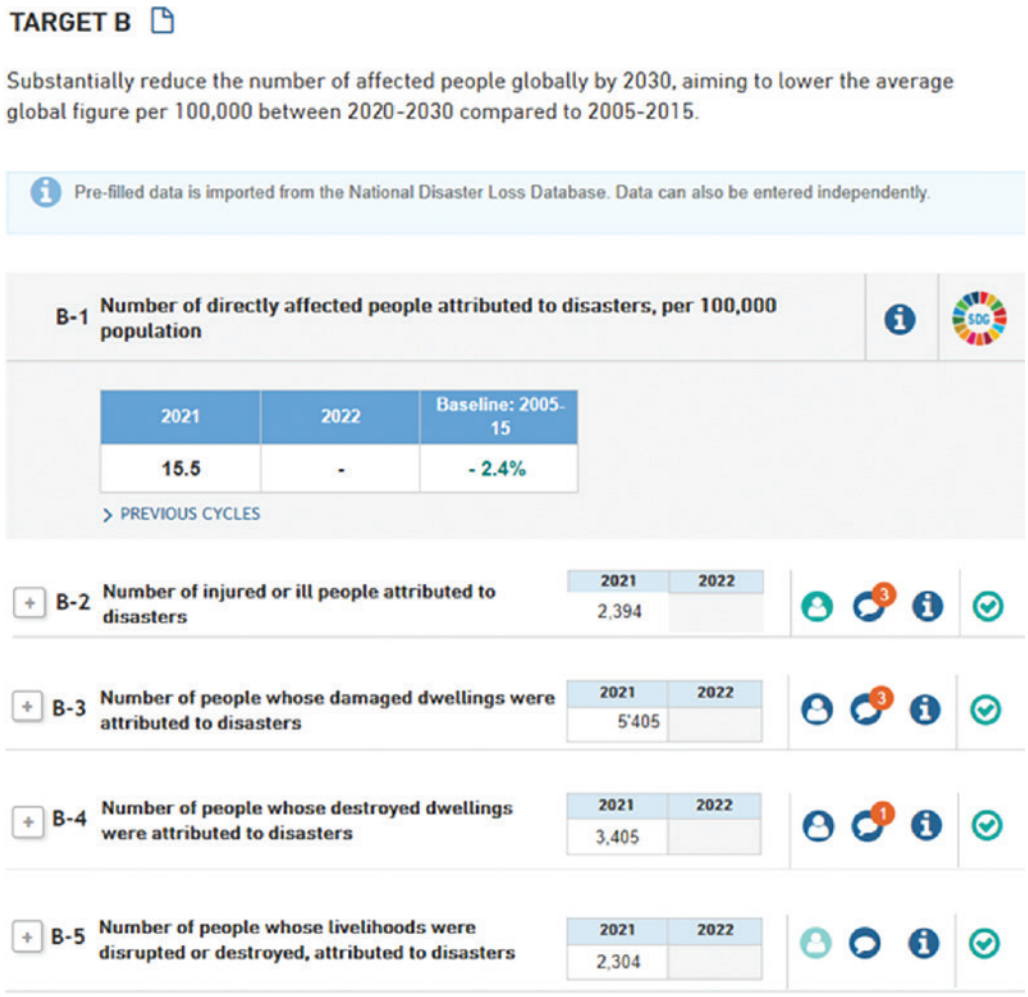
Statistics of workers per activity (USA)
https://www.bls.gov/emp/ep_table_102.htm

Statistics of Establishments by size and economic activity, Norway :
https://www.ssb.no/291607/establishments-by-size-and-economic-activity

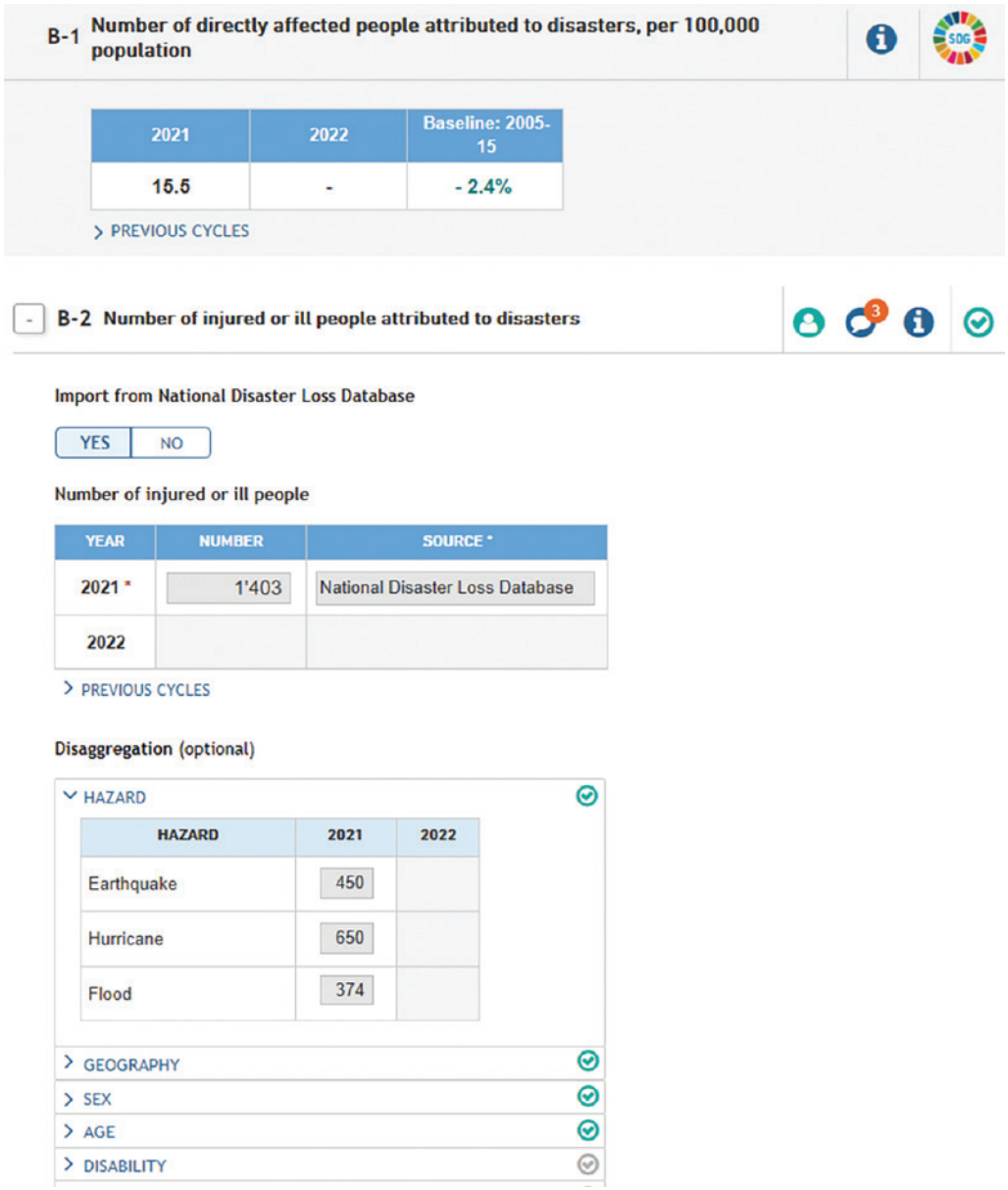
7. Sample Data Entry Screens

The following are illustrative screen captures taken from the Sendai Framework Monitor Prototype system. Actual implementation may vary.

1. Main Summary of Target B:



2. Expansion of Indicator B-2, showing disaggregation by hazard.



B-1 Number of directly affected people attributed to disasters, per 100,000 population

2021	2022	Baseline: 2005-15
15.5	-	- 2.4%

> PREVIOUS CYCLES

B-2 Number of injured or ill people attributed to disasters

Import from National Disaster Loss Database

YES | NO

Number of injured or ill people

YEAR	NUMBER	SOURCE *
2021 *	1'403	National Disaster Loss Database
2022		

> PREVIOUS CYCLES

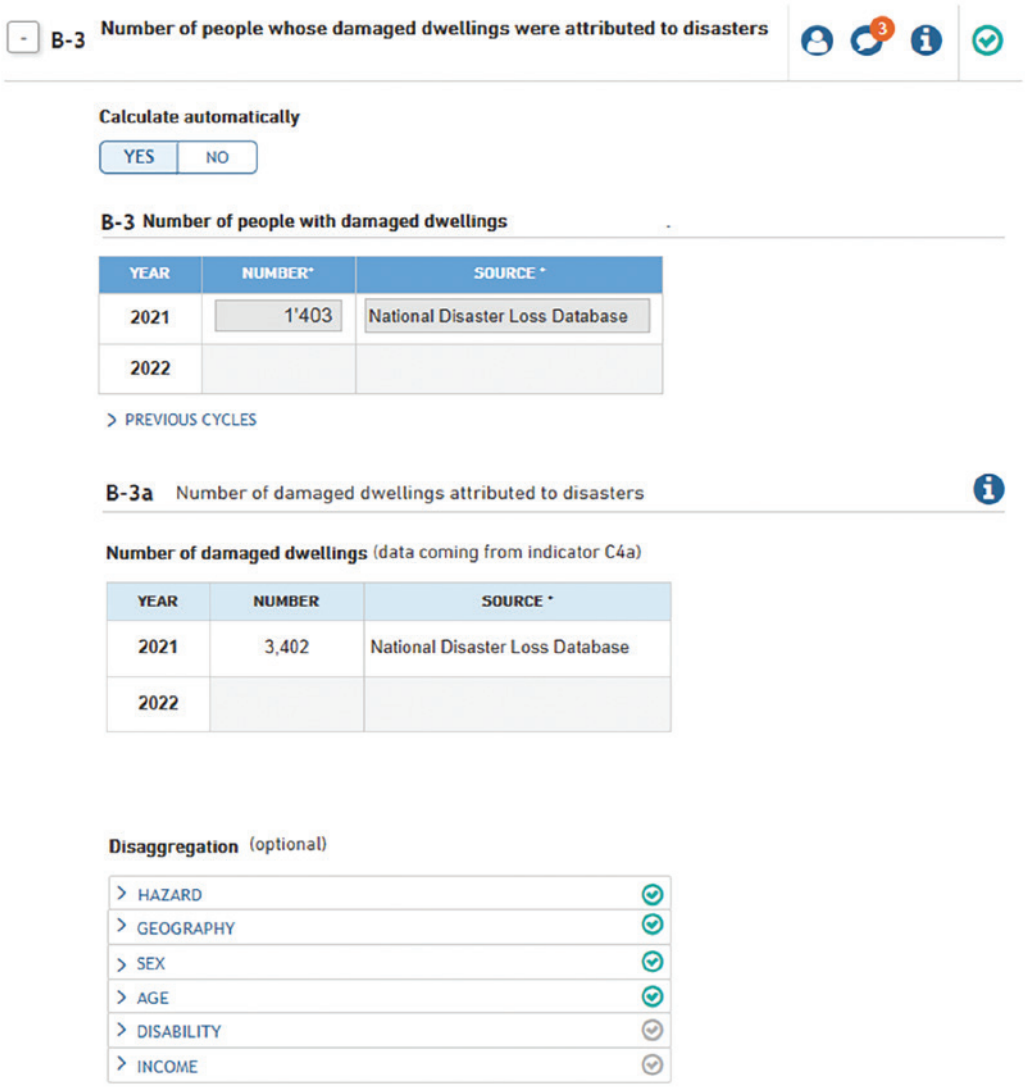
Disaggregation (optional)

HAZARD

HAZARD	2021	2022
Earthquake	450	
Hurricane	650	
Flood	374	

> GEOGRAPHY
> SEX
> AGE
> DISABILITY

3. Expansion of Indicator B-3, showing the possibility of entering directly or calculating the number of people living in damaged dwellings, and entering the number of damaged dwellings itself.



REFERENCES

United Nations. 2016a. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c)
Sustainable development : disaster risk reduction. 1 December 2016.

United Nations. 2016b. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. Note by the Secretary-General. E/CN.3/2016/2/Rev.1*. United Nations Economic and Social Council. Statistical Commission. Forty-eighth session. Item 3 (a) of the provisional agenda. 15 December 2016.

United Nations. 2017. *Resolution adopted by the General Assembly on 2 February 2017*. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. A/RES/71/276. United Nations General Assembly, Seventy-first session Agenda item 19 (*c*). 2 February 2017.

United Nations Economic and Social Council. 2017. *Draft report subject to editing.* Report on the forty-eighth session (7-10 March 2017). Statistical Commission. E/2017/24-E/CN.3/2017/35. Economic and Social Council. Official Records 2017. Supplement No. 4.

JRC, Tom De Groeve, Karmen Poljansek, Daniele Ehrlich, 2013. Recording Disaster Losses : Recommendations for a European approach. European Commission, 2013. EUR 26111 EN. – Joint Research Centre – Institute for the Protection and the Security of the Citizen.

Integrated Research on Disaster Risk (IRDR). 2015. Guidelines on measuring losses from disasters. Human and Economic Impact Indicators. Integrated Research on Disaster Risk (IRDR), Data Project Report No. 2. 2015.

Université Catholique de Louvain. EM-DAT - The OFDA/CRED international disaster database—www.emdat.net. Université Catholique de Louvain, Brussels, Belgium. http ://www.emdat.be

DesInventar - UNISDR Open Source Loss Data Platform, Geneva, Switzerland.
http ://www.desinventar.net

OSSO Desinventar.org—DesInventar Project for Latin America. Corporación OSSO, Cali, Colombia. http ://desinventar.org/en/

United Nations Development Programme (UNDP). 2013. A comparative review of country-level and regional disaster loss and damage databases. UNDP, Bureau for Crisis Prevention and Recovery. New York. 2013.

United Nations Office for Disaster Risk Reduction (UNISDR). 2009. Global Assessment Report on Disaster Risk Reduction : Risk and Poverty in a Changing Climate. Geneva, Switzerland : UNISDR.

UNISDR. 2011a. Global Assessment Report on Disaster Risk Reduction : Revealing Risk, Redefining Development. Geneva, Switzerland : UNISDR.

UNISDR. 2011b. *Desinventar.net database global disaster inventory.* United Nations International Strategy for Disaster Reduction, Geneva.

UNISDR. 2013. Global Assessment Report on Disaster Risk Reduction : From Shared Risk to Shared Value : the Business Case for Disaster Risk Reduction. Geneva, Switzerland : UNISDR. http ://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2015a. GAR 2015. Annex 2: Loss Data and Extensive Risk Analysis. UNISDR. Geneva, 2015. http://www.preventionweb.net/english/hyogo/gar/2015/en/gar-pdf/Annex2-Loss_Data_and_Extensive_Risk_Analysis.pdf

UNISDR. 2015b. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2015c. Technical Collection of Issue Papers on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2016. Technical Collection of Concept Notes on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 10 June 2016.

Working Text on Terminology. Based on negotiations during the Second Session of the Open-ended Intergovernmental Expert Working Group on Terminology and Indicators Relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Working Text on Indicators. Based on negotiations during the Second Session of the Open-ended Inter-Governmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

WHO (2015). Global Reference List of 100 Core Health Indicators. Geneva, Switzerland.

WHO (2016). International Health Regulations (2005), 3rd Edition. Geneva, Switzerland.

Lim, S.S., Allen, K., Bhutta, Z.A., Dandona, L., Forouzanfar, M.H., Fullman, N., Gething, P.W., Goldberg, E.M., Hay, S.I., Holmberg, M. and Kinfu, Y., 2016. Measuring the health-related Sustainable Development Goals in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015. The Lancet, 388(10053), pp.1813-1850.

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

United Nations Office
for Disaster Risk Reduction

1. Overview

The purpose of this note 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 note 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 Technical guidance 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[8]) 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 choose between the methodology proposed by the secretariat or a selected nationally defined methodology 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 such as PDNA (Post Disaster Damage and Needs Assessment) and DALA (Damage, Loss and Need Assessment) derived from the above-mentioned ECLAC methodology[9]. However, the economic losses associated with small and medium-scale disasters are rarely assessed or even documented. Furthermore, in the minority of cases where the attribute *economic loss* is present in many disaster loss databases and disaster situation reports, 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.

The methodology proposed here suggests, 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 and verification mechanism 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.

6 See Global Assessment Report 2015. Annex 2. Loss Data and Extensive Risk Analysis. Geneva, Switzerland. See also 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 *Handbook for Disaster Assessment,* UN Economic Commission for Latin America and the Caribbean ECLAC, http://repositorio.cepal.org/bitstream/handle/11362/36823/S2013817_en.pdf?sequence=1

9 *Damage, Loss And Needs Assessment - Tools And Methodology*, GFDRR, accessible at https://www.gfdrr.org/damage-loss-and-needs-assessment-tools-and-methodology

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 example those existing in European countries such as Spain or France) for the determination of damage in the housing sector, which are conducted by damage assessment experts in situ and provide estimations of the economic loss on a case by case basis.

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

The methodologies presented here for the economic assessment of direct losses of 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.

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, schools, 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.

In all cases and independently of the selected economic assessment methodology, the secretariat strongly suggests, 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, to help understanding disaster risk, 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 *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. *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. *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. *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[10] for adoption by the Economic and Social Council.

10 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, impacts on natural assets, loss of revenue or income due to missing assets, interruptions to transportation networks, 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 (please note this does not consider building back better).

Metadata: a set of data that describes, provides context and gives information about other data. In the context of the Sendai Framework Targets and Indicators, Metadata provides the additional information about the number, list, type and description of the elements (Productive Assets and Infrastructure elements) for which Member States are collecting data and estimating losses. Additionally, Metadata will also be used to provide additional information about the described items themselves (like typical size, or average number of employees) and the country (with data such as population, GDP, total number of households, etc.) that provide the required context for the indicators (notably economic loss and livelihoods) to be successfully estimated.

Annotations: Metadata has been proposed for a number of knowledge domains, most notably for geographic and spatial information, but there are also many standards and de-facto proposals for many other areas such as health, documentation, internet registry, government records, statistical data and many other.

5. Computation Methodology

Given the very significant differences among data collection processes around the world, the OIEWG Report and discussions gave countries freedom to choose between the methodologies proposed by the secretariat or a selected nationally defined methodology by which direct economic loss to damaged or destroyed productive assets attributed to disasters is determined.

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

1. C-1 compound 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/DALA.[11]

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 (PPP) into consideration.

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

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

An 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.

11 Economic Commission for Latin America and the Caribbean "Handbook for the 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-2C: Direct crop loss
- C-2L: Direct livestock loss [12]
- C-2FO: Direct forestry loss
- C-2A: Direct aquaculture loss
- C-2FI: Direct fisheries loss

$$\boldsymbol{Impact\ to\ Agriculture}: \boldsymbol{C2} = C2C + C2L + C2FO + C2A + C2FI$$

Sub-indicator components:

- **Production**
- **Productive 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. reduction 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 computation methods and subsector-relevant formulas, please refer to Annex 1.

12 Should also include apiculture

DISASTER IMPACT ON PRODUCTION	
Items	**Measurement**
Stocks: **Stored inputs** (Seeds, fertiliser, feed, fodder, etc.) **Stored production** (Crops, livestock produce, fishes, logs, etc.) **Perennial trees**	1. Pre-disaster replacement value of destroyed stored production and inputs
Production **Value of lost crops, livestock, forestry, aquaculture production and fisheries capture production** (excluding stored outputs, already stated above)	2. Difference between expected and actual value of production (crops, livestock, forestry, aquaculture production and fisheries capture) in disaster year For perennial crops and forestry: 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 For livestock and aquaculture: 2. Discounted foregone value of livestock products from dead livestock until full recovery 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 [13] used in crop and livestock farming, forestry, fisheries, aquaculture, apiculture	Total destruction: replacement cost of fully destroyed assets at pre-disaster price Partial destruction: repair/rehabilitation cost of partially destroyed assets at pre-disaster price

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)

13 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.

- *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* **r***eplacement 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* **+** *Aquaculture 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 III 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 suggested here proposes the conversion of physical damage value into economic value using replacement cost to estimate direct economic loss. The methodology is consistent with UN-ECLAC DALA and PDNA methodology. Collection and calculation is described in 3 steps.

Step 1: Collect good quality data on physical damage, ideally disaggregated and described in Metadata

- 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 kinds of assets in all economic sectors, including services, according to an international classification.***"

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.

In order to make more precise the estimation of losses, it is suggested that countries consider additional disaggregation criteria; one could be size typologies (for example small, medium, large health facilities), and/or the different levels of damage (partially, fully destroyed).

The decision of including more disaggregation criteria involves imposing additional burden to the data collection:

Option 1: Basic 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** (or by brackets of damage ratio such as light damage, medium damage, total loss) are collected and reported separately per type of asset.

Option 3: Number of assets damaged and destroyed (or by brackets of damage ratio) is collected and also reported by size category, level of damage and type of asset.

As an example of these 3 options, a country may decide to report only on **Educational** and **Health** Facilities as follows:

Example for Option 1: The total number of health facilities affected and the total number of educational facilities affected are reported.

Example for Option 2: For each type of asset **(**Education and Health facilities), the total number of damaged facilities and the number of destroyed facilities will be collected and reported.

Example for Option 3 : For assets of type Education Facility, each of the numbers of damaged and destroyed facilities will be reported separately for Elementary, High school, Universities and other Training Centres. In this case the Metadata of the country will be set-up with typical sizes assigned to each class of education facility. A similar approach could be followed for Health Facilities, with number of damaged and destroyed facilities of each of the classes Health posts and centres, Clinics, Hospitals, and the Metadata reflecting a typical size for each of these.

The Metadata for **Option 3 of** this example would look like the following table :

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

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

The OIEWG report requests that "*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.*"

In order to comply with the Member State request that countries should describe which productive assets are taken into account, and in order to allow for a uniform estimation of the economic losses when it is opted for the methodology described below, the secretariat will implement the concept of extended **Metadata** within the online Sendai Framework Monitor, allowing all of this information to be entered into the reporting system.

It is important to note that* most *of the Metadata will be entered once into the system, at the setup of the system and would not change for the span of the reporting period. Exception will be construction costs, which may vary from year to year, and demographic data. Metadata will also help in calculating livelihoods affected.

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

The general methodology is based in the concept of Replacement Value. It is important to note that replacement value does not necessarily correspond to Market Value. The calculation of replacement cost is based on construction cost, and takes into account the following (based upon DALA/PDNA methodology):

- Average size (area) of affected premises
- Construction cost per square metre
- Estimated average value of stored equipment and products (including raw materials & finished product)
- Estimated average value of the associated connections to public services and utilities infrastructure (i.e. roads, electricity, water, sewage, etc.)

Depending on the level of disaggregation (damage/destroyed, size, etc.) in which the data is collected, the following methods would be applied:

Direct Productive Asset Loss Method 1 – Affected Assets Reporting

Applicable if no differentiation between damaged and destroyed is made in the data collection. Calculating equation for economic loss due to affected (damaged or destroyed) productive assets is as follows:

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

- Where
  - C_{3a} is number of productive assets of each type, either damaged **OR** destroyed
  - *Average asset size* is size established in the Metadata describing the asset type. 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.

/ Value of size defined by expert criteria on the design of a small and conservative productive asset of that type.

– *Construction cost per square meter* is the average national value of construction cost per square metre (if reported)

– *Equipment ratio* is the estimated value (expressed as a percentage of the value of the asset) of stored equipment and products (including raw materials and finished products)

– *Infrastructure ratio* is the estimated value (expressed as a percentage of the value of the asset) of the associated connections to utilities infrastructure

– *Affected ratio* is calculated as the estimated average ratio of damage (as a percentage) of all productive assets, including all damaged/destroyed productive assets.

/ **Example:** Assuming 20% of the industries reported to be affected are considered destroyed (i.e. need a replacement or to be rebuilt) and the rest (80%) suffered damage. If an average damage ratio of 25% is used, then the overall affected ratio would be the composite of 100% damage for 20% of industries plus 25% damage to 80% of industries, giving an overall average affected ratio of 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 3** in calculation steps:

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

- 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 the average damage ratio expressed as percentage of the total value of the assets, suggested to be 25% (same as housing sector)
  - **All other variables correspond to those in Method 1**

- Countries are therefore recommended to report information, and to **use the metadata facility described in Annex I** (average size per type, construction cost per square metre, % for content value, % for associated urban infrastructure)

- UNISDR will use statistical methods, national and international data sources, expert criteria 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 and literature references for further information on construction costs.

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, furniture and products stored in premise, and associated urban infrastructure. An **overhead of 25% is proposed to be used as default in the case of productive assets, but it can be 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 25% 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 initial **default metadata**, including these percentages usually attributed to stored equipment and urban infrastructure.

Step 3: Ensure proper comparison across time and convert the value expressed in national currency into USD and derive global loss value

- 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

  - **Method 1:** Observe only affected volume trend, using the same unit price in constant monetary units for all the moments from baseline period until 2030.

  - **Method 2:** Use specific unit price for each year, so that the relative unit price increase/decrease of construction costs in relation to other goods and services indicate the influence of industrial facility loss on overall economy. It is suggested to use nominal per unit price in each moment of time.

- It is recommended to use the official exchange rate in the year of event to convert the value expressed in national currency into USD. (Recommended 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 here suggests 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, similar to C-3 indicator, will account for the following (based upon DALA/PDNA methodology):

- Average size (area) of affected dwellings
- Construction cost per square metre
- Estimated average value of stored furniture and home equipment.
- Estimated average value of the associated connections to public services and utilities infrastructure (i.e. roads, electricity, water, sewage, etc.)

Direct loss in the housing sector – Method
Main Calculating Equation:

$$C_4 = C_{4a} + C_{4b}$$

- Where:
  - C_{4a} is the economic value of loss in houses damaged by disaster
  - C_{4b} is the economic value of loss in houses destroyed by disaster

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

Where:

- *average size, construction cost per square metre, equipment ratio, and infrastructure ratio* have the same definitions as in Indicator C-3.
- *damage ratio* (average damage) is suggested to be 25% of the cost of a completely destroyed house (percentage based on suggestions from DALA/PDNA methods).
- Note the *Number houses damaged* is B_{3a}, also needed and collected for indicator B-3

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

- Note the *Number houses destroyed* is B_{4a}, also needed and collected for indicator B-4

Step 1: Collect good quality data on physical damage, disaggregated by damaged or destroyed.

- **Minimum requirement:** Total number of houses damaged and destroyed collected separately.

It is noted, however, that housing units can have large variations in terms of size and structural type, and therefore construction costs, although not as large as industrial and commercial facilities.

Therefore, if a Member State wishes to improve the accuracy of the estimated losses, it could be suggested that **in addition** to disaggregating the number of houses damaged and destroyed, data could be collected also 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 and would allow a more accurate estimation.

This more 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 policies. Disaggregated data collection can make estimation more accurate and more usable for policy making, but will definitely increase the burden and complexity of the data collection process.

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

Determining the construction cost per square metre and size of housing affected may be difficult given the lack of sources of information and the diversity of housing structure (concrete to wooden)

Several considerations are to be taken into account in the calculations of replacement costs for a number of items in a certain class:

- **Construction Costs:** Countries will need the necessary construction cost per square metre that are to be included in the Metadata. 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.

- **When the housing construction cost per square metre is missing:** Priority will be given to national sources of information about construction cost data, but if there is no alternative available, and after reviewing different options, UNISDR may opt to utilize global data sources regarding unit cost information. Other sources, including private sector data can also 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 in many countries of the world. Annex IV shows a potential method to extrapolate these values from available global information.

- **Average size of houses:** Countries will need the necessary average size of houses, or the different average sizes if more disaggregation is pursued, data that are to be included in the Sendai Framework Monitor Metadata. 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.

- **When the average size is not available:** If it is not possible to obtain size information from official sources, or from private markets (associations of real

estate companies, for example), the size of houses in social interest housing projects might provide a useful benchmark. It is suggested that a small 'social housing solution' be used as model as estimation of the size to be used in methodology (This approach was tested successfully using a simplified GAR 2013 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 also varies by country. If even this size proves to be difficult to establish, then, and 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.

Step 3: 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 the same critical infrastructure units and facilities as considered for Target D, in particular for Indicators D-2, D-3 and D-4.

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

- 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.

The set of critical infrastructures for which Member States are permitted to report is very wide. Please see the Technical Guidance for Target D, which provides complete details of the proposed classification of Critical Infrastructure. It will be noted that, from the point of methodologies to estimate direct loss, it is almost impossible to provide guidance for all types of infrastructure.

This Guidance will only provide two methodological approaches to estimate economic loss that have been developed by UNISDR and the scientific community, which in general cover the following generic types of elements:

- Critical Infrastructure that consists of buildings (for example Health and Education facilities) or can be assimilated to a Productive Asset. Loss denoted by $C_{5\ [buildings]}$
- Roads and Highways and, in general, linear structures for which rehabilitation or reconstruction costs can be estimated based on the length of the affected element (e.g. meters of road damaged) and a stable fixed price for length unit (cost per linear meter). Loss denoted by $C_{5\ [linear]}$

  Infrastructure that belong to these two Groups will be marked as such in the Metadata and have relatively simple methods for the estimation of losses, which are reviewed in this section.
- For the rest of the elements of critical infrastructure NOT belonging to any of these groups, Member States are requested to **provide the corresponding rehabilitation or reconstruction cost,** depending on the level of damage. Also, it is requested to countries that **the number of these infrastructures** is also reported. The associated **Metadata** will reflect these considerations. Loss denoted by $C_{5\ [other]}$

Therefore, indicator C-5 will consist of:

$$C_5 = C_{5[buildings]} + C_{5[linear]} + C_{5[other]}$$

The UNISDR secretariat will attempt in the future to develop (or simplify) additional methodologies for the guidance of countries, in partnership with Member States, other UN agencies and relevant stakeholders. In the meanwhile it is suggested that countries use:

- A nationally developed methodology
- The actual costs incurred for rehabilitation or reconstruction
- Internationally developed and recognized methodologies such as UN-ECLAC, UN-PDNA or WB-DALA (see References)

Direct Critical Infrastructure Loss – for Critical Infrastructures that consists of buildings (for example Health and Education facilities)

Suggested methods correspond to those suggested to C-3. Please refer to that section for additional details:

Method 1 – Data not disaggregated (no distinction of Damaged/Destroyed)

$$C_{5[buildings]} = Number\ of\ affected\ facilities * average\ size\ of\ the\ facilities * construction\ cost\ per\ Unit * equipment\ ratio * infrastructure\ ratio * affected\ ratio$$

Where

- $C_{5\ [buildings]}$ is economic loss from affected infrastructure, either damaged or destroyed

Method 2 – Data disaggregated in Damaged and Destroyed

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

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

Where

- $C_{5\ [buildings]}$ is economic loss from damaged infrastructure (building types)
- $C_{5\ [buildings]}$ is economic loss from destroyed infrastructure (building types)
- *the rest of variables are defined as in C-3*

Direct Critical Infrastructure Loss – for Critical Infrastructures that consists of linear elements (for example roads)

Evaluation of the economic loss of this elements will be based on the total length of the elements affected, damaged or destroyed, and the rehabilitation and reconstruction costs. These two costs will be recorded in the metadata.

It is expected that relevant Ministries (Transportation, Public Works) should be enabled to provide average rehabilitation and reconstruction costs for the different types of linear structures that can be estimated with this methods.

In particular it is expected that this methodology can be applied for road damage. Annex V shows the case of a global effort testing this methodology and using road rehabilitation and reconstruction costs obtained by the World Bank.

While not tested, it is possible that this methodology is also applicable to other linear elements, such as railway lines, power transmission lines, oil pipelines, and other similar elements for which cost can be established by length unit and for which damage is measured also in units of length.

Method 1 – Data no disaggregated (no distinction of Damaged/Destroyed)

$$C_{5[linear]} = Length\ of\ affected\ elements * rehabilitation\ cost\ per\ Unit\ length$$

Where

- $C_{5\ [linear]}$ is the direct economic loss from affected linear infrastructure, either damaged or destroyed

Method 2 – Data disaggregated in Damaged and Destroyed

$$C_{5a[linear]} = Length\ of\ damanged\ elements * rehabilitation\ cost\ per\ Unit\ length$$

$$C_{5b[linear]} = Length\ of\ damanged\ elements * reconstruction\ cost\ per\ Unit\ length$$

Where

- $C_{5a\ [linear]}$ is economic loss from damaged infrastructure (linear element types)
- $C_{5b\ [linear]}$ is economic loss from destroyed infrastructure (linear element types)

Note that in this case, when data is not disaggregated in damaged and destroyed the method suggested uses the most conservative approach, taking as base the rehabilitation cost.

Direct Critical Infrastructure Loss – Data Collection considerations

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 (and D-4, therefore) data should be described using the same Metadata Format as C3. ISIC classification already includes codes and groups for

Health and Education facilities. ISIC codes will also be used for infrastructures that are classified in that standard.

- 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 must 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.

Damage to transportation facilities can be very 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

  Metadata for the Sendai framework will contain a set of Infrastructure items that will include these items, in different levels of details to make more accurate the application of the groups of methods hereby described.

- The data available in national 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 as described above. **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 element, 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, and the variance in this value is very large.
  – 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), actual reconstruction costs, or estimates 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 metres 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
/ Number of meters of flood protection walls damaged
/ Area in square meters of green infrastructure elements.

– For Indicator C-5 :

/ Economic value of damages to road networks
/ Economic value of damages to bridges affected
/ Economic value of damages to railway networks
/ Economic value of damages to ports affected
/ Economic value of damages to airports affected
/ Economic value of flood protection walls damaged
/ Economic value of green infrastructure elements.

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, a good part of economic losses associated with cultural assets are indirect losses, mainly connected to future income losses associated 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 C_{6a} and the second composed of 'movable' elements such as art, historical artefacts (C_{6b}):
  - C_{6a} for damaged non-movable assets: is the cost of rehabilitating, recovering and restoring the assets to a standard similar to that of the pre-disaster situation of buildings, monuments and fixed infrastructure of cultural heritage assets
  - C_{6a} for destroyed non-movable assets that have a real estate market value, the property price could be kept as a proxy C_{6a} .
  - C_{6a} for destroyed non-movable assets that have no real estate market value, the cost of replacing the asset by a new one with similar functions can be used as a proxy for C-6a. In case of assets that can be assimilated to buildings, the replacement cost methodology described for C-3 and other indicators – based on replacement value- can be used.
  - C_{6b} is cost of rehabilitation or restoring of movable cultural heritage damaged
  - C_{6c} is (whenever is available) acquisition or market value of movable cultural heritage destroyed or totally lost.
- Along with these economic loss estimations, it is also recommended to record simple measures of physical damage:
  - C_{6d} is number of buildings, monuments and fixed infrastructures of cultural heritage assets damaged by disasters.
  - C_{6e} is number of buildings, monuments and fixed infrastructures of cultural heritage assets destroyed by disasters.
  - C_{6f} is number of movable cultural heritage assets (such as artworks) damaged
  - C_{6g} is number of movable 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 consequence 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.** **COMPOUND INDICATOR. See computation methodology, Section 5.** **Additional demographic and socio-economic parameters needed** **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**

[Minimum data requirements]:

Data to be collected for each disaster
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.

- **C-2:** Direct agricultural loss attributed to disaster.
- **C-2C:** Loss in crops damaged or destroyed by disasters
- **C-2L:** Loss in livestock dead by disasters
- **C-2Fo:** Loss in forests damaged or destroyed by disasters
- **C-2A:** Loss in Aquaculture production area affected
- **C-2Fi:** Loss in Fisheries production area affected
- **C-2Ia:** Loss in damaged/destroyed productive assets (machinery and facilities) in all of the above subsectors. In the case of fishing sector this will include vessels
- **C-2Ib:** Pre-disaster value of Stock (stored inputs such as Seeds, fertiliser, feed, fodder, forage, etc., and stored production such as crops, livestock produce, fishes, logs, etc.)

The following physical damage indicators will be required, and will be accepted in lieu of the corresponding estimated economic loss.

- **C-2Ca:** Number of Hectares of crops damaged or destroyed by disasters
- **C-2La:** Number of livestock lost 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 damaged/destroyed productive assets (machinery and facilities) associated to all agricultural subsector above. In the case of fishing sector this will include vessels.

Note that for sub-indicators C-2Ia and C-2Iaa 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.

Loss in Agricultural productive assets will be reported in C-2 and must not be duplicated in C-3. The classification and related metadata mechanism will allow this distinction.

For countries that wish to obtain more accurate economic loss estimates, 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. Note that countries opting for higher accuracy using this mechanism will have a more complex data collection.

To be Included based upon A/71/644:

- **C-2Ia, C-2Laa:** Include in this sub-indicator **Losses to apiculture**

Definition of Metadata Describing Assets and Infrastructure elements:
For each type of productive asset that is reported Metadata should contain:

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

Note that the majority of Metadata definition and entry would happen only once, at the setup of the data collection process, with the exception of Value per unit, an optional annual series. Please see ANNEX I for more information and examples of proposed Metadata schema.

[Desirable Disaggregation]:

- **ALL:** by Hazard
- **ALL:** by Geography (Administrative unit)
- **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	**Direct economic loss to all other damaged or destroyed productive assets attributed to disasters.** ***Annotation from A/71/644:*** *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.* **Please see note and brief description of Metadata in Indicator C-2 in this table.** *Please see ANNEX I for more information and examples of proposed Metadata schema.* **[Minimum data requirements]:** **Data to be collected for each disaster** **For each of the asset types declared in Metadata that are affected in a disaster:** • **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. • **C-3a:** Number of productive assets of each type, either damaged or destroyed **or** • **C-3b:** Number of productive assets damaged of each type • **C-3c:** Number of productive assets destroyed of each type **[Desirable Disaggregation]:** • by Hazard • by Geography (Administrative Units) • By type level of affectation (damaged/destroyed). This should be reflected in Metadata. • By size of Facility (small/medium/large). This should be reflected in Metadata.
C-4	**Direct economic loss in the housing sector attributed to disasters.** **[Minimum data requirements]:** **Data to be collected for each disaster** • **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. • **C-4a:** Number of houses damaged by disasters • **C-4b:** Number of houses destroyed by disasters **[Desirable Disaggregation]:** • by Hazard • by Geography (Administrative unit) Optionally, countries wishing to have more accurate estimates: • Criteria such as size of House (small/medium/large), and/or • Criteria such as rural/urban, and/or • Criteria such as material (wood, cardboard, masonry, etc.) **Additional demographic and socio-economic parameters required** • **Average size:** weighted average of house size in the country (or per class of house, if so declared in Metadata) • **Value per unit:** [Series per Year 2005… 2030]

C-5	**Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters.** ***Annotation from A/71/644:*** *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.* **[Minimum data requirements]:** **Data to be collected for each disaster** For each of the infrastructure types declared in Metadata that are affected in a disaster: • **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. • **C-5a:** Type of asset (Code, see metadata) • **C-5b:** Number of Units or Number of these Infrastructure assets damaged/destroyed **Please see note and brief description of Metadata in Indicator C-2 in this table.** *Please see ANNEX I for more information and examples of proposed Metadata schema.* **[Desirable Disaggregation]:** • By type level of affectation (damaged/destroyed) • By size of Facility (small/medium/large or criteria such as unpaved, single paved, highway for roads)
C-6	**Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.** **Data to be collected for each disaster:** **[Minimum data requirements]:** • C_{6a} economic value of loss of damaged or destroyed non-movable assets • C_{6b} economic value of loss of movable cultural heritage damaged • C_{6c} economic value of loss of movable cultural heritage destroyed or totally lost. • C_{6d} is number of buildings, monuments and fixed infrastructures of cultural heritage assets damaged by disasters. • C_{6e} is number of buildings, monuments and fixed infrastructures of cultural heritage assets destroyed by disasters. • C_{6f} is number of movable cultural heritage assets (such as artworks) damaged • C_{6g} is number of movable cultural heritage assets destroyed

7. Other specific issues

Given the very significant differences among data collection processes around the world, the OIEWG Report and discussions gave countries freedom to choose between the methodologies proposed by the secretariat or a selected nationally defined methodology by which direct economic loss to damaged or destroyed productive assets attributed to disasters is determined.

Temporal Aspects

An 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*, where most impacts occur close to the time of initial onset of the event, finalizing data collection and declaring the data collected as final is relatively straightforward. However, some challenges may be encountered – for instance with regard to the definition of the period after which costs of reconstruction of infrastructure should be reflected in the data collected as attributed to the disaster.

In these cases, the decision of a cut-off period will be made by each Member state, based on its own legal system and data collection objectives. On the one hand, some cases may take very long before they can be registered (for example with a long reconstruction of a cultural heritage site). In general, it is assumed these cases represent a small minority and should not affect the statistical strength, **from a global perspective,** of data that are collected within sensible and consistently applied cut-off time periods.

However, other Member States may decide to be fully sensitive about all economic loss, meaning that even the costs obtained long time after the event should be also counted and respected in statistics, regardless of the impact on the overall data. In both cases the recommendation is to keep a consistent treatment of these data.

In *large-scale, slow-onset and long duration disasters,* where losses accumulate over time, the issue is more problematic. Large-scale disasters usually require a much longer response phase, for example, or entail a more complex information management to determine the final economic losses that are attributed to disasters. Slow-onset and long duration disasters (e.g. droughts, epidemics) may span several years, with the corresponding challenge of compounding the information across the time span of the disaster. However, the data should be reported as the economic loss in the year when the loss occurred, without waiting for the complete response phase to cease.

Usually there are two temporal frameworks for the assessment of economic loss in the aftermath or during large scale disasters, the first one a "Rapid assessment" which is usually completed within one month (28 days) of disaster taking place using methods such as the PDNA. The purpose of these assessments is to provide reliable enough figures for a Humanitarian Appeal/Relief triggering mechanism, for example UN Flash Appeals, EU solidarity fund, or other international aid mechanisms.

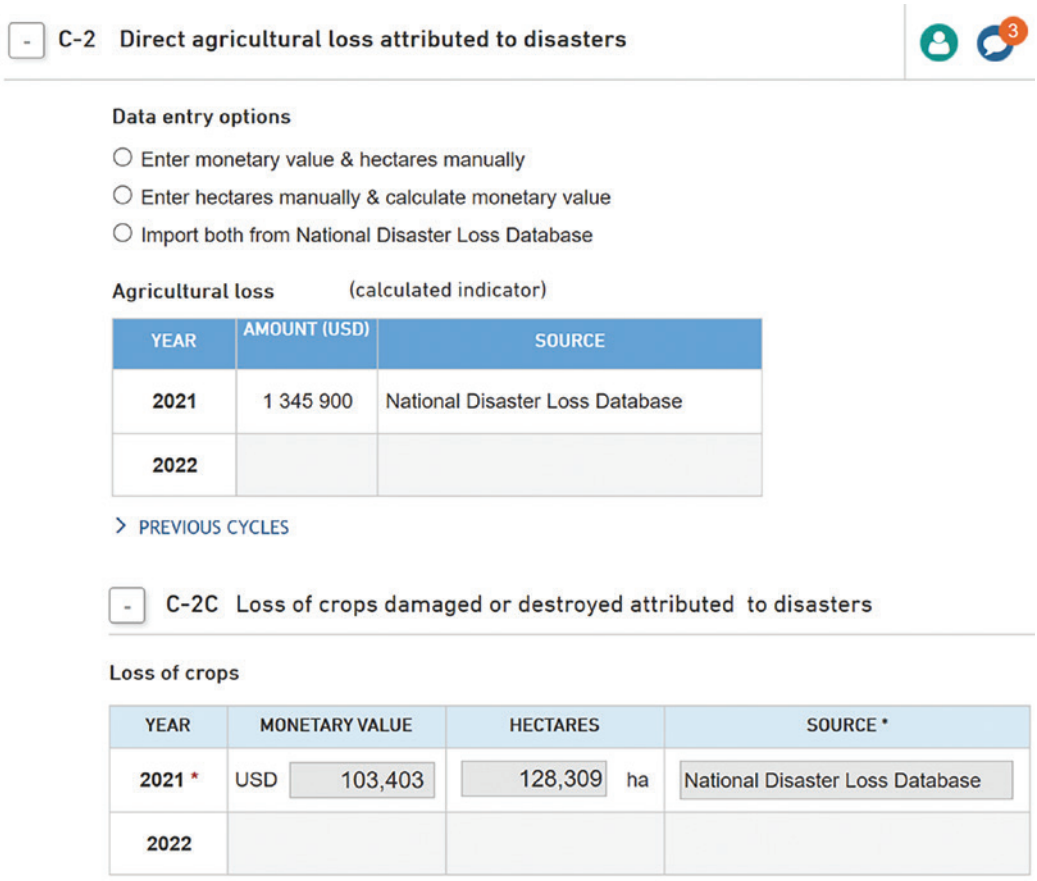
A second type of assessment a "Detailed assessment" using comprehensive, multi-sectoral methodologies such as the UN-ECLAC or WB-DALA, are completed within 3-12 months of disaster taking place. Their purpose is to obtain figures to fund and guide Reconstruction planning, and compensation payment.

For the purposes of a good data collection, **UNISDR recommends, if it is available, the usage of a Detailed Assessment,** and encourages Member States to introduce procedures by which the quality, comprehensiveness and coverage of a Rapid assessment could be improved and made more reliable over each country's defined cut-off period.

8. Sample Data Entry Screens

The following are illustrative screen captures taken from the Sendai Framework Monitor Prototype system. Actual implementation may vary.

1. Data Entry, section Target C-2 :



C-2 Direct agricultural loss attributed to disasters

Data entry options

- ○ Enter monetary value & hectares manually
- ○ Enter hectares manually & calculate monetary value
- ○ Import both from National Disaster Loss Database

Agricultural loss (calculated indicator)

YEAR	AMOUNT (USD)	SOURCE
2021	1 345 900	National Disaster Loss Database
2022		

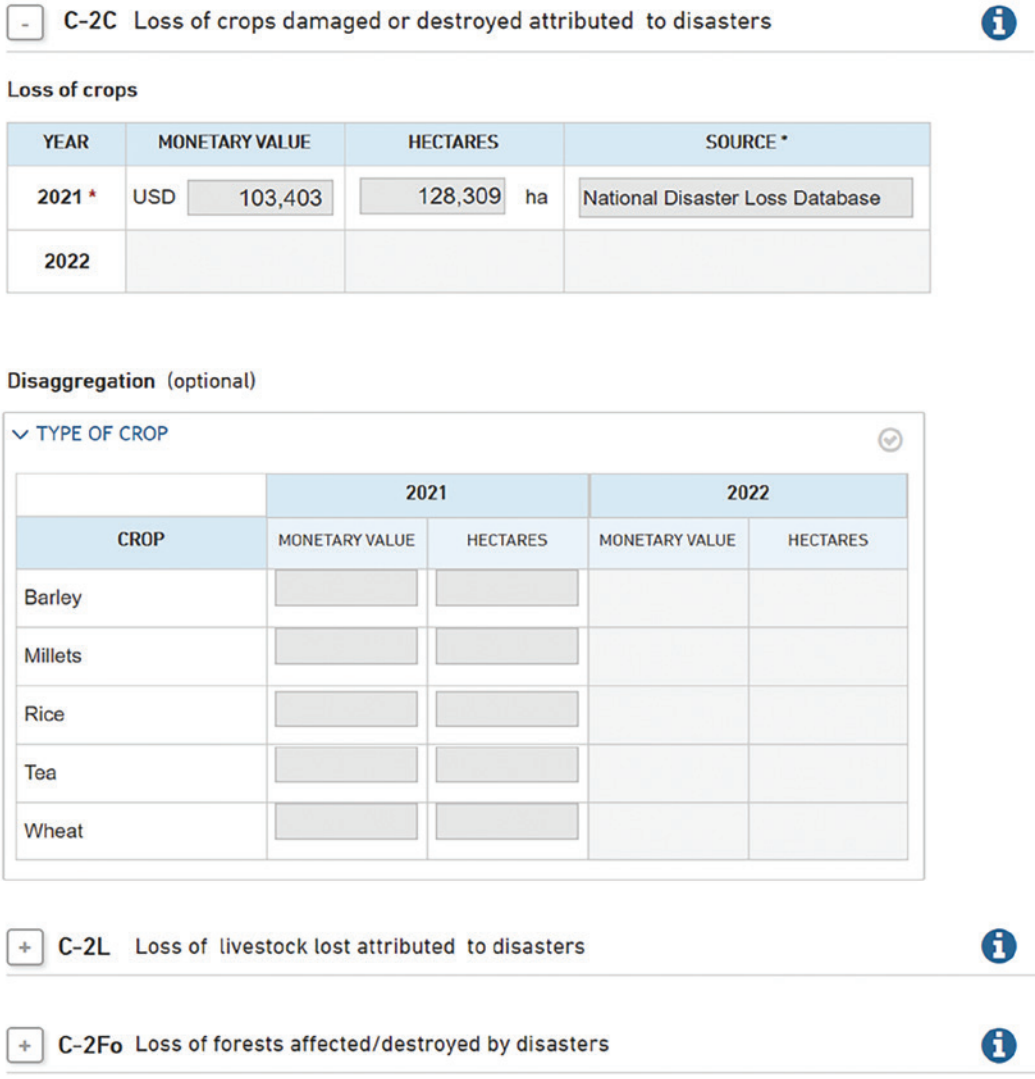
› PREVIOUS CYCLES

C-2C Loss of crops damaged or destroyed attributed to disasters

Loss of crops

YEAR	MONETARY VALUE	HECTARES	SOURCE *
2021 *	USD 103,403	128,309 ha	National Disaster Loss Database
2022			

2. Disaggregation of C-2 according to types of crops in metadata :



- C-2C Loss of crops damaged or destroyed attributed to disasters

Loss of crops

YEAR	MONETARY VALUE	HECTARES	SOURCE *
2021 *	USD 103,403	128,309 ha	National Disaster Loss Database
2022			

Disaggregation (optional)

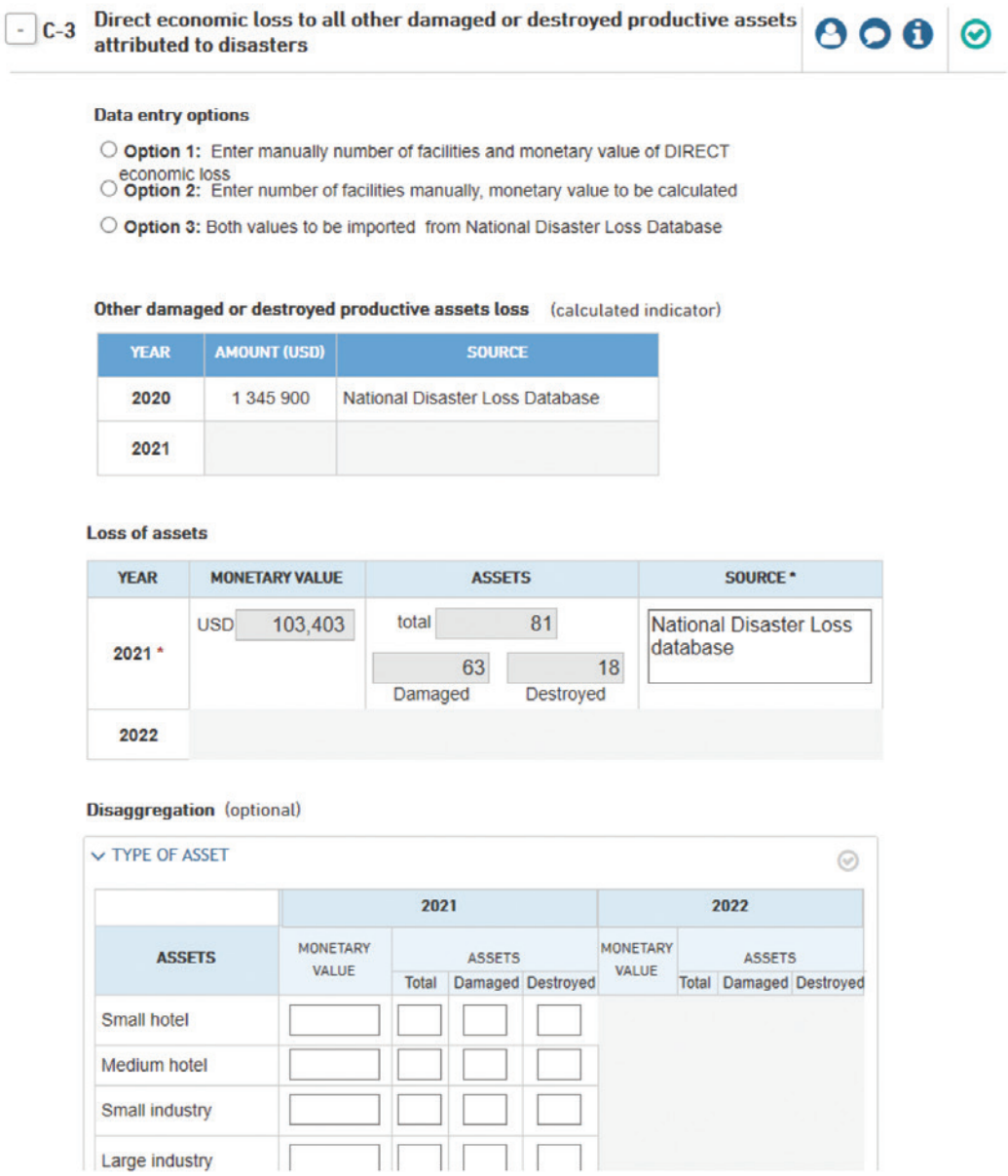
TYPE OF CROP

	2021		2022	
CROP	MONETARY VALUE	HECTARES	MONETARY VALUE	HECTARES
Barley				
Millets				
Rice				
Tea				
Wheat				

+ C-2L Loss of livestock lost attributed to disasters

+ C-2Fo Loss of forests affected/destroyed by disasters

3. Data entry for C-3, including Metadata-driven List of productive assets.:



C-3 **Direct economic loss to all other damaged or destroyed productive assets attributed to disasters**

Data entry options

- ○ **Option 1:** Enter manually number of facilities and monetary value of DIRECT economic loss
- ○ **Option 2:** Enter number of facilities manually, monetary value to be calculated
- ○ **Option 3:** Both values to be imported from National Disaster Loss Database

Other damaged or destroyed productive assets loss (calculated indicator)

YEAR	AMOUNT (USD)	SOURCE
2020	1 345 900	National Disaster Loss Database
2021		

Loss of assets

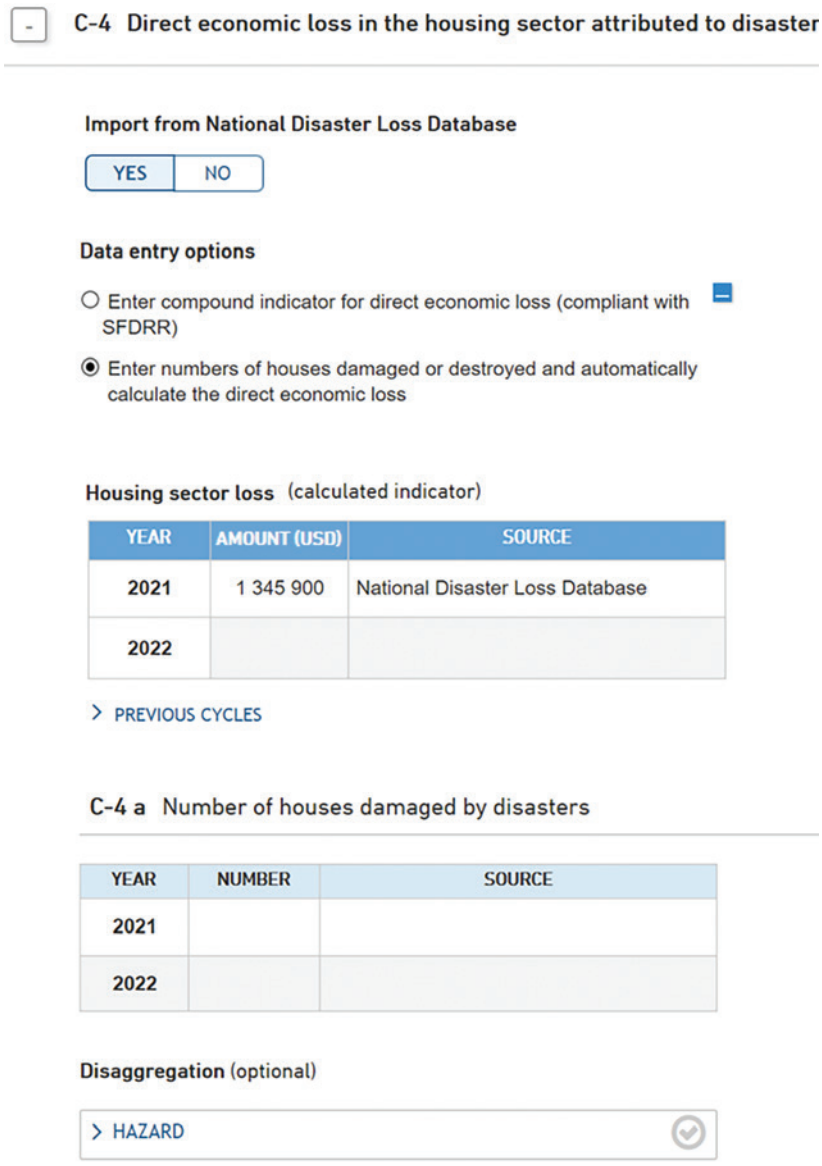
YEAR	MONETARY VALUE	ASSETS	SOURCE *
2021 *	USD 103,403	total 81 63 Damaged 18 Destroyed	National Disaster Loss database
2022			

Disaggregation (optional)

TYPE OF ASSET

	2021				2022			
ASSETS	MONETARY VALUE	ASSETS			MONETARY VALUE	ASSETS		
		Total	Damaged	Destroyed		Total	Damaged	Destroyed
Small hotel								
Medium hotel								
Small industry								
Large industry								

4. Data Entry for indicator C-4 :



ANNEX I: Definition and examples of Metadata

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

In the context of the Sendai Framework Targets and Indicators, Metadata provides the additional information about the number, list, type and description of the elements (Productive Assets and Infrastructure elements) for which Member States are collecting data and estimating losses. Additionally, Metadata will also be used to provide additional information about the described items themselves (like typical size, or average number of employees) and the country (with data such as population, GDP, total number of households, etc.) that provide the required context for the indicators (notably economic loss and livelihoods) to be successfully estimated.

Annotations: Metadata has been proposed for a number of knowledge domains, most notably for geographic and spatial information, but there are also many standards and de-facto proposals for many other areas such as health, documentation, internet registry, government records, statistical data and many other.

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 summary, the definition of Sendai Framework Metadata is as follows:

Sendai Framework 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 additional 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, meter, 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 or description of method 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 examples 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 1,3m 2018 1,4m 2019 ….. …..	Persons	National Census
Number of Households	250k 2017 254k 2018 259k 2019 ….. …..	Households	National Census
GDP	5.1 b 2017 5.6 b 2018 5. 9b 2019 ….. …..	USD	Ministry of finances World Bank
GDP Deflator	1.0 2017 1.1 2018 1.12 2019 ….. …..	Multiplier	Ministry of finances World Bank
…	…. …. …. ….		
…	…. …. …. ….		
…	…. ….		

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

Type of Productive asset or Infrastructure	average size of facilities	construction cost per Unit USD $, by YEAR (b) USD of 2015	Addi-tional % Equip-ment, furni-ture & mate-rials	Addi-tional % associat-ed infra-structure	Meas-ure-ment UNIT	For-mula	No. Work-ers
Small Industrial Facility (Group C Manufacturing on ISIC)	100	1,200 2017 1,220 2018 1,245 2019 ….. …..	25%	25%	Mt^2	A* B* C* D* DR	10
Medium Industrial Facility (Group C Manufacturing on ISIC)	600	1,200 2017 1,205 2018 1,215 2019 ….. …..	40%	25%	Mt^2	…	50
Large Industrial Facility (Group C Manufacturing on ISIC)	3,000	1,200 2017 1,220 2018 1,245 2019 ….. …..	60%	20%	Mt^2	…	1000
Commercial – small shop (Group G Wholesale and retail trade on ISIC)	60	800 2017 809 2018 ….. …..	50%	25%	Mt^2	…	3
Commercial – large shop (Group G Wholesale and retail trade on ISIC)	1,000	800 2017 809 2018 ….. …..	800	25%	Mt^2	…	100.
Small tourism facility (Group I Accommodation and food service on ISIC)	1,000	800 2017 809 2018 ….. …..	25%	25%	Mt^2	…	15
Large tourism facility (Group I Accommodation and food service on ISIC)	10,000	1,200 2017 1,220 2018 1,245 2019 ….. …..	25%	25%	Mt^2	…	300
Housing (C4)	55	500 2017 509 2018 ….. …..	25%	25%	Mt^2	…	1
Small Health facility (C5) (Group Q, Human health and social work on ISIC)	60	800 2017 809 2018 ….. …..	40%	25%	Mt^2		8
Medium Health facility(C5) (Group Q, Human health and social work on ISIC)	1,000	800 2017 809 2018 ….. …..	50%	25%	Mt^2		25
Large health facility(C5)(Group Q, Human health and social work on ISIC)	10,000	800 2017 809 2018 ….. …..	80%	25%	Mt^2		800
Education – Small school (for C5)	100	800 2017 809 2018 ….. …..	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 m2 or a suitable unit)*
- *Construction cost per m2 (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, due to potential retroactive effects.

An important consideration is **that most Metadata is a static data set**. It would contain only a dynamic part, the 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	Measure-ment UNIT	Formula
Industrial Facility (Group C Manufacturing on ISIC)	185	1,200 2017 1,220 2018 1,245 2019 ….. …..	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	Measure-ment UNIT	Formula	No. Workers
Small Industrial Facility (Group C Manufacturing on ISIC)	100	1,200 2017 1,220 2018 1,245 2019 ….. …..	25%	25%	Mt^2	A* B* C* D* DR	10
Medium Industrial Facility (Group C Manufacturing on ISIC)	600	1,200 2017 1,205 2018 1,215 2019 ….. …..	40%	25%	Mt^2	…	50
Large Industrial Facility (Group C Manufacturing on ISIC)	3,000	1,200 2017 1,220 2018 1,245 2019 ….. …..	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 809 2018 ….. …..	40%	25%	Mt^2	…	8
Medium Health facility(C5) (Group Q, Human health and social work on ISIC)	1,000	800 2017 809 2018 ….. …..	50%	25%	Mt^2	…	25
Large health facility(C5)(Group Q, Human health and social work on ISIC)	10,000	800 2017 809 2018 ….. …..	80%	25%	Mt^2	…	800
Education – Small school (C5) (Group P, Education on ISIC)	100	800 2017 809 2018 ….. …..	15%	25%	Mt^2	…	7
Education – Medium Education facility (C5) (Group P, Education on ISIC)	1,000	800 2017 809 2018 ….. …..	25%	25%	Mt^2	…	25
Education – Large education facility (C5) (Group P, Education on ISIC)	10,000	800 2017 809 2018 ….. …..	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-5 and D4 ,D6	Critical Infrastructure and basic public services
C-6	Cultural Heritage
C-5 and D-2	Health
C-5 and D-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 *is output*

j *is geographical units affected by the disaster*

k *is asset (equipment, machinery, tool, facilities) used to produce an agricultural output*

x *is input used for agricultural production*

h *is trees (perennial crop trees and forest trees)*

t *is the first time unit when post − disaster data are available*

$t-1$ *is the first time unit when pre − disaster data are available*

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

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

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

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

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

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

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

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

$ha_{ij,t}$ *is the number of hectares devoted to item i in zone j at time t*

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:
   $(\Delta q_{ij,t} \cdot \bar{w}_i) \cdot (p_{ij,t-1} - \alpha \cdot p_{ij,t})$

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

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

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

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.
- 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.

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.

- For each cluster (i.e. category of stressor's intensity), the mean of loss in zones falling *j* 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.
	"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.
	"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.
	"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.

Terms – Assets	Definition
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).
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.

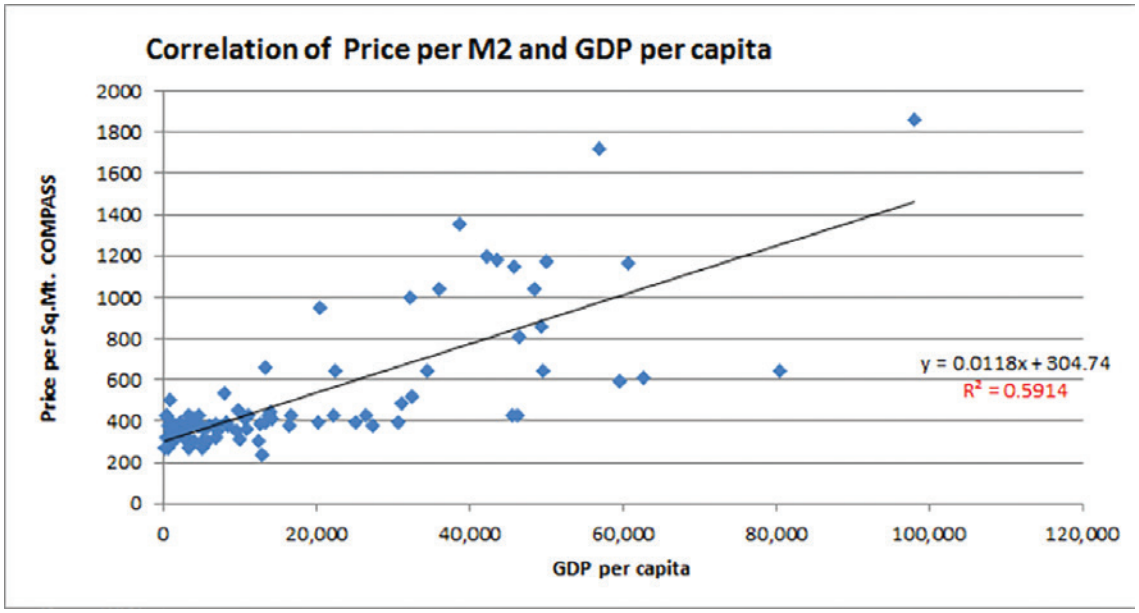
ANNEX IV: Method to derive a proxy for average construction cost

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)[14]. 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.

14 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: GAR 2013 Methodology to derive costs of losses due to road damage

In order to assess the value of damages to roads the following methodology was used and tested in GAR 2013, based on road damage (Mts. of road affected) recorded in DesInventar national datasets, and data about average costs of rehabilitation and reconstruction 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

REFERENCES

United Nations. 2016a. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c) Sustainable development: disaster risk reduction. 1 December 2016.

United Nations. 2016b. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. Note by the Secretary-General. E/CN.3/2017/2. United Nations Economic and Social Council. Statistical Commission. Forty-eighth session. Item 3 (a) of the provisional agenda. 15 December 2016.

Compass International Inc. 2012. *Global construction cost and reference yearbook (2012)*.

United Nations Economic Commission for Latin America and the Caribbean (ECLAC). 2003. *Manual para la estimación de los efectos socio-económicos de los desastres naturales* (LC/MEX/G.5). CEPAL, Banco Mundial, Mexico DF

UNISDR (The United Nations Office for Disaster Risk Reduction). 2009. *GAR 2009: Global assessment report on disaster risk reduction: risk and poverty in a changing climate*. United Nations International Strategy for Disaster Reduction, Geneva

UNISDR (The United Nations Office for Disaster Risk Reduction). 2011a. *GAR 2011: Global Assessment Report on disaster risk reduction: revealing risk, redefining development*. United Nations International Strategy for Disaster Reduction, Geneva

UNISDR (The United Nations Office for Disaster Risk Reduction). 2011b. *Desinventar.net database global disaster inventory.* United Nations International Strategy for Disaster Reduction, Geneva

UNISDR (The United Nations Office for Disaster Risk Reduction). 2013a. *GAR 2013: Global Assessment Report on disaster risk reduction: from shared risk to shared value; the business case for disaster risk reduction*. United Nations International Strategy for Disaster Reduction, Geneva. This document can be accessed online in: http://www.preventionweb.net/english/hyogo/gar/

UNISDR (The United Nations Office for Disaster Risk Reduction) 2013b. *GAR 2013 ANNEX II: Loss Data and Extensive/Intensive Risk Analysis*. United Nations International Strategy for Disaster Reduction, Geneva. This document can be accessed online in: http://www.preventionweb.net/english/hyogo/gar/2013/en/gar-pdf/Annex_2.pdf

UNISDR (The United Nations Office for Disaster Risk Reduction). 2015a. *Indicators to Monitor Global Targets of the Sendai Framework for Disaster Risk Reduction 2015-2030: A Technical Review*. Background paper presented for the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Geneva, Switzerland. This document can be accessed online in: http://www.preventionweb.net/files/45466_indicatorspaperaugust2015final.pdf

UNISDR (The United Nations Office for Disaster Risk Reduction). 2015d. *Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review*. Background paper presented for the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Geneva, Switzerland. This document can be accessed online in: http://www.preventionweb.net/files/45462_backgoundpaperonterminologyaugust20.pdf

UNISDR (The United Nations Office for Disaster Risk Reduction). 2015c. *GAR 2015: Global Assessment Report on disaster risk reduction: Making development sustainable: The future of disaster risk management*. United Nations International Strategy for Disaster Reduction, Geneva. This document can be accessed online in: http://www.preventionweb.net/english/hyogo/gar/

UNISDR (The United Nations Office for Disaster Risk Reduction). 2015d. *GAR 2015 ANNEX II: Loss Data and Extensive Risk Analysis*. United Nations International Strategy for Disaster Reduction, Geneva. This document can be accessed online in: http://www.preventionweb.net/english/hyogo/gar/2015/en/gar-pdf/Annex2-Loss_Data_and_Extensive_Risk_Analysis.pdf
Velásquez, C. A., Cardona, O. D., Mora, M. G., Yamin, L. E., Carreño, M.L and Barbat, A. H. 2014. "Hybrid loss exceedance curve (HLEC) for disaster risk assessment". *Nat Hazards* (2014) 72:455–479. DOI 10.1007/s11069-013-1017-z

Working Text on Terminology. Based on negotiations during the Second Session of the Open-ended Intergovernmental Expert Working Group on Terminology and Indicators Relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Working Text on Indicators. Based on negotiations during the Second Session of the Open-ended Inter-governmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 20160

ECLAC. 2012. *Valoración de daños y pérdidas: Ola invernal en Colombia* 2010–2011. ECLAC, IDB, Bogota

ECLAC. 2014. *Handbook for Disaster Assessment*. Santiago, Chile. http://repositorio.cepal.org/bitstream/handle/11362/36823/S2013817_en.pdf?sequence=1

Université Catholique de Louvain. EM-DAT - The OFDA/CRED international disaster database—www.emdat.net. Université Catholique de Louvain, Brussels, Belgium. http://www.emdat.be

United Nations Food and Agriculture Organization (FAO). 2012. *Post Disaster Damage, Loss and Needs Assessment in Agriculture.* http://www.fao.org/docrep/015/an544e/an544e00.pdf

DesInventar - UNISDR Open Source Loss Data Platform, Geneva, Switzerland. http://www.desinventar.net

OSSO Desinventar.org—DesInventar Project for Latin America. Corporación OSSO, Cali, Colombia. http://desinventar.org/en/

United Nations Development Programme UNDP (), 2013. *A comparative review of country-level and regional disaster loss and damage databases*. Bureau for Crisis Prevention and Recovery. New York.

Cardona, O.D. 1985. *Hazard, vulnerability analysis and risk assessment.* Institute of Earthquake Engineering and Engineering Seismology IZIIS, Skopje

Cardona OD, Ordaz MG, Marulanda MC, Barbat AH. 2008. *Estimation of probabilistic seismic losses and the public economic resilience—an approach for a macroeconomic impact evaluation*.

Cardona OD, Ordaz MG, Reinoso E, Yamin LE, Barbat AH. 2010. *Comprehensive approach for probabilistic risk assessment (CAPRA): international initiative for disaster risk management effectiveness.* Presented at the 14th European conference on earthquake engineering, Ohrid, Macedonia

CIMNE, EAI, INGENIAR, ITEC. 2013a. *Probabilistic modelling of natural risks at the global level: global risk model. Background paper prepared for the 2013 global assessment report on disaster risk reduction.* UNISDR. Geneva, Switzerland. http://www.preventionweb.net/gar

CIMNE, EAI, INGENIAR, ITEC. 2013b. *Probabilistic modelling of natural risks at the global level: the hybrid loss exceedance curve. Background paper prepared for the 2013 global assessment report on disaster risk reduction*. UNISDR. Geneva, Switzerland. http://www.preventionweb.net/gar

United Nations Office for Disaster Risk Reduction. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. 23 December 2015.

United Nations Office for Disaster Risk Reduction. Technical Collection of Issue Papers on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. 23 December 2015.

National Information Standards Organization NISO, Jenn Riley. *Understanding Metadata What Is Metadata, And What Is It For?* A Primer Publication of NISO, 2017.

ISO 19139, 19115. 2009, 2014 - Geographic information Metadata XML Standard. available at https://www.iso.org/standard/32557.html

ISO 15836, 2009, A standard for cross-domain resource description, Dublin Core Metadata Element Set. https://www.iso.org/standard/52142.html

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

United Nations Office
for Disaster Risk Reduction

1. Overview

The purpose of this note 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 note 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).

If **all** aspects of a service disruption due to a disaster were to be measured, the following elements would need to be considered: the length of time of the disruption; the number of times a service is interrupted as a consequence of a disaster, and the length of each interruption; the number of users that suffer the interruption; or a lower quality of service provided.

However, detailed 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 2015-2017 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 and number of infrastructure units** 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**.

Emphasis is made in the fact that a "**disruption"** includes: interruptions, either single or multiple, short or long, of the services, damage to the facilities or networks that provide the service, or a measurable/noticeable reduction in the quality of the service, or reduction in the population covered by the service, **or a combination of all the above**.

Under this schema, if during a disaster, and/or as a consequence of that disaster any of the above situations happen to a given service it would count as **one disruption of a service**. In other words, a service can be disrupted once per disaster, and several services can be disrupted during a disaster. Cascading disruptions of services (for example when the interruption of electricity causes disruption of health services) can also be taken into account as they can be attributed to disasters.

Examples of Disruptions are:

- **Example 1:** During a flood, and sometime after the flood, the water supply was affected in a province. Water was not of the purity required, and because many sources of water were damaged, it had to be rationed to 6 hours per day during 1 month. This means that under this methodology, water service was disrupted by one disaster (**one disruption**).

- **Example 2:** As a consequence of a wind storm, electricity was fluctuating in voltage, it was interrupted several times in different parts of a city, leaving several neighbourhoods without power. This means that electricity was disrupted for this one disaster. As electricity was disrupted, water supply and communications were also interrupted in several neighbourhoods. This means that for this disaster three services were disrupted (electricity, communications and water), counting for **three (3) disruptions**.

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 suggests 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. *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. *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[15] for adoption by the Economic and Social Council.

15 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, regional and tertiary hospitals, outpatient centres, health laboratories 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 methodology proposes to calculate the indexes as follows:

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 disruptions occurred/ population * 100,000

The number of disruptions occurred 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 Indicators C-3 and 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.

It 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.** **[Minimum data requirements]:** **Data to be collected for each disaster (linked to C-5):** D-2 Number of health facilities destroyed or damaged attributed to disasters **[Desirable Disaggregation Requirements] (same as for C-5):** Hazard Geography (Administrative unit) Level of affectation (damaged/destroyed) 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.** **[Minimum data requirements]:** **Data to be collected for each disaster (linked to C-5):** D-3 Number of educational facilities destroyed or damaged attributed to disasters **[Desirable Disaggregation] (same as for C-5):** Hazard Geography (Administrative unit) Level of affectation (damaged/destroyed) 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

Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters.

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.

NOTE THAT THIS INDICATOR SHARES (OR SHOULD SHARE) DATA AND METADATA WITH INDICATOR C-5

[Minimum data requirements]:

Data to be collected for each disaster (linked to C-5):

- **For each of the infrastructure types declared in the Metadata that are affected in a disaster:**
  - **C-5a**: Type of asset (Code, see metadata)
  - **C-5b:** Number of Units or Facilities of these Infrastructure assets damaged/destroyed
  - **C-5c:** Measurement of the damage **for Network units** (in measurement units such as meters or kilometres)

Definition of Metadata describing assets and Infrastructure elements
For each type of productive asset that is reported:

- Code
- Description
- Group or Economic Sector/Activity in ISIC or adopted classification
- Measurement Units (M2, Mt, Hectare, Km, etc.)
- Value per measurement unit [Series per Year 2005… 2030]
- % of value for equipment, furniture, materials, product
- % of value for associated physical infrastructure

Please see ANNEX I of Technical Note for Target C for more information and examples of proposed Metadata schema

[Desirable Disaggregation]:
Hazard
Geography (Administrative unit)
Level of affectation (damaged/destroyed)
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. See method **METADATA** **Additional demographic and socio-economic parameters needed** **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. The global indicator is the sum of the populations of all countries having reported.
D-6	**Number of disruptions to educational services attributed to disasters.** **[Minimum data requirements]:** **Data to be collected for each disaster (linked to D-3):** **D-6** Number of disruptions to educational services attributed to disasters. **[Desirable Disaggregation]:** Hazard Geography (Administrative unit) Disrupted means one or a combination of the following: • Provision of the service was partially or totally interrupted one or more times as consequence of the disaster • Level of quality of the service was degraded • Coverage of the service was reduced • Service Infrastructure was damaged/destroyed
D-7	**Number of disruptions to health services attributed to disasters.** **[Minimum data requirements]:** **Data to be collected for each disaster (linked to D-2):** D-7 Number of disruptions to health services attributed to disasters. **[Desirable Disaggregation]:** Hazard Geography (Administrative unit) Disrupted means one or a combination of the following: • Provision of the service was partially or totally interrupted one or more times as consequence of the disaster • Level of quality of the service was degraded • Coverage of the service was reduced • Service Infrastructure was damaged/destroyed

D-8

Number of disruptions to other basic services attributed to disasters.

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.

[Minimum data requirements]:

Data to be collected for each disaster:

- **For each of the service types declared in Metadata that are affected in a disaster:**
- **D-8a:** Type of asset (Code, see metadata)
- **D-8b: Yes/No** Service was **disrupted**

Definition of Metadata describing services and infrastructure elements
For each type of productive asset that is reported:

- Code
- Description
- 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.

Services for which data collection is recommended:
Water services were disrupted, (linked to D-4)
Sewerage services were disrupted, (linked to D-4)
Transport services were disrupted. (linked to D-4)
Government services were disrupted. (linked to D-4)
Power and Energy services were disrupted. (linked to D-4)
Emergency services were disrupted. (linked to D-4)
Communications /ICT services were disrupted. (linked to D-4)
Solid Waste services were disrupted. (linked to D-4)

These sectors will be integral part of default Metadata added by UNISDR secretariat

[Desirable Disaggregation]:
Hazard
Geography (Administrative Unit)

Disrupted means one or a combination of the following:

- Provision of the service was partially or totally interrupted one or more times as consequence of the disaster
- Level of quality of the service was degraded
- 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 damage to critical infrastructure and basic services attributed to disasters, given the very significant differences among legal regimes, managing authorities and operational procedures 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 :
An 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*, where most impacts occur close to the time of initial onset of the event, finalizing data collection and declaring the data collected as final is relatively straightforward. However, some challenges may be encountered – for instance with regard to the definition of the period after which disruptions to services or damages to infrastructure should be reflected in the data collected as attributed to the disaster.

In these cases, the decision of a cut-off period will be made by each Member state, based on its own legal system and data collection procedures. On the one hand, some cases may take very long before they can be registered (for example with a service that fails long after because of a disaster). In general, it is assumed these cases represent a small minority and should not affect the statistical strength, **from a global perspective,** of data that are collected within sensible and consistently applied cut-off time periods.

However, other Member States may decide to be fully sensitive about all damages and service interruptions, meaning that even some interruptions or damages identified long time after the event should be also counted and respected in statistics, regardless of the impact on the overall data. In both cases the recommendation is to keep a consistent treatment of these data.

In *large-scale, slow-onset and long duration disasters,* where losses accumulate over time, the issue is more problematic. Large-scale disasters usually require a much longer response phase, for example, or entail a more complex information management to determine the final damages and disruptions that are attributed to disasters. Slow-onset and long duration disasters (e.g. droughts) may span several years, with the corresponding challenge of compounding the information across the time span of the disaster. However, the data should be reported as the damage or disruptions in the year when it occurred, without waiting for the complete response phase or disaster to cease.

Usually there are two temporal frameworks for the assessment of damages and economic loss in the aftermath or during large scale disasters, the first one a "Rapid assessment" which is usually completed within one month (28 days) of disaster taking place using methods such as the PDNA. The purpose of these assessments is to provide reliable enough figures for a Humanitarian Appeal/Relief triggering mechanism, for example UN Flash Appeals, EU solidarity fund, or other international aid mechanisms.

A second type of assessment a "Detailed assessment" using comprehensive, multi-sectoral methodologies such as the UN-ECLAC or WB-DALA, are completed within 3-12 months of disaster taking place. Their purpose is to obtain figures to fund and guide Reconstruction planning, and compensation payment.

For the purposes of a good data collection, **UNISDR recommends, if it is available, the usage of a Detailed Assessment**, and encourages Member States, if detailed assessments are not available, to introduce procedures by which the quality, comprehensiveness and coverage of a Rapid/Initial assessment could be improved and made more reliable over each country's defined cut-off period.

Comments and limitations:
It has to be recognized that 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 Clinics Health Centres
Education Sector	Universities and Colleges Secondary (high and middle schools) Elementary schools Pre-school facilities Other training centres Play schools, kindergartens, Training centres, adult education Military schools Prison schools
Energy Sector	Power grids Transmission lines Power generation plants Electrical stations and sub-stations Oil or Gas pipelines Refineries
Transportation Systems Sector	Highways Paved roads Unpaved roads Road Bridges Surface railroads Underground railroads Railroad stations Railroad bridges International airports National airports Local airports and aerodromes International ports Fisheries ports Other docks and piers
Information and Communications Sector	Telephone networks Other communication networks Communication facilities
Water Sector	Water distribution networks Water treatment plants Water reservoirs Wells
Sewerage Sector	Sewerage collection networks Waste water treatment plants
Waste management Sector	Waste management plants Landfills
Government Facilities Sector	Government buildings
Emergency Services Sector	Firefighting facilities

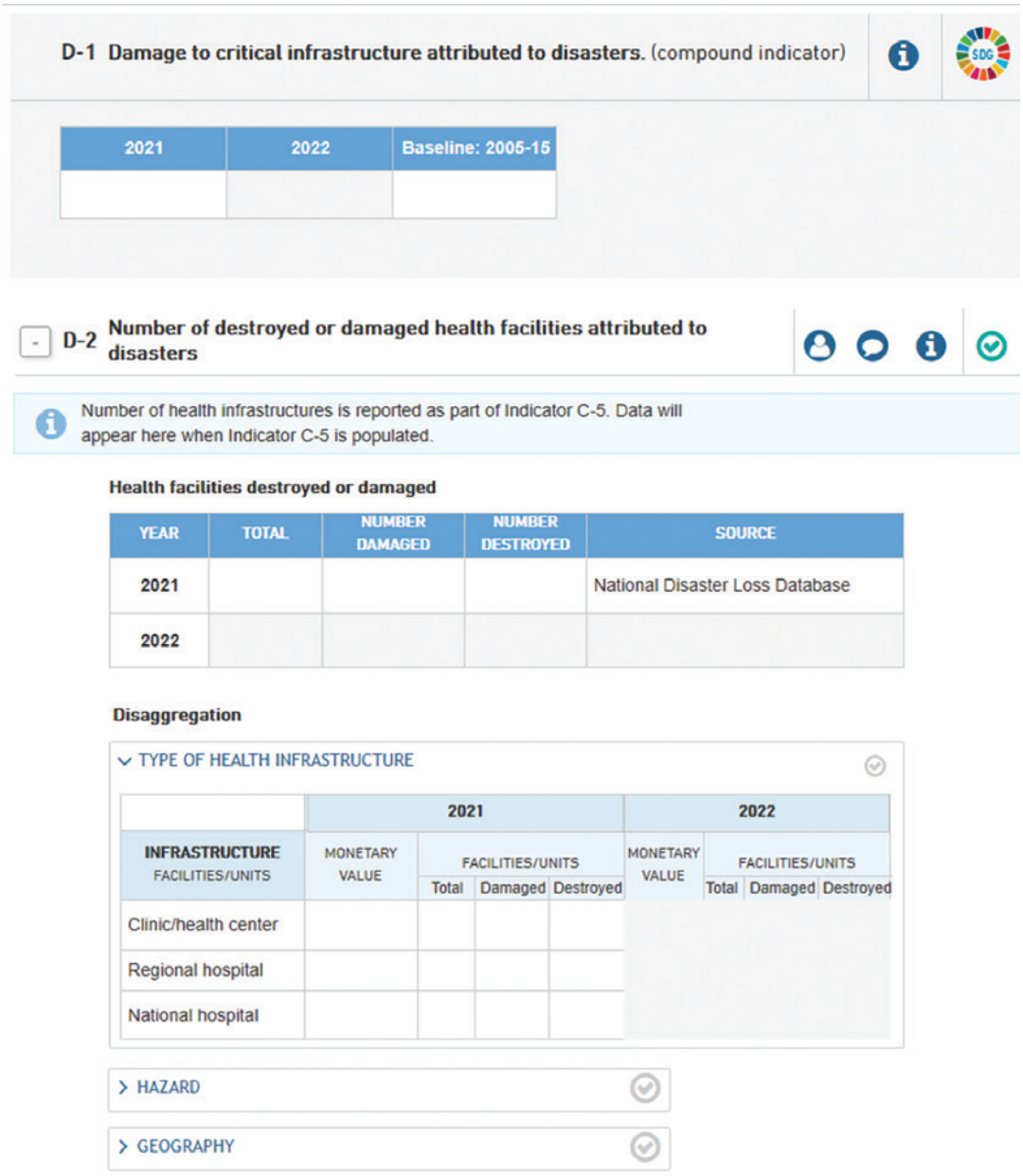
Protective Infrastructure	Flood protection walls and river defenses Drainage systems Ground reinforcement for landslide prevention Canals, dams, dykes and other water regulation mechanisms Coastal defenses for storm surge and tsunami Cyclone and tornado shelter systems Hazard monitoring and early warning systems infrastructure Police/Emergency Services Stations Depots of emergency stockpiles
Green Infrastructure	Parks and green areas Rain gardens Underground water infiltration trenches and storage systems Regional storm water reservoirs Rain harvesting systems Coastal protection mangrove systems Urban tree canopy 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.

8. Sample Data Entry Screens

The following are illustrative screen captures taken from the Sendai Framework Monitor Prototype system. Actual implementation may vary.

1. Data Entry, section Target D-1 and D-2:



D-1 Damage to critical infrastructure attributed to disasters. (compound indicator)

2021	2022	Baseline: 2005-15

D-2 Number of destroyed or damaged health facilities attributed to disasters

Number of health infrastructures is reported as part of Indicator C-5. Data will appear here when Indicator C-5 is populated.

Health facilities destroyed or damaged

YEAR	TOTAL	NUMBER DAMAGED	NUMBER DESTROYED	SOURCE
2021				National Disaster Loss Database
2022				

Disaggregation

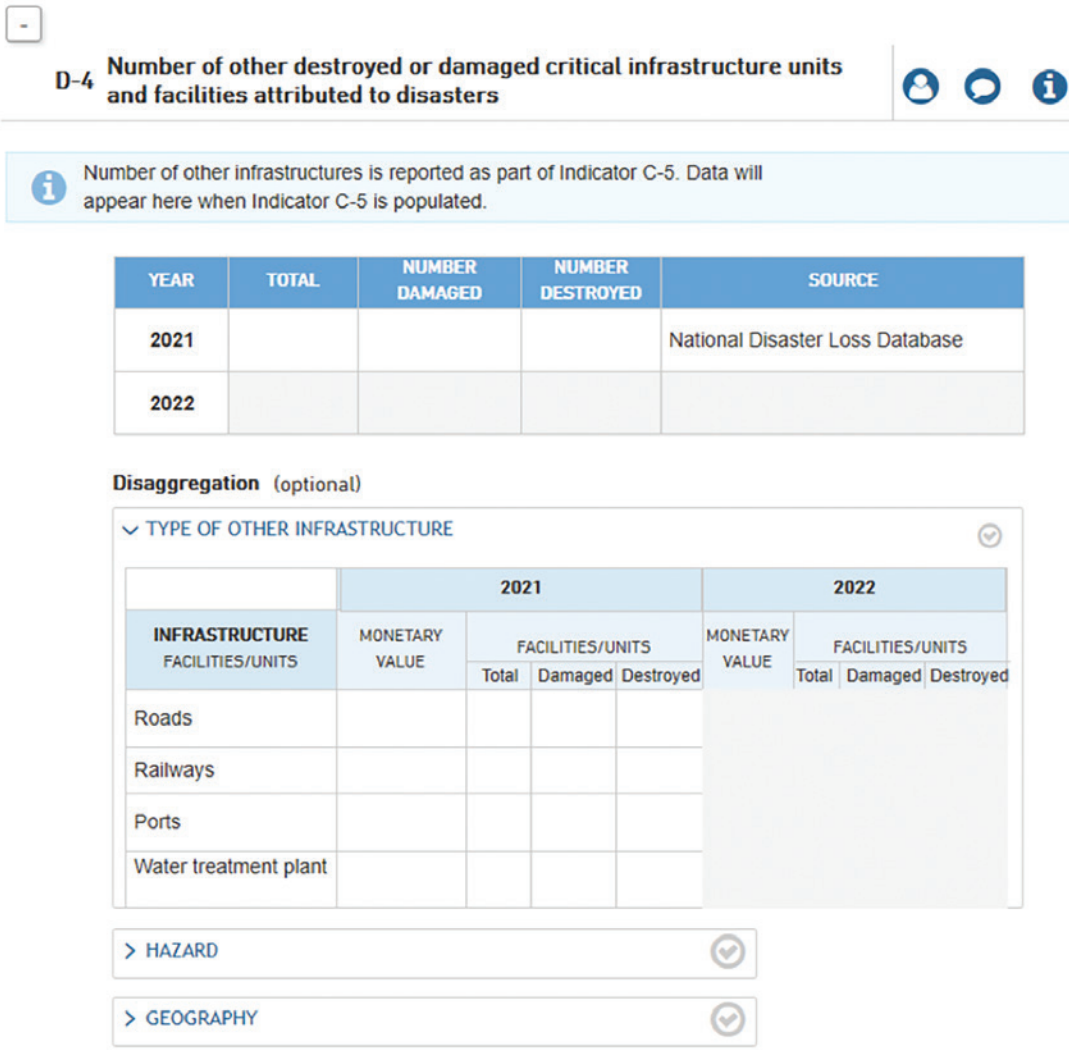
TYPE OF HEALTH INFRASTRUCTURE

INFRASTRUCTURE FACILITIES/UNITS	2021 MONETARY VALUE	2021 FACILITIES/UNITS Total	2021 FACILITIES/UNITS Damaged	2021 FACILITIES/UNITS Destroyed	2022 MONETARY VALUE	2022 FACILITIES/UNITS Total	2022 FACILITIES/UNITS Damaged	2022 FACILITIES/UNITS Destroyed
Clinic/health center								
Regional hospital								
National hospital								

HAZARD

GEOGRAPHY

2. Example of Data Entry, section Target D-4 :



D-4 **Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters**

Number of other infrastructures is reported as part of Indicator C-5. Data will appear here when Indicator C-5 is populated.

YEAR	TOTAL	NUMBER DAMAGED	NUMBER DESTROYED	SOURCE
2021				National Disaster Loss Database
2022				

Disaggregation (optional)

TYPE OF OTHER INFRASTRUCTURE

INFRASTRUCTURE FACILITIES/UNITS	2021 MONETARY VALUE	2021 FACILITIES/UNITS Total	2021 FACILITIES/UNITS Damaged	2021 FACILITIES/UNITS Destroyed	2022 MONETARY VALUE	2022 FACILITIES/UNITS Total	2022 FACILITIES/UNITS Damaged	2022 FACILITIES/UNITS Destroyed
Roads								
Railways								
Ports								
Water treatment plant								

HAZARD

GEOGRAPHY

REFERENCES

United Nations. 2016a. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c) Sustainable development : disaster risk reduction. 1 December 2016.

United Nations. 2016b. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. Note by the Secretary-General. E/CN.3/2016/2/Rev.1*. United Nations Economic and Social Council. Statistical Commission. Forty-eighth session. Item 3 (a) of the provisional agenda. 15 December 2016.

United Nations. 2017. *Resolution adopted by the General Assembly on 2 February 2017*. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. A/RES/71/276. United Nations General Assembly, Seventy-first session Agenda item 19 (*c*). 2 February 2017.

United Nations Economic and Social Council. 2017. *Draft report subject to editing.* Report on the forty-eighth session (7-10 March 2017). Statistical Commission. E/2017/24-E/CN.3/2017/35. Economic and Social Council. Official Records 2017. Supplement No. 4.

JRC, Tom De Groeve, Karmen Poljansek, Daniele Ehrlich, 2013. Recording Disaster Losses : Recommendations for a European approach. European Commission, 2013. EUR 26111 EN. – Joint Research Centre – Institute for the Protection and the Security of the Citizen.

OECD. 2008. "Protection of Critical Infrastructure and the Role of Investment Policies Relating to National Security. It cites Australia : "What is critical infrastructure? Australian National Security (www.ag.gov.au/add),

Public Policy Canada. Canada : About Critical Infrastructure. www.ps-sp.gc.ca

Ministry of Interior, Netherlands. 2005. Report on Critical Infrastructure Protection. 16 September 2005.

Home Office, UK. Counter-terrorism strategy. www.security.homeoffice.gov.uk

Department of Homeland Security, USA. Security Sector Specific Plans. www.dhs.gov

Commission of the European Communities. 2005. Green Paper on a European Programmes for Critical Infrastructure Protection (COM 2005)576.

ECLAC (2012) *Valoración de daños y pérdidas : Ola invernal en Colombia* 2010–2011. ECLAC, IDB, Bogota

Université Catholique de Louvain. EM-DAT - The OFDA/CRED international disaster database—www.emdat.net. Université Catholique de Louvain, Brussels, Belgium. http ://www.emdat.be

DesInventar - UNISDR Open Source Loss Data Platform, Geneva, Switzerland. http ://www.desinventar.net

OSSO Desinventar.org—DesInventar Project for Latin America. Corporación OSSO, Cali, Colombia.
http ://desinventar.org/en/

FAO (United Nations Food and Agriculture Organization). 2012. *Post Disaster Damage, Loss and Needs Assessment in Agriculture.* http ://www.fao.org/docrep/015/an544e/an544e00.pdf

United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC). 2014. *Handbook for Disaster Assessment*. Santiago, Chile. in : http ://repositorio.cepal.org/bitstream/handle/11362/36823/S2013817_en.pdf?sequence=1

United Nations Office for Disaster Risk Reduction (UNISDR). 2009a. Global Assessment Report on Disaster Risk Reduction : Risk and Poverty in a Changing Climate. Geneva, Switzerland : UNISDR.

UNISDR. 2011a. Global Assessment Report on Disaster Risk Reduction : Revealing Risk, Redefining Development. Geneva, Switzerland : UNISDR.

UNISDR. 2011b. *Desinventar.net database global disaster inventory.* United Nations International Strategy for Disaster Reduction, Geneva.

UNISDR. 2013a. Global Assessment Report on Disaster Risk Reduction : From Shared Risk to Shared Value : the Business Case for Disaster Risk Reduction. Geneva, Switzerland : UNISDR. http ://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2013b. *GAR 2013. ANNEX II : Loss Data and Extensive/Intensive Risk Analysis*. Geneva, Switzerland. UNISDR. http ://www.preventionweb.net/english/hyogo/gar/2013/en/gar-pdf/Annex_2.pdf

UNISDR. 2015a. *Indicators to Monitor Global Targets of the Sendai Framework for Disaster Risk Reduction 2015-2030 : A Technical Review*. Background paper presented to the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Geneva, Switzerland.
http ://www.preventionweb.net/files/45466_indicatorspaperaugust2015final.pdf

UNISDR. 2015b. *Proposed Updated Terminology on Disaster Risk Reduction : A Technical Review*. Background paper presented to the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Geneva, Switzerland.
http ://www.preventionweb.net/files/45462_backgoundpaperonterminologyaugust20.pdf

UNISDR. 2015c. Global Assessment Report on Disaster Risk Reduction : *Making Development Sustainable : The future of disaster risk management*. Geneva, Switzerland. UNISDR. http ://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2015d. GAR 2015. Annex 2 : Loss Data and Extensive Risk Analysis. UNISDR. Geneva, 2015. http ://www.preventionweb.net/english/hyogo/gar/2015/en/gar-pdf/Annex2-Loss_Data_and_Extensive_Risk_Analysis.pdf

Working Text on Terminology. Based on negotiations during the Second Session of the Open-ended Intergovernmental Expert Working Group on Terminology and Indicators Relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Working Text on Indicators. Based on negotiations during the Second Session of the Open-ended Inter-governmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016

UNISDR. 2015e. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2015f. Technical Collection of Issue Papers on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

Environmental Protection Agency (EPA), USA. Green Infrastructure web site. https://www.epa.gov/green-infrastructure

European Commission. 2013. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI) — Enhancing Europe's Natural Capital. COM(2013) 249 final. Brussels, Belgium. 6 May 2013. http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

ARISE. 2017. Critical Infrastructure and Disaster Resilience: Issue Brief by Private Sector, Geneva, Switzerland. November 2017. http://www.preventionweb.net/publications/view/55922

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

United Nations Office
for Disaster Risk Reduction

1. Overview

The purpose of this note 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 2015-2030, as well as those indicators in common with Sustainable Development Goals 1, 11 and 13.

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

This note 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 the UNISDR to undertake technical work and provide technical guidance to develop minimum standards and the methodologies for the measurement of the global indicators.

The methodology described here proposes simple data collection easily generated through the Sendai Framework Monitor with uniform scales of achievement on national and local DRR strategies.

2. Introduction

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

This Technical Guidance is based on 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) regarding the existence of DRR strategies.

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

The methodology is also informed by the 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 National Progress Reports) and the Sendai Framework Data Readiness Review conducted by 87 Member States between February and April 2017. From April through July 2017 UNISDR widely circulated the draft of the Technical Notes for consultation and those comments have been fed into this note.

A global, agreed policy for 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 Sendai Framework over these 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". The Framework asserts "that to attain the expected outcome, the following goal must be pursued: Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience".

3. Indicators

The following table lists the indicators recommended by the OIEWG for the measurement of global Target E of the Sendai Framework, 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*.

From the perspective of feasibility of data collection and measurability, the OIEWG has recommended two indicators; one is for the national DRR strategies and the other the local DRR strategies.

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. *Information should be provided on the appropriate levels of government below the national level with responsibility for disaster risk reduction.*

Additionally, in the report E/CN.3/2017/2, the 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, which reinforces the importance of the Sendai Framework Targets and Indicators.

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[16] for adoption by the Economic and Social Council.

The most important aspect of these indicators should be that DRR strategies must be "**in line with the Sendai Framework for Disaster Risk Reduction 2015-2030**".

The Sendai Framework represents an expansion from its predecessor, the Hyogo Framework for Action, with a greater focus on preventing new risk, reducing existing risk and strengthening resilience, as opposed to managing disasters. National and local DRR strategies should be based on, and aligned with, the scope, outcome, goal, guiding principles, and priorities for action of the Sendai Framework, as referred above.

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.

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

4. Applicable Definitions and Terminology

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

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.

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 with responsibility for disaster risk reduction – to be determined by countries for the purposes of monitoring Target E.

Please note that administrative reforms over time in a country could 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. ComputationMethodology

In the case of Target E, the method of computation is a simple arithmetic average of ***the level of implementation in each key element*** which Member States will report their status information in the Sendai Framework Monitor system. Then the system will calculate the score for the reporting country according to the following methodologies.

By introducing quantitative indicators – including the key 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. Reflecting deliberations of Members of both the OIEWG and the IAEG-SDGs, indicators can measure a progress over time with reports by 5 levels of implementation/achievement, as the previous monitoring i.e. the HFA National Progress Reports.

In order to design a methodology of quantitatively measurements that national and local DRR strategies are not only adopted and in course of implementation, but also aligned with the Sendai Framework. (see Annex)

Drawing from the Sendai Framework, the following 10 key elements should be covered by DRR strategies in order to be considered in alignment with the Sendai Framework:

DRR strategies are to

i. *Have different timescales, with targets, indicators and time frames*

ii. *Have aims at preventing the creation of risk*

iii. *Have aims at reducing existing risk*

iv. *Have aims at strengthening economic, social, health and environmental resilience*

v. Address the recommendations of Priority 1, Understanding disaster risk : *Based on risk knowledge and assessments to identify risks at the local and national levels of the technical, financial and administrative disaster risk management capacity*

vi. Address the recommendations of Priority 2, Strengthening disaster risk governance to manage disaster risk : *Mainstream and integrate DRR within and across all sectors with defining roles and responsibilities*

vii. Address the recommendations of Priority 3, Investing in disaster risk reduction for resilience : *Guide to allocation of the necessary resources at all levels of administration for the development and the implementation of DRR strategies in all relevant sectors*

viii. Address the recommendations of Priority 4, Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction : *Strengthen disaster preparedness for response and integrate DRR response preparedness and development measures to make nations and communities resilient to disasters*

ix. *Promote policy coherence relevant to disaster risk reduction such as sustainable development, poverty eradication, and climate change, notably with the SDGs the Paris Agreement*

x. *Have mechanisms to follow-up, periodically assess and publicly report on progress.*

In identifying the key 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 multi-sectoral people-centred approach. However, the Sendai Framework does not focus on population coverage, rather it stresses the prevalence of local DRR strategies in every local government. Members agreed that the indicator should therefore 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, the following computation methodologies for E-1 (National Strategies) and E-2 (Local Strategies) were proposed 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

Ten quantitative sub-indicators are proposed to measure the existence or the quality of each key element in 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 task, the above 10 key issues are proposed to as norms to measure the alignment with the Sendai Framework, considering their importance and relevance.

Member States will assess the level of implementation for each key element and enter all information in the web-based Sendai Framework Monitor. The ten key elements are proposed to be weighted equally by assigning 10% (or 0.1) to each element. As each element in itself may be composed of multiple sub-elements, countries will benchmark according to the following weighting:

i. Comprehensive implementation (full score): 1.0,
ii. Substantial implementation, additional progress required: 0.75,
iii. Moderate implementation, neither comprehensive nor substantial: 0.50,
iv. Limited implementation: 0.25,

If there is no implementation 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 key elements by the online system. Though it is a simple measurement, 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.

$$\boldsymbol{Country\ Score} = {\sum_{j=1}^{10} KE_{ij} \times 0.1}/{n}$$

Thus:

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

Where:

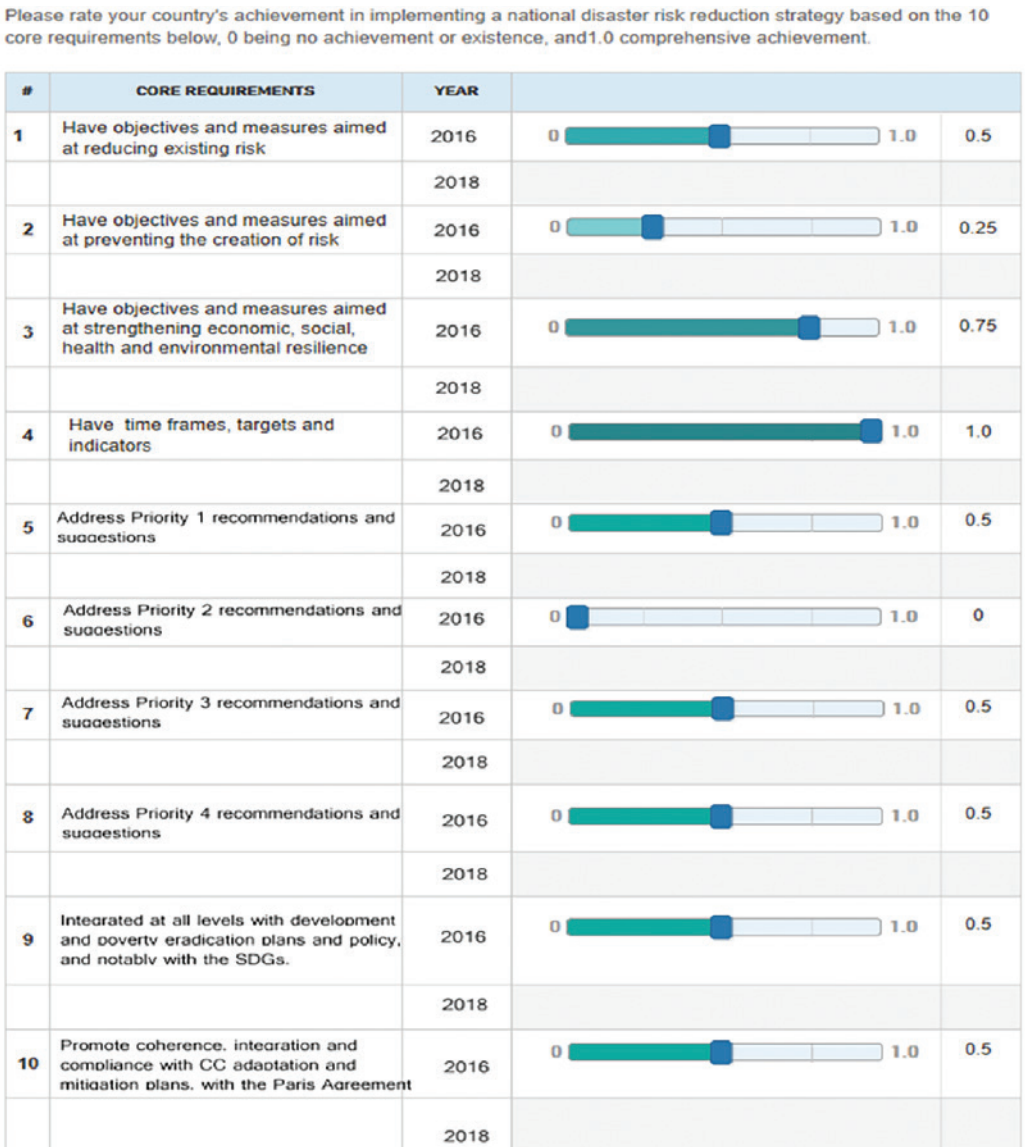
KE_{ij}: the level of achievement of the key element j (=1, .., 10) in country i (=1, .., n) , {0, 0.25, 0.50, 0.75, 1.0}

n: number of countries

Example

1. If a country has a DRR strategy satisfying all the key elements, 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 strategy which only partially fulfils one of the key elements - for example, the country has a strategy, across different timescales with targets and *time frames but no indicators,* then it is calculated as follows: 0.1 for the one key element multiplied by 0.75 ("substantial implementation, additional progress required") then the country score is 0.075.
4. If a country has a national DRR strategy which only partially fulfils one key element but fulfils the other 9 key elements, then it is calculated as follows: 0.75 for one key element ("substantial achievement, additional progress required") and 0.1 for other 9 elements. The country Score will be 0.975 = 0.1*(0.75*1 + 1.0*9)

The following screen capture of the Sendai monitoring prototype is showing how the data entry would look for a country:



Please rate your country's achievement in implementing a national disaster risk reduction strategy based on the 10 core requirements below, 0 being no achievement or existence, and1.0 comprehensive achievement.

#	CORE REQUIREMENTS	YEAR		
1	Have objectives and measures aimed at reducing existing risk	2016	0 1.0	0.5
		2018		
2	Have objectives and measures aimed at preventing the creation of risk	2016	0 1.0	0.25
		2018		
3	Have objectives and measures aimed at strengthening economic, social, health and environmental resilience	2016	0 1.0	0.75
		2018		
4	Have time frames, targets and indicators	2016	0 1.0	1.0
		2018		
5	Address Priority 1 recommendations and suggestions	2016	0 1.0	0.5
		2018		
6	Address Priority 2 recommendations and suggestions	2016	0 1.0	0
		2018		
7	Address Priority 3 recommendations and suggestions	2016	0 1.0	0.5
		2018		
8	Address Priority 4 recommendations and suggestions	2016	0 1.0	0.5
		2018		
9	Integrated at all levels with development and poverty eradication plans and policy, and notably with the SDGs.	2016	0 1.0	0.5
		2018		
10	Promote coherence, integration and compliance with CC adaptation and mitigation plans, with the Paris Agreement	2016	0 1.0	0.5
		2018		

In this case the overall score of the country would be:
(0.5+0.25+0.75+1.0 +0.5+0+0.5+0.5+0.5+0.5) * 0.1 = **0.5**

It is also important to remind that with the mechanism of "Custom Indicators" of the Online Monitoring System, countries will be able to monitor the details of progress of each of these elements using sub-indicators that could help to assess the progress more in detail and systematically on each area.

Countries will be able to take advantage of the menu of pre-defined indicators that address most aspects of the elements as suggested in the Sendai Framework. For example, each recommendation of all of the 4 Priorities for Action has a corresponding monitoring indicator in the online system.

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

It is proposed 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.

Local governments are determined by the reporting country for this indicator, considering sub-national public administrations with responsibility to develop local disaster risk reduction strategies.

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.

The decision regarding measuring the alignment with its national strategies is left to the Member States. It would be easier to assume the alignment if it is enforced by Executive Order, Ministerial Decree or similar instrument with local legislation and regulations.

Each Member State will calculate the ratio of the number of local governments with local DRR strategies in line with national strategies and the total number of local governments. Global Average will then be calculated as below through arithmetic average of the data from each Member State.

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

Where:

n: number of countries

6. Specific issues

Disaster risk governance

Strengthening disaster risk governance arrangements to manage disaster risk, stipulated in the Sendai Framework Priority 2, is of paramount importance in developing and implementing national and local DRR strategies. Paragraph 26 of the Sendai Framework articulates the need for clear vision, plans, competence, guidance and coordination within and across sectors, as well as participation of relevant stakeholders. Paragraph 27 (a) addresses the importance of mainstreaming and integrating disaster risk reduction 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. Paragraph 27 (b) describes elements of the DRR strategies :

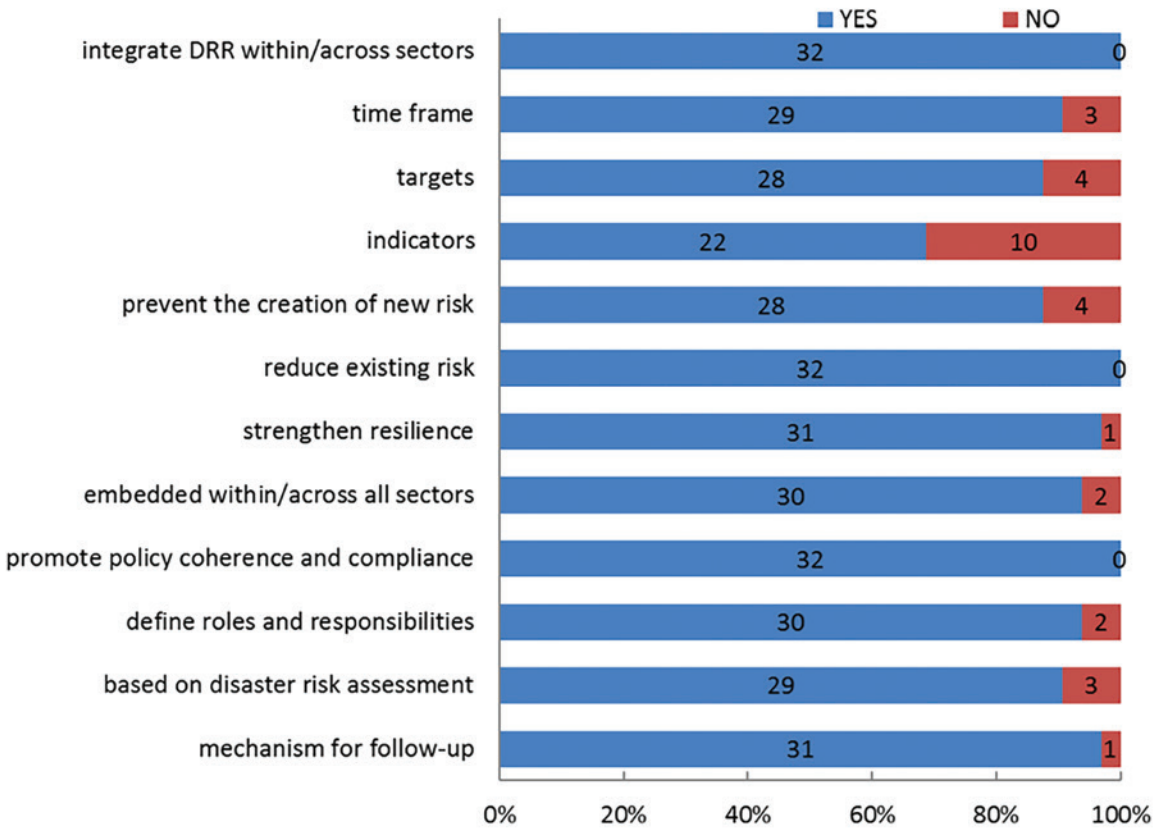
> *To adopt and implement national and local disaster risk reduction strategies and plans, across different timescales, with targets, indicators and time frames, aimed at preventing the creation of risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience;*

These elements have been selected as five of the 10 key elements to calculate the data for the indicator E-1.

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 also considered important in the development and implementation of national and local DRR strategies, however, these elements would be addressed in national reports by custom targets and indicators.

The outcome of the Data Readiness Review shows how many countries responded whether their national DRR strategies have each important element among 32 reporting countries. Though the total number is not large, it shows the tendency that most national DRR strategies are to integrate DRR within and across all sectors, promote policy coherence and compliance, reduce risks, strengthen economic, social, health and environmental resilience, and have a mechanism for follow-up. Having indicators in the national DRR strategies seems to be the biggest challenge among countries (about 1/3 of reporting countries), and having targets and aiming at preventing the creation of new risk seems another challenge (1/8 each).

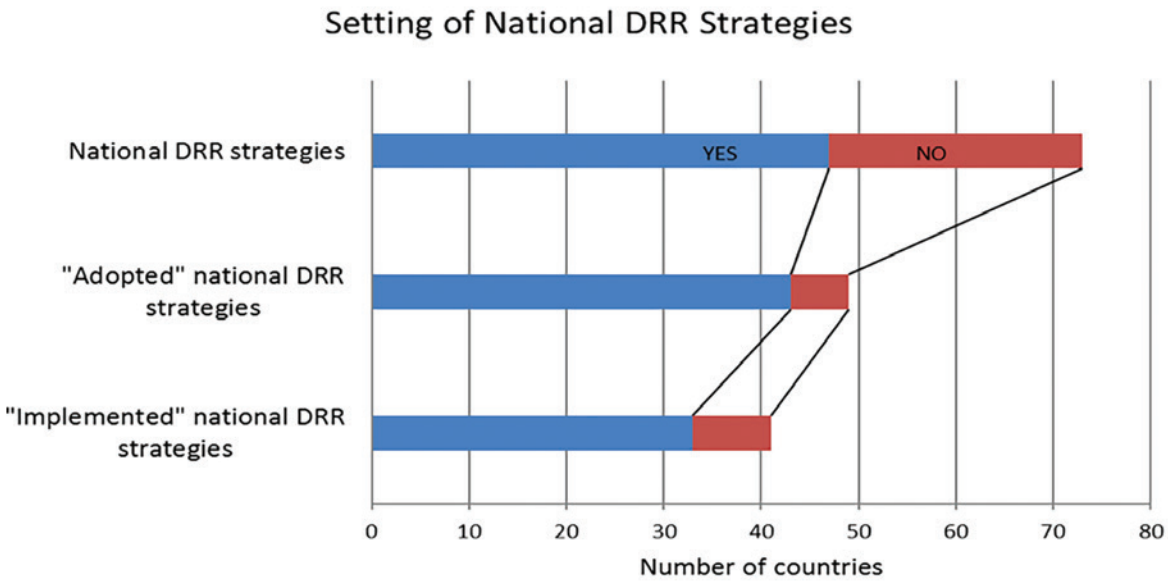
National DRR Strategies (32 countries)



Adopt and implement national and local disaster risk reduction strategies.

The Sendai Framework makes clear the relationship between the adoption and implementation of DRR strategies and addresses the importance of "national and local frameworks of laws, regulations and public policies". Nevertheless, a focus should be placed on implementation of DRR strategies. Since the statutory and regulatory systems are varied among the Member States, the decision regarding the adoption and implementation of DRR strategies to be included in the calculation will be left to Member States.

The outcome of the Data Readiness Review shows the discrepancy between having a national DRR strategy and implementing it : 47 countries (representing 54% of 73 reporting countries) have a national DRR strategy, among them 33 countries have implemented it.



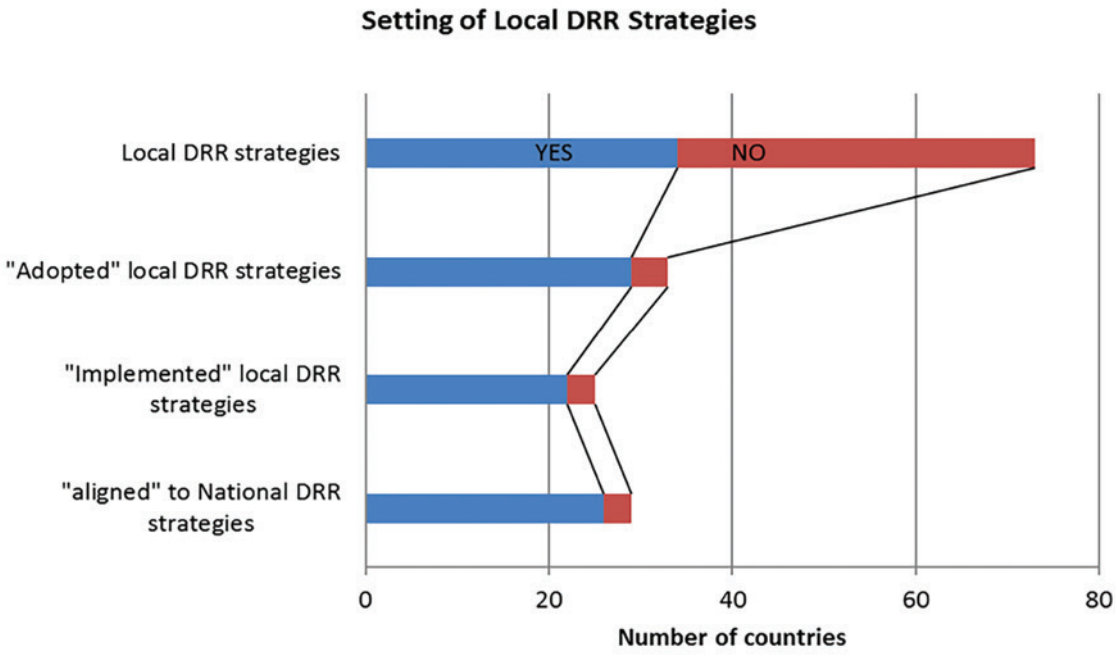
Investment in disaster risk reduction.

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. These issues are also left to countries' decision to adopt their custom targets and indicators.

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. The outcome of the Data Readiness Review shows that about a half of the reporting countries have local DRR strategies and that 26 countries out of 29 countries reporting this questionnaire have ones in line with national strategies. The outcome also shows a discrepancy between having local DRR strategies and implementing them.



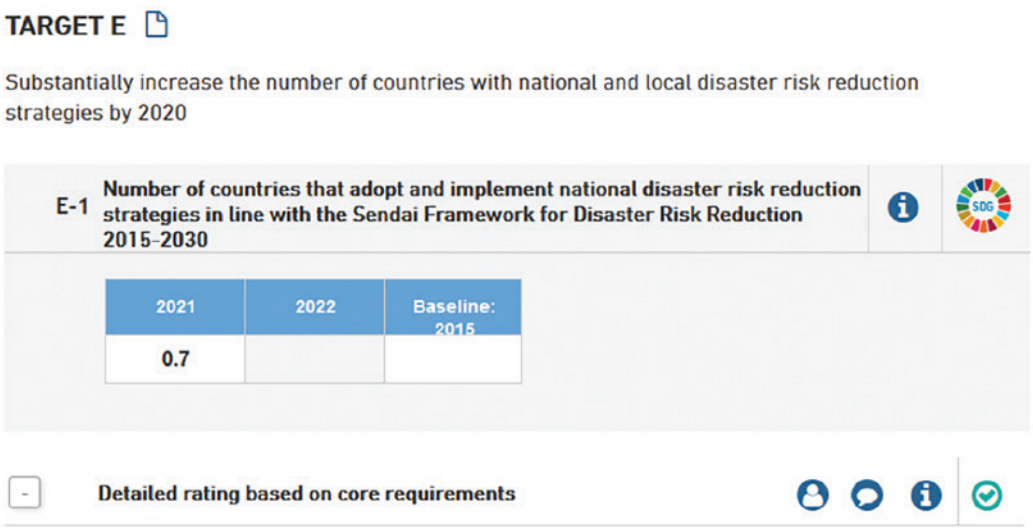
Assessing the degree of alignment with national strategies would therefore be nationally determined using custom targets and indicators. Member States may wish to draw from relevant sections of the Sendai Framework, as well as other guidance[17], when determining indicators appropriate to country context for national level monitoring of their local strategies.

17 For instance: the Ten Essentials (www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=1), the Disaster Resilience Scorecard for Cities (www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=4)

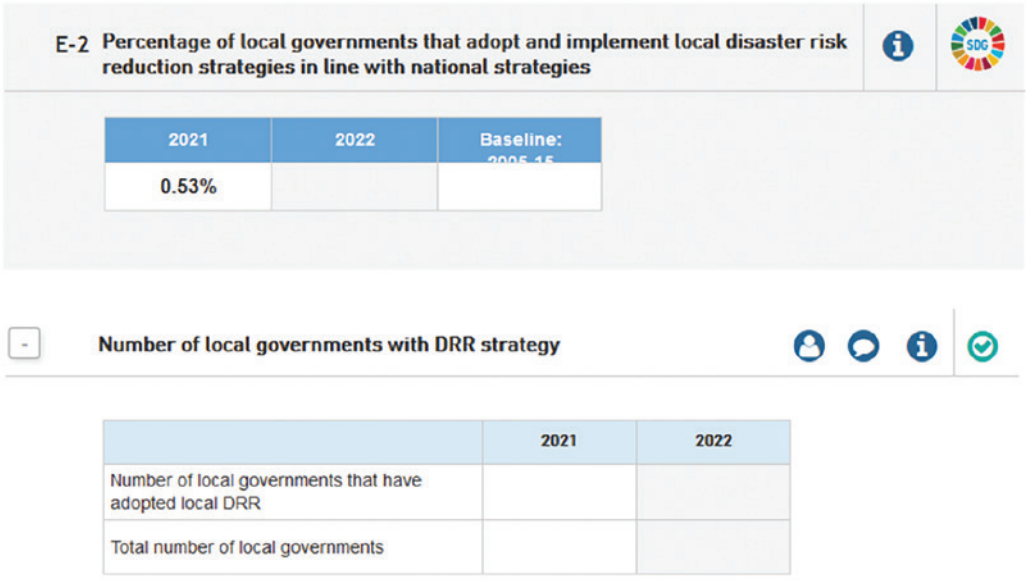
7. Sample Data Entry Screens

The following are illustrative screen captures taken from the Sendai Framework Monitor Prototype system. Actual implementation may vary.

Main Summary of Target E:



(see. The previous section of E-1 in 5. Computation Methodology E-1)



ANNEX

The Sendai Framework and the 10 key elements proposed for the measurement of Target E

The following table cross-references, in a non-exhaustive manner, shows the 10 key elements and the texts in the Sendai Framework from which each element has been extracted. It is important to acknowledge that the proposed elements are for the measurement of Target E, i.e. alignment and compliance of DRR strategies.

Element	Priority/ Goal	Paragraph and Text
Have different timescales, with targets, indicators and time frames;	Priority 2	27 (b)Adopt and implement national and local disaster risk reduction strategies and plans, across different timescales, with targets, indicators and time frames, aimed at preventing the creation of risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience;
Have aims at preventing the creation of risk	Goal, Priority 2	17 Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience 27 (b)Adopt and implement national and local disaster risk reduction strategies and plans, across different timescales, with targets, indicators and time frames, aimed at preventing the creation of risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience;
Have aims at reducing existing risk	Goal, Priority 2	
Have aims at strengthening economic, social, health and environmental resilience	Goal, Priority 2	
Be based on risk knowledge and assessments to identify risks at the local and national levels of the technical, financial and administrative disaster risk management capacity.	Priority 1 Priority 2	24 (n) Apply risk information in all its dimensions of vulnerability, capacity and exposure of persons, communities, countries and assets, as well as hazard characteristics, to develop and implement disaster risk reduction policies; 27 (c) Carry out an assessment of the technical, financial and administrative disaster risk management capacity to deal with the identified risks at the local and national levels;
Mainstream and integrate disaster risk reduction within and across all sectors	Priority 2	27 (a) Mainstream and integrate disaster risk reduction within and across all sectors and review and promote the coherence and further development, as appropriate, of national and local frameworks of laws, regulations and public policies, which, by defining roles and responsibilities, guide the public and private sectors… 26 … Clear vision, plans, competence, guidance and coordination within and across sectors, as well as participation of relevant stakeholders, are needed. Strengthening disaster risk 26 - … Strengthening disaster risk governance for prevention, mitigation, preparedness, response, recovery and rehabilitation is therefore necessary and fosters collaboration and partnership across mechanisms and institutions for the implementation of instruments relevant to disaster risk reduction and sustainable development.

Guide to allocation of the necessary resources at all levels of administration for the development and the implementation of DRR strategies in all relevant sectors.	Priority 3	30 (a) 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;
Strengthen disaster preparedness for response and integrate DRR response preparedness and development measures to make nations and communities resilient to disasters.	Priority 4	27 (e)Develop and strengthen, as appropriate, mechanisms to follow up, periodically assess and publicly report on progress on national and local plans. Promote public scrutiny and encourage institutional debates, including by parliamentarians and other relevant officials, on progress reports of local and national plans for disaster risk reduction; 32. … the need to further strengthen disaster preparedness for response, take action in anticipation of events, integrate disaster risk reduction in response preparedness and ensure that capacities are in place for effective response and recovery at all levels. … Disasters have demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of a disaster, is a critical opportunity to "Build Back Better", including through integrating disaster risk reduction into development measures, making nations and communities resilient to disasters.
Promote policy coherence relevant to disaster risk reduction such as sustainable development, poverty eradication, and climate change, notably with the SDGs and the Paris Agreement;	Preamble Guiding Principles Priority 2 Priority 3	2. During the World Conference, States also reiterated their commitment to address disaster risk reduction and the building of resilience to disasters with a renewed sense of urgency within the context of sustainable development and poverty eradication, and to integrate, as appropriate, both disaster risk reduction and the building of resilience into policies, plans, programmes and budgets at all levels and to consider both within relevant frameworks. 19(h) The development, strengthening and implementation of relevant policies, plans, practices and mechanisms need to aim at coherence, as appropriate, across sustainable development and growth, food security, health and safety, climate change and variability, environmental management and disaster risk reduction agendas. Disaster risk reduction is essential to achieve sustainable development; 28 (b) To foster collaboration across global and regional mechanisms and institutions for the implementation and coherence of instruments and tools relevant to disaster risk reduction, such as for climate change, biodiversity, sustainable development, poverty eradication, environment, agriculture, health, food and nutrition and others, as appropriate; 31(a) To promote coherence across systems, sectors and organizations related to sustainable development and to disaster risk reduction in their policies, plans, programmes and processes;
Have mechanisms to follow-up, periodically assess and publicly report on progress.	Priority 2	27 (e)Develop and strengthen, as appropriate, mechanisms to follow up, periodically assess and publicly report on progress on national and local plans. Promote public scrutiny and encourage institutional debates, including by parliamentarians and other relevant officials, on progress reports of local and national plans for disaster risk reduction;

REFERENCES

United Nations. 2005. Hyogo Framework for Action 2005-2015 : Building the resilience of nations and communities to disasters.
http ://www.preventionweb.net/files/1037_hyogoframeworkforactionenglish.pdf

Hyogo Framework for Action - National Progress Reports 2007-2015. (4 cycles)
http ://www.preventionweb.net/english/hyogo/progress/

United Nations. 2015. The Sendai Framework for Disaster Risk Reduction 2015-2030
http ://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

United Nations. 2016a. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c)
Sustainable development : disaster risk reduction. 1 December 2016.

United Nations. 2016b. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. Note by the Secretary-General. E/CN.3/2017/2. United Nations Economic and Social Council. Statistical Commission. Forty-eighth session. Item 3 (a) of the provisional agenda. 15 December 2016.

United Nations. 2017. *Resolution adopted by the General Assembly on 2 February 2017*. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. A/RES/71/276. United Nations General Assembly, Seventy-first session Agenda item 19 (*c*). 2 February 2017.

United Nations Economic and Social Council. 2017. *Draft report subject to editing.* Report on the forty-eighth session (7-10 March 2017). Statistical Commission. E/2017/24-E/CN.3/2017/35. Economic and Social Council. Official Records 2017. Supplement No. 4.

Shaw, Rajib and Krishnamurthy, R R. 2009. Disaster Management : Global Challenges and Local Solutions. Universities Press, India

United Nations Office for Disaster Risk Reduction (UNISDR). 2009a. UNISDR Terminology on Disaster Risk Reduction. United Nations International Strategy for Disaster Reduction. Geneva, Switzerland.

UNISDR. 2009b. Global Assessment Report on Disaster Risk Reduction : Risk and Poverty in a Changing Climate. Geneva, Switzerland : UNISDR.

UNISDR. 2011. Global Assessment Report on Disaster Risk Reduction : Revealing Risk, Redefining Development. Geneva, Switzerland : UNISDR.

UNISDR. 2013. Global Assessment Report on Disaster Risk Reduction : From Shared Risk to Shared Value : the Business Case for Disaster Risk Reduction. Geneva, Switzerland : UNISDR. http ://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2014. Progress and Challenges in Disaster Risk Reduction : A contribution towards the development of policy indicators for the Post-2015 Framework on Disaster Risk Reduction. Geneva, Switzerland. UNISDR.

Davis, I, Yanagisawa, K and Georgieva, K. 2015. Disaster Risk Reduction for Economic Growth and Livelihood. Routeledge, NY

UNISDR. 2015a. Global Assessment Report on disaster risk reduction : Making development sustainable : The future of disaster risk management. Geneva, Switzerland : UNISDR. http ://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2015b. Support to National Implementation of the Sendai Framework 2015 -2013. Geneva.

UNISDR. 2015c. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2015d. Technical Collection of Issue Papers on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2016a. Technical Collection of Concept Notes on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 10 June 2016.
http ://www.preventionweb.net/documents/oiewg/Technical%20Collection%20of%20Concept%20Notes%20on%20Indicators.pdf

UNISDR. 2016b. *Results of the informal consultations of the Chair on indicators for global targets A, B, C, D, E, F and G of the Sendai Framework for Disaster Risk Reduction*. Issued on 12 November 2016.

UNISDR. 2016c. *Results of the Informal Consultations of the Chair on Terminology related to Disaster Risk Reduction*. Issued on 12 November 2016.
http ://www.preventionweb.net/files/50683_resultsinformalconsultationstermino.pdf

Working Text on Terminology. Based on negotiations during the Second Session of the Open-ended Intergovernmental Expert Working Group on Terminology and Indicators Relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Working Text on Indicators. Based on negotiations during the Second Session of the Open-ended Inter-governmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016

Technical Guidance 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

United Nations Office
for Disaster Risk Reduction

1. Overview

The purpose of this note 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 outlines the data, indicators 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 methodology described here proposes simple data collection generated through the Sendai Framework Monitor with uniform scales of achievement. 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 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.

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

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. *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.

These indicators can be classified to the above mentioned categories as follows;

(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 indicators 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, internationally accepted 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.

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: concerns Official Development Finance (ODF) which is used by the OECD DAC to measure the inflow of resources to recipient countries, and includes: (a) bilateral ODA, (b) grants and concessional and non-concessional development lending by multilateral financial institutions, and (c) Other Official Flows (OOF) for development purposes (including refinancing loans) which have too low a grant element to qualify as ODA.

It is recognised that non-ODA flows far exceed ODA flows in some countries, however, more inclusive methodologies capturing the totality of flows are yet to be developed. Thus despite the risk of under-reporting, and until such time as methodologies are enhanced, in the context of these indicators, the amount of ODA related to support for national disaster risk reduction actions can be used as a proxy.

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 (developing countries) and to multilateral agencies which are: i) provided by official agencies, including state and local governments, or by their executive agencies; ii) administered with the promotion of the economic development and welfare of developing countries as the main objective; and iii) are concessional in character with a grant element of at least 25 per cent (using a fixed 10 per cent rate of discount). In addition to financial flows, technical co-operation is included in aid. Grants, loans and credits for military purposes are excluded. Transfer payments to private individuals (e.g. pensions, reparations or insurance payouts) are in general not counted[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

19 See http://www.oecd.org/dac/stats/dac-glossary.htm#ODA

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.

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 target. 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).

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 not 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 **a policy marker for disaster risk reduction**.

If approved, the policy marker will provide an additional qualitative element to monitoring

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)

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."

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 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 submitted to the OIEWG.

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.

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

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

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[28]. 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.

28 *IAEG-SDGs Indicator Tier Classification Criteria/Definitions:* **Tier 3:** No internationally established methodology or standards are yet available for the indicator, but methodology/standards are being (or will be) developed or tested.

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[29]. 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[30]. 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[31].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 countries to accelerate the transfer of climate technologies; creating access to information and knowledge on climate technologies; and fostering collaboration among climate technology stakeholders.

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

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. 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.

The work being undertaken under the auspices of the new measurement framework, **Total Official Support for Sustainable Development (TOSSD)**[32] is therefore of interest, which will include for example, scientific and technological co-operation activities that respond to the needs of developing countries.

Additional 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, and 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.

32 Annex I. of the Concept Note on Indictors for Global Target F

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 of the PRESS report). 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.

6. Minimum and Desirable Data Requirements

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

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

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.

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.

Use of a DRR Marker for Reporting on achievement of the global targets of the Sendai Framework and 2030 Agenda

AID TARGETING THE OBJECTIVES OF THE SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION 2015 - 2030	
DEFINITION **An activity should be classified as DRR-related (score Principal or Significant) if:**	It promotes the goal and global targets* of the Sendai Framework to achieve 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.
CRITERIA FOR ELIGIBILITY	The activity contributes to: a) the prevention of new disaster risk, and/or b) the reduction of existing disaster risk, and/or c) the strengthening of resilience through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, and increase preparedness for response and recovery with the explicit purpose of increasing human security, well-being, quality of life, resilience, and sustainable development. The activity will score "**principal objective**" if it directly and explicitly contributes to at least one of the four Priorities for Action of the Sendai Framework: ▫ **Priority 1:** Understanding disaster risk. ▫ **Priority 2:** Strengthening disaster risk governance to manage disaster risk. ▫ **Priority 3:** Investing in disaster risk reduction for resilience. ▫ **Priority 4:** Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.
EXAMPLES OF TYPICAL ACTIVITIES	· Support for design, implementation, and evaluation of strategies, policies, and measures to improve the understanding of disaster risk · DRR considerations integrated into development policies, planning and legislation · Fostering political commitment and community participation in DRR · Multi-hazard risk mapping, modelling, assessments and dissemination · Decision support tools for risk-sensitive planning · Early warning systems with outreach to communities · Developing knowledge, public awareness and co-operation on DRR · Inclusion of DRR into curricula and capacity building for educators · Disaster risk management training to communities, local authorities, and targeted sectors · DRR considerations integrated with the climate change adaptation, social protection and environmental policies · Legal norms for resilient infrastructure and land use planning · Disaster financing and insurance · Disaster preparedness planning and regular drills for enhancing response · Protective infrastructure and equipment · Resilient recovery planning and financing

Disaster Risk Reduction (430xx) and Multi-hazard response preparedness 740xx) score, by definition, principal objective. See the annexes for examples of scoring and an indicative list of activities by sector.

***** The global targets of the Sendai Framework are : a) Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020–2030 compared to the period 2005–2015; b) Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015; c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030; 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; e) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020; f) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030; g) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

ANNEX II: POTENTIAL SCORING OF A SAMPLE OF AID ACTIVITIES

The table below shows sample aid activities and/or development objectives and potential eligibility and scoring for the DRR marker based on the decision process and eligibility criteria presented in the proposal. The marker coverage and scoring *(2-Principal; 1-Significant)* are only for illustrative purposes. The actual screening and scoring will require a thorough review of an aid activity's documentation and development objectives.

Sector / purpose	Short description of the aid activity and / or development objectives	Potential Score
General Environment Protection	Integrating disaster risk considerations in environmental law, regulation, policy, planning and programming.	**2**
Disaster Risk Reduction	Building disaster resilient communities by strengthening national systems for disaster risk management, with accompanying national and sub-national risk assessment.	**2**
Industry	Assessment of disaster risk in the development of the industrial sector, and corollary impacts of industrial development on disaster risk.	**2**
Multi-hazard response preparedness	Strengthening national weather forecasting and warning services and disaster risk analysis for building sustainable national capacity for disaster risk management.	**2**
Energy Generation and Supply	Retrofitting and upgrading smart grids to be resilient to modelled cyclonic wind and flood risk, and promoting continuous service delivery.	**2**
Other Multisector	Building a city's resilience to earthquakes by reinforcing public buildings to seismically safe standards, and developing city-level disaster preparedness plans and policies.	**2**
Water Supply and Sanitation	Mobilise networks of NGOs and communities to advocate in favour of a strengthened national water policy and law, which considers sustainable use of water resources, sanitation services, and disaster risk reduction to support vulnerable populations.	**1**
Education	Support to Ministry of Education for shaping the research agenda on education in conflict-affected states, developing guidelines on education and child protection and corresponding training to education practitioners, and developing disaster risk reduction (DRR) plans for the education sector.	**1**
Agriculture	Enhancing the resilience of smallholder producers to climate variability by improved management of watersheds, introducing or expanding soil management practices, and reducing vulnerability of crop storage facilities to hazards.	**1**

ANNEX III: LIST OF EXAMPLES BY SECTOR

The following list of examples is not exhaustive.

EDUCATION (110)	• Development or introduction of educational programmes that promote resilience to natural hazards such as disaster resistant construction practices. • Development or introduction of a DRR curriculum in school education and training programmes. • Retrofitting existing schools and any academic facilities for disaster resilience. • Integration of disaster resistant standards in academic infrastructure design and development. • Support for the establishment of hazard safety plans and training drills in academic institutions.
HEALTH (120)	• Training of health care providers in disaster preparedness and response. • Retrofitting existing health infrastructure such as health centres and hospitals with disaster resilient building codes. • Assessing changes in risk (exposure and sensitivity to disaster-related diseases, including in respect of vulnerable groups and post-disaster incidence. • Incorporating disaster-related health risks into clinical practice guidelines, and curricula for continuous medical education and training. • Preventive measures to counteract increased exposure to diseases related to disasters. • Strengthening health management information systems related to disaster risk management. • Strategies that aim to improve the disaster risk management of the health and insurance system. • Including disaster-related diseases in basic benefits of insurance policies.
WATER AND SANITATION (140)	• Reducing the vulnerability of public drinking water supply and distribution systems. • Strengthening of hydrometeorology capacity and early warning systems. • Reducing the vulnerability to natural hazards of wastewater treatment and disposal designs. • Integration of DRR measures in river basin's development and management.
GOVERNMENT AND CIVIL SOCIETY (150)	• Public financial management integrating DRR measures, including strengthening risk-informed financial and managerial accountability, public expenditure and financial management systems and budget drafting. • Legal and judicial development addressing DRR, including measures that support the improvement of risk-informed legal frameworks, constitutions, laws and regulations.

OTHER SOCIAL INFRASTRUCTURE AND SERVICES (160)	• Housing sector policy, planning and programmes that integrate DRR measures. • Multisector aid for basic social services (including basic education, basic health, basic nutrition, population/reproductive health and basic drinking water supply and basic sanitation) that integrate DRR. • Specific targeting of groups vulnerable to natural hazards for social protection programmes. • Development of social protection strategies / safety nets to respond to natural disasters.
TRANSPORT AND STORAGE (210)	• Embedding disaster-resilient elements in the existing transportation network. • Assessing economic, environmental, or social impacts of natural hazards on transportation, as well as disaster risk impacts of new transport and infrastructure investments. • Introducing disaster resilient building codes in road construction projects.
COMMUNICATION (220)	• Incorporating hazard and disaster risk considerations in information and communication policies and institutions. • Establishment of disaster resilient connectivity. • Development or strengthening of telecommunications infrastructure, including for use as part of an emergency response system during times of natural disasters.
ENERGY GENERATION AND SUPPLY (230)	• Incorporation of the potential impacts of disasters in the design standards of generation, transmission and distribution lines and power system reliability assessments. • Integration of DRR considerations in energy sector planning and institution capacity building. • Supporting the increased production of climate smart sources of energy.
BANKING AND FINANCIAL SERVICES (240)	• Assistance in the development of disaster risk transfer/insurance initiatives • Support for the integration of disaster risk reduction incentives within housing finance programs • Establish a risk management framework integrating natural hazard risk mitigation strategies • Disaster risk insurance schemes for productive sectors such as agriculture, fishing etc. • Fiscal policy and management measures in support of disaster risk reduction • Economic research, modelling, and policy making for disaster risk reduction

AGRICULTURE (311)	• Developing, testing or introducing practices or techniques that are more resilient to disasters and climate variability in farming systems or plant breeding. • Research of existing and new threats to agriculture from disaster related hazards. • Integration of disaster resilience into extension services and programmes. • Development of irrigation or drainage networks to reduce vulnerability to disasters. • Developing or introducing strategies to intensify crop production to mitigate rising food prices that result from drought. • Introducing or strengthening soil management practices to adapt to climate hazards.
FORESTRY (312)	• Introducing the use of forest systems to reduce vulnerability to landslides, flooding or other natural hazards. • Reforestation and afforestation with species less vulnerable to climate variability and natural hazards. • Forest fire prevention measures. • Mangrove preservation and afforestation to improve a coastal community's resilience to disasters. • Forestry sector policy, planning and programmes, and institution capacity building integrating DRR.
FISHING (313)	• Fishing sector policy, planning and programmes, and institution capacity building integrating DRR.
INDUSTRY (321)	• Assessing economic, environmental, or social impacts of disasters on industrial policy, planning and programmes, as well as disaster risk impacts of investments in industrial development.
CONSTRUCTION (323)	• Including disaster resilient building codes / design standards in infrastructure development.
General environmental protection (410)	• Establishment of database, inventories / accounts of physical and natural resources; environmental profiles and impact studies, and risk assessment. • Environmental policy, laws, regulations, planning and programmes, and institution capacity building, integrating DRR. • Supporting development and use of approaches, methods and tools for assessment, valuation and sustaining of ecosystem services in managing disaster risk.

Other multi-sector (430)	• Integration of DRR measures in urban development projects, urban planning and/or policies. • Integrated rural development policies and programmes incorporating DRR. *Activities coded under Disaster Risk Reduction (CRS purpose code 430xx) score, by definition, **principal** objective:* • Preparation of national disaster risk reduction strategies, plans and programmes. • Capacity building in DRR-related taxonomy, hazard classification, standard setting and information management. • Identifying groups vulnerable to hazards and undertaking measures to reduce their vulnerability. • Assistance in the development of disaster risk transfer / insurance initiatives, including disaster risk insurance schemes for productive sectors. • Development of flood prevention / control measures: floods from rivers or the sea; including sea water intrusion control and sea level rise related activities. • Support for research on ecological, socio-economic and policy issues related to disaster risks and their inter-dependencies, including research on and application of knowledge.
Developmental food aid/ Food security assistance (520)	• Food aid / Food security programmes implemented in the aftermath of disasters
ACTION RELATING TO DEBT (600)	• Debt forgiveness, relief of multilateral debt, rescheduling and refinancing carried out for risk reduction measures or necessitated due to large-scale disasters
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, to be excluded.)*
Reconstruction relief and rehabilitation (730)	• Restoring pre-existing infrastructure with disaster-resilient features and providing associated social services ("build back better").
Multi-hazard response preparedness (740)	*Activities coded under Multi-hazard response preparedness (CRS purpose code 740xx) score, by definition, **principal** objective.* • Construction of evacuation shelters for communities to use in times of natural disasters. • Developing storage capacities for pre-positioning of disaster preparedness equipment, material and supplies. • Development of disaster helplines.
REFUGEES IN DONOR COUNTRIES (930)	Refugees displaced due to severe natural disaster.

REFERENCES

United Nations. 2016. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c) Sustainable development disaster risk reduction. 1 December 2016.

United Nations. 2016. Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators. Note by the Secretary-General. E/CN.3/2016/2/Rev.1*. United Nations Economic and Social Council. Statistical Commission. Forty-eighth session. Item 3 (a) of the provisional agenda. 15 December 2016.

United Nations. 2017. *Resolution adopted by the General Assembly on 2 February 2017*. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. A/RES/71/276. United Nations General Assembly, Seventy-first session Agenda item 19 (*c*). 2 February 2017.

United Nations Economic and Social Council. 2017. *Draft report subject to editing.* Report on the forty-eighth session (7-10 March 2017). Statistical Commission. E/2017/24-E/CN.3/2017/35. Economic and Social Council. Official Records 2017. Supplement No. 4.

Organisation for Economic Co-operation and Development (OECD). 2016a. Converged Statistical Reporting Directives for the Creditor Reporting System (CRS) and the Annual DAC Questionnaire. Chapters 1-6. Development Co-Operation Directorate. Development Assistance Committee (DAC). DCD/DAC(2016)3/FINAL. 8 April 2016.

OECD. 2016b. Proposal for modernising CRS classifications of humanitarian assistance and disaster risk reduction. DAC Working Party on Development Finance Statistics (WP-STAT). DCD/DAC/STAT/RD(2016)2/RD3. 30 June 2016. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DCD/DAC/STAT/RD(2016)2/RD3&docLanguage=En

OECD. 2017a. The List of CRS Purpose Codes and Voluntary Budget Identifier Codes. Updated July 2017. http://www.oecd.org/dac/stats/documentupload/CRS_BI_VOLUNTARY_purpose_codes2016flows_en_July17.pdf

OECD. 2017b. Proposal to Establish a Policy Marker for Disaster Risk Reduction (DRR) in the OECD DAC Creditor Reporting System (CRS). DAC Working Party on Development Finance Statistics (WP-STAT). DCD/DAC/STAT(2017)26. 6 December 2017. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DCD/DAC/STAT(2017)26&docLanguage=En

Sparks, D. 2012. Aid investments in disaster risk reduction - rhetoric to action. Briefing Paper. Global Humanitarian Assistance.

PARIS21. 2015. Partner Report on Support to Statistics (PRESS). Secretariat of the Partnership in Statistics for Development in the 21st Century (PARIS21). September 2015

United Nations Office for Disaster Risk Reduction (UNISDR). 2013. Global Assessment Report on Disaster Risk Reduction: From Shared Risk to Shared Value: the Business Case for Disaster Risk Reduction. Geneva, Switzerland: UNISDR. http://www.preventionweb.net/english/hyogo/gar/2013/en/home/download.html

UNISDR. 2015a. Global Assessment Report on Disaster Risk Reduction: Making Development Sustainable: The future of disaster risk management. Geneva, Switzerland. UNISDR. http://www.preventionweb.net/english/hyogo/gar/2015/en/home/index.html

UNISDR. 2015b. Concept Note on Indicators for Global Target F. Geneva, Switzerland. 10 December 2015.

UNISDR. 2015c. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2016. Technical non-paper on indicators for Target F. Geneva, Switzerland. 7 November 2016.
http ://www.preventionweb.net/drr-framework/open-ended-working-group/sessional-intersessional-documents

Working Text on Terminology. Based on negotiations during the Second Session of the Open-ended Intergovernmental Expert Working Group on Terminology and Indicators Relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Working Text on Indicators. Based on negotiations during the Second Session of the Open-ended Inter-governmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction held in Geneva, Switzerland from 10-11 February 2016. Issued on 3 March 2016. Reissued with factual corrections on 24 March 2016.

Technical Guidance Note on Data and Methodology to Estimate 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

United Nations Office
for Disaster Risk Reduction

1. Overview

The purpose of this note 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 note outlines computation methodologies for estimating progress in increasing availability of and access to multi-hazard early warning systems (MHEWS) and disaster risk information and assessments to the people. 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 herein proposes simple data collection for the global indicator easily generated through the Sendai Framework Monitor[33] with uniform scales of achievement.

2. Introduction

The methodologies outlined here aims to quantify the quality of public policy, i.e. MHEWS and disaster risk information and assessments, that would quantify improvement of the policy over time.

This note is based on deliberations in the OIEWG, ongoing work on Multi-Hazard Early Warning Systems Checklist[34] (henceforth referred to as "draft MHEWS Checklist"), and existing Early Warning Check List (UNISDR 2016) as well as previous experience of a number of governments, academic and research institutions, the United Nations and other organizations. It was informed, inter alia, by experts who have been involved in UNISDR risk assessment work and also from the World Meteorological Organization (WMO), the National Meteorological and Hydrological Services (NMHSs) of its Members, the United Nations Office for Outer Space Affairs (UNOOSA), 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) and the Multi-Hazard Early Warning Conference 2017.

Through the deliberations of the OIEWG, computation methodologies of incremental measurements for achievement was proposed that would capture the level of progress in each **key element of MHEWS** and contribute to policy improvement.

It is also informed by the 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 National Progress Reports) and the Sendai Framework Data Readiness Review conducted by 87 Member States between February and April 2017. From April through August 2017 UNISDR widely circulated the draft of the Technical Notes for consultation and comments received have been fed in this note.

33 The Sendai Framework Monitor is currently under development.
34 presented at the Multi-Hazard Early Warning Conference (MHEWC) held in May 2017 https://www.wmo.int/pages/prog/drr/documents/mhews-ref/EW%20Checklist%20DRAFT.pdf

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. *(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. *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 (see section 4 below), all of which need to be coordinated across 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 draft MHEWS Checklist- were proposed to measure progress in achieving the Target.

In regard to Indicator G-5, measuring **disaster risk information and assessments**, which are 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. A number of options beyond a simple binary consideration are proposed, 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 important criteria listed in the section of Disaster Risk Knowledge in the draft EWS Checklist (see section 5).

Each country should specify the major hazards to be included in a "multi-hazard" EWS, and indicators should be weighted accordingly. Issues were raised at OIEWG and MHEWC that the level of achievement in terms of "multi-hazard" as simultaneous, cascading or cumulative effects by multiple hazardous events should be considered to measure effectiveness of the system.

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.

A complete and effective MHEWS **should meet all the four key elements of MHEWS.** Indicators G-2 through G-5 correspond each to one of the key elements:

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

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 here 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. Instead, it was proposed measuring global and national progress in each element; this is particularly relevant for such indicators which require a multi-faceted approach.

However, there were a number of suggestions made by member states during consultations after the OIEWG, suggesting the methodology should be as simple as possible for the first stage, and that once countries have strengthened in monitoring and consolidated the information required for an advanced option then pursue more detailed approach to measure the progress.

As each Member State can choose its methodology reflecting a development stage of MHEWS, it is proposed to Member States, if they are in a position to do so, to consider advanced options to measure progress. Note that the applied methodologies and metadata should be consistent during the reporting period, i.e. 2015-2030. Should these methodologies change afterwards, it is recommended that retroactive reporting with the adjusted methodology is carried out to avoid biases and distortions in the measurement of the target.

There are several important issues to be addressed to deal with multi-hazard early warning system.

(1) A Multi-hazard approach:
Each Member State should specify those major hazards to be included in its "multi-hazard" EWS. For the list-up, UNISDR encourages Member States to consider the agreed terminology of "multi-hazard" in the OIEWG Report that hazardous events may occur simultaneously or cascadingly.

For example, in some countries, tropical cyclones were often followed by floods and landslides while Earthquakes were followed by Tsunami, landslides or could bring technological hazards. In this case the complete list would be as follows:

Simultaneous		*Cascading*
	Tropical cyclone	Flood
		Landslide
		Technological hazards
	Earthquake	Tsunami
		Landslide
		Technological hazards

Data for the global indicators should be weighted accordingly when reporting, reflecting impacts by each hazard type. In a multi-hazard approach, impacts for a major hazard should also include the cascading effects. In the example above, when looking at the impact of Tropical Cyclones the impact of cascading landslides, floods and associated technological hazards should be added to those of winds and storm surges caused by the cyclones.

There are several possible ways to weigh hazard types considering countries' risk profiles. It is recommended a **weighting for major hazards** which can reflect **impacts** according to **hazard types** on each country. These weights should be used with all the following proposed methodologies of global indicators because the principal objective of people-centred EWS is to **reduce impacts on human lives, particularly losses in lives, livelihoods and economic assets.**

Member states may consider determining impacts and weights based on the following approaches:

(i) **potential impacts on human or natural hazard risk** of a certain level of frequency and intensity/severity of each hazard. These thresholds can be decided by countries reflecting their vulnerability conditions. For example, multi-hazard national risk assessments may provide risk metrics such as Average Annual Loss or Probable Maximum Loss that can be used for a quantitative determination of weights. The weight given to each hazard could be determined by prorating the loss by the total multi-hazard loss. It is also important to consider the determination of weights according to the different types of losses (lives, livelihoods and economic loss).

(ii) **historical records** on impacts; for example, using a baseline data for the Target A and Target B, i.e. *number of deaths, missing persons and directly affected persons attributed to disasters,* between 2005 and 2015 by hazard types. Then hazard weights should be prorated accordingly. If applicable, the fact that return

periods of most sever hazards are much longer than 10 years should be taken into account. **National disaster loss databases** may provide a longer period of data and complement the decision of weighting each hazard according to human and economic losses.

(iii) If countries wish, and especially when data is not available, weights could be based on expert criteria.

(iv) If countries wish, it is also advisable to make weights according to their own objectives or targets.

The following example table shows weights proposed in a hypothetical country based on human losses:

Hazard	Mortality per year	Weight
Tsunami	89	25%
Flood	35	10%
Cyclone	122	34%
Epidemic	110	31%
Total Mortality	356	100%

The following example table shows weights proposed in the same country, but based on a combination of human and economic losses represented by Average Annual Loss (AAL), for example assigning 70% importance to human losses and 30% importance to economic loss:

Hazard	Mortality per year	Weight Mortality	AAL (Million USD)	Weight AAL	Combined (70:30)
Tsunami	89	25%	130	0.19	23%
Flood	35	10%	250	0.36	18%
Cyclone	122	34%	280	0.40	36%
Epidemic	110	31%	34	0.05	23%
Total	356	100%	694	1.00	100%

Using these figures, a **weighted average** can be calculated for all multi-hazard indicators, particularly G-2, and G-4 which depends on each system. G-6 should be calculated by each event.

Although Member States could choose a nationally defined hazard classification for the purpose of weighting, they may wish to refer the classification by "Main Events" in Annex I, which was proposed during the OIEWG and is based in international standards (IRDR 2014).

(2) Considering the Coverage of MHEWS

MHEWS could vary within a country with different hazard prone areas, and in many cases not all prone areas of a country are covered. If this is the case, weights by hazard types could be complemented with an additional **coverage factor** to be considered to determine the national figure.

UNISDR encourages Member States, if appropriate and available, to consider a **coverage factor** determined by population so as to ensure a people-centred approach. If data is available, exposed population should be taken as a denominator of this factor to obtain population coverage. Otherwise, demographic data, which is usually available through resident registration, should be used as a proxy of exposed population in the targeted areas.

On the other hand, geographical coverage could also be used for coverage factor (i.e. covered area divided by total exposed area) if it is reasonable for Member States to do so, or if population data is not available.

Example Case 1: Considering only impacts in hazard weights

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

In the case of Tsunamis, the MHEWS indicator scores 0.50 (moderate implementation, see below scoring system),

While in the case of Cyclones, the MHEWS indicator scores 0.75 (substantial implementation).

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

Country score = (Tsunami 70 x 0.50 + Cyclones 30 x 0.75) /100 = **0.575**

Example Case 2: Considering a weight that includes coverage factor

The same country has determined that its MHEWS of tropical cyclones and floods cover the entire nation (100% coverage), those of Tsunami cover only 60% of the total population exposed to Tsunami.

When considering a coverage of MHEWS of major hazards, the country score of MHEWS is calculated as follows;

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

Country score = (Tsunami 70 x 0.50 x 0.6 + Cyclones 30 x 0.75 x 1.0) /100 = **0.435**

If the country takes this approach, the weights should be multiplied by the coverage factor. In the example, the weights would be 70 * 0.6 = 42 for Tsunami and same 30 x 1.0 (unchanged) for Cyclone. Note that when using this approach, the score of a country will not reach 100% as far as MHEWS do not have full coverage.

As expected, in the example case the score is reduced due to the reduced coverage by Tsunami EWS.

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

G-1 is a compound indicator for MHEWS, calculated as an index using the indicators representing the aforementioned four key elements of MHEWS, namely G-2 through G-5. The *compounding methodology* for G-1 entails computing, for each country, 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.

The Secretariat will 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 including coverage of major hazards and/or exposed population, and (b) the quality of MHEWS improves by satisfying key elements increases over time.

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*.

UNISDR requests Member States to do the weighting by their major hazard types, if appropriate, and also consider population coverage as stated above.

Two options for computation of the country score are suggested, from a simpler to a more complex one to reflect the quality/achievement of the system. In either option, the index will be between 1 and 0.

$$\textbf{country score} = \sum_{j=1}^{n}\sum_{j=1}^{m} Score_{ij} \times weight_i \Big/ \left(\sum_{1}^{n} weight_i\right)$$

- Where:

  Score *ij*: score of sub-indicator j (=1, …, m) for each hazard specific EWS type i (=1, .., n) specified in a given table

  Weight i: weight of the hazard i, calculated based on impacts and coverage or determined by each country;

  (see computation methodology).

  n: number of hazard types

  m: number of sub-indicators

MINIMUM DATA REQUIREMENT

A simpler methodology calculates a score by country which depends on the existence of a multi-hazard monitoring and forecasting system for each of the major hazards determined by each country. Each country will report in a simple form, hazard by hazard, if there is a **monitoring and forecasting system** for it (in a binary form, 0 or 1). The score of the country will be the weighted average of the scores for each major hazard.

At global level, the score will be the arithmetic average of the country scores, i.e. the sum of all country scores divided by the number of reporting countries.

RECOMMENDED DATASET
In addition to weighting by hazard types and coverage, this option enables Member States to monitor gradual progress and improvement in the quality of the multi-hazard monitoring and forecasting system, rather than just its existence.

Member States will assess the level of implementation for the **monitoring and forecasting** system of each of the major hazards, and enter all information in the web-based Sendai Framework Monitor. Member States will assess this level of implementation according to the following weighting:

- Comprehensive implementation (full score): 1.0,
- Substantial implementation, additional progress required: 0.75,
- Moderate implementation, neither comprehensive nor substantial: 0.50,
- Limited implementation: 0.25,
- If there is no implementation or no existence, it will be 0.

This index is more complicated than minimum data requirement written above, however, it enables monitoring the improvement in the quality of the system.

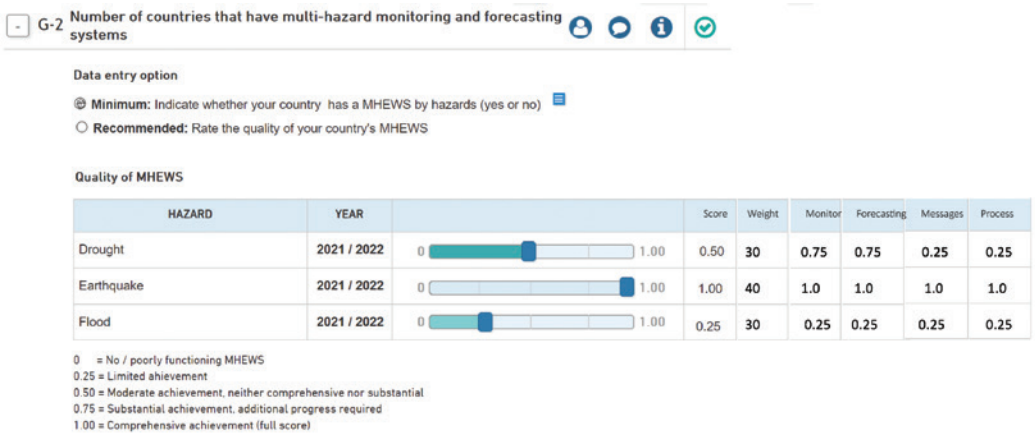
Considering their importance and relevance, the following elements are proposed to be used when measuring the extent to which the multi-hazard monitoring and forecasting system meets the criteria listed in the draft MHEWS Checklist of ***Key Element 2: DETECTION, MONITORING, ANALYSIS AND FORECASTING OF THE HAZARDS AND POSSIBLE CONSEQUENCES***:

i. **Monitoring** data available through established network with observed by well-trained staff
ii. **Forecasting** through data analysis and processing, modelling, and prediction based on accepted scientific and technical methodologies and disseminated within international standards and protocols
iii. **Warning messages** which include risk/impact information with clear emergency preparedness to trigger response reactions generated and disseminated in a timely and consistent manner
iv. Standardized **Process, and roles and responsibilities** of all organizations generating and issuing warnings established and mandated by legislation or other authoritative instrument (e.g., MoU, SOP).

In order to calculate in a more objective way the score for each hazard, countries can use sub-indicators with level of implementation or achievement for each of these four elements. These sub-indicators (which could be optionally entered in the system as well) are proposed to be considered of equal importance (25% each), thus the score will be calculated by the arithmetic average:

$$score_i = (score_{monitor_i} + score_{forecasting_i} + score_{messages_i} + score_{process_i})/4$$

In this way, the quality of a MHEWS for a certain hazard could be assessed more objectively taking into account the elements that are considered to be essential in such a system.



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

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

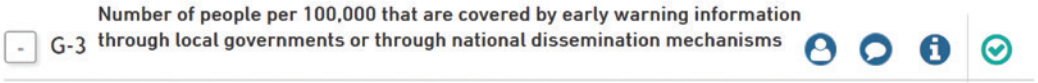
For indicator G-3 it is not required a weighted average of hazard types, as it may be that communication doesn't differ by hazard type. In measuring the population coverage, this indicator represents both inputs and outputs.

MINIMUM REQUIREMENT
Simply determine any **primary media/mode** for early warning 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.



Number of people covered by MHEWS

PEOPLE	2021 / 2022
Number of people covered by MHEWS*	
Estimated population exposed to hazards (optional)	

Quality of Primary media / mode of MHEWS

MEDIA	YEAR	Coverage
Mass media including radio, TV, internet - website, e-mail, SMS, social media, and app	2021 / 2022	
Local communication system including siren, public board, and phone	2021 / 2022	

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, as data collection and the computation methodology to measure overlap of several modes will be complex and difficult– it is therefore not recommended for global indicators.

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

For the purposes of this indicator, ***a "plan to act on early warnings" could be a preparedness plan, an emergency plan, an action plan or any plans that describe who and how to react to an early warning.***

Therefore, 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 disaggregating the indicator by hazards and qualify the scores by hazard with the weights of their major hazard types, in the same way as G-2.

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.

There was an issued raised at the OIEWG 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 national monitoring frameworks introducing appropriate targets and indicators.

A set of data is proposed, from the minimum required to a desirable dataset. The methodology of this indicator is similar to that of G-3; however, the use of a weighted average of hazard types may be determined by country.

MINIMUM REQUIREMENT
Simply count the number of local governments which have a plan to act on early warnings. This will be the sum of a binary value (0 or 1) for each local government.

RECOMMENDED DATASET
Member States may consider monitoring gradual progress and improvements in the quality of a plan to act on early warnings, rather than just its existence, by sub-indicators with level of implementation or achievement at local level.

Quantitative sub-indicators are proposed to measure the extent to which each of the local EWS plans meet the criteria listed in the draft MHEWS Checklist of ***Key Element 4:*** *PREPAREDNESS AND RESPONSE CAPABILITIES,* as follows, answered by binary, yes/no:

i. Are disaster **preparedness** measures, including response plans, developed and operational?

ii. Is public **awareness** and education conducted?

iii. Is public awareness and response tested and **evaluated**?

Member States will assess each sub-indicator on each local government, and assign a score of 1 or 0 to each of them. These sub-indicators are proposed to be weighted equally, in the above case 1/3 to each, thus the score will be calculated by the arithmetic average for each local government.

The country score will then be calculated by the summation of all scores of local governments divided by the number of the local governments.

$$\textbf{country score} = \sum_{k=1}^{l} (score_{preparedness_k} + score_{awareness_k} + score_{evaluation_k}) \Big/ 3 * l$$

- Where :

  Score_xxx_*k*: binary score (0 or 1) of the sub-indicator corresponding to XXX in the list above, in the local government k (= 1, …, l);

  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 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. 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 **weights for major hazards**. In either option, the index will be between 1 and 0.

MINIMUM REQUIREMENT
Member States simply report whether it has accessible, understandable, usable and relevant disaster risk information and assessment, which is basically determined by each country in binary (i.e. yes or no, 1 or 0), for each of the major hazard types the country faces, calculating the score as the arithmetic average of all of the hazard specific scores.

RECOMMENDED ADDITIONAL DATA
Taking a balance between precision and practicality of the indicator, this option can measure the progress and improvement better with a focus on accessibility and availability as well as quality of disaster risk information and risk assessment. In so doing, Member States will first determine major hazard types to be considered in their multi-hazard national risk assessment and weights for each of their major hazards as written above.

Accessibility and availability
Member States are request to report the rate of accessibility and availability of disaster risk information by hazard type. If disaster risk information is publicly available on the web or/and any other means (e.g. community boards, signs, and fliers) to all the (exposed) population, it can report 100%. If the main communication tool is internet, a national internet penetration rate could be used as a proxy.[35]

Incremental measurement of the quality
Additionally, this option enables Member States to monitor gradual progress and improvement in the quality of risk information and assessment over time, rather than just its existence, by sub-indicators with level of implementation or achievement.

Since G5 does not only relate to MHEWS but also risk assessment and information in a broader context, the proposed measurement is specific to this indicator. From past UNISDR work on risk assessment, the best methodology used to carry out a risk assessment will vary depending on the hazard type, and should consider the following elements:

i. Be based on the most **scientific** approach possible (ideally probabilistic where feasible);

ii. the product of a national **consultation**, shared, coordinated, and used by national institutions;

iii. with clear **responsibilities** for decision making, planning, and storing data and information.

Member States will assess each sub-indicator on each hazard type, and assign an incremental score from 0 to 1 (i.e. 0, 0.25, 0.50, 0.75, 1) to the sub-indicator i and 1/0 (binary) to the sub-indicator ii and iii. These sub-indicators are proposed to be weighted equally, in the above case 1/3 to each, thus the score will be calculated by the arithmetic average for each hazard.

The first sub-indicator is proposed to measure the quality of the risk assessment / risk information considering the most scientific approach on which the risk assessment is based for each hazard type. Member States may wish to refer to a sample scoring table provided in the online monitoring system and take the highest score if their assessment is based on several approaches (see Annex II). The three sub-indicators are to be treated equally and be calculated by the arithmetic average.

35 For example, International Telecommunications Union (ITU) has published Country ICT Data (https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx)

Taking into account of both accessibility and the quality, the country score will be calculated as

$$\textbf{country score} = (\textbf{Accessibiity Rate})_i \times \sum_{i=1}^{n} \sum_{j=1}^{3} Score_{ij} / 3 \times {weight_i}/{(\sum_1^n weight_i)}$$

- Where:

  Score *ij*: score of sub-indicator j (=1, 2, 3) for each hazard type i (=1, .., n)
  Weight i: weight of the hazard i, calculated based on impacts and coverage or determined by each country;
  n: number of hazard types

While this proposed methodology cannot perfectly capture the quality of risk assessment, it could be used consistently across countries and over time to measure the progress of multi-hazard risk assessment as a whole. Member States may wish to develop further Custom Indicators more appropriate to country context for national level monitoring.

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

This output indicator quantifies the impact and effectiveness of early warning information, and may only be possible at local level. As "evacuated" we refer to people who have been required to move at least *temporarily* from their places of residence to safer places when threatened by a hazardous event. There was discussion in OIEWG that this indicator has two aspects: a) measuring the degree to which the relevant authorities have been successful in avoiding human losses by evacuating populations pre-emptively, and b) measuring the degree to which populations' lives and assets are negatively affected due to evacuation.

In the deliberation by the OIEWG, a number of the Members raised 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. Therefore, 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, 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 or shelter in place (because it may be safer in some situations or for some sub-populations (e.g. high dependency patients).

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 the OEIWG and other technical meetings and suggestions raised during consultation, UNISDR recommends disaggregating data:

Indicator No.	Indicators
G-1	**Number of countries that have multi-hazard early warning systems.** COMPOUND INDICATOR. See computation method
G-2	**Number of countries that have multi-hazard monitoring and forecasting systems.** **[Minimum data requirements]:** G-2a Score of existence of monitoring and forecasting systems (1/0), calculated per hazard type Weight per Hazard type (0.00 to 1.00, see suggested methodology) **[Desirable data]** **Data for each hazard type:** G-2b Overall Score of the quality of monitoring and forecasting systems in 5 levels from 0 to 1 (see methodology) Scores of 4 elements of EWS (G-2c Monitoring, G-2d forecasting, G-2e Messages and G-2f process) **[Disaggregation]** Both minimum and desirable datasets are to be disaggregated by hazard type. (List of hazards to be defined by country or as per Annex I). **[Additional Data]** Note: see recommendations and examples for the calculation of hazard weight based on estimated or historical impacts, or by expert criteria, or by country priorities and objectives.
G-3	**Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms.** **[Minimum data requirements]:** G-3a Number of people covered by early warning information through local governments or through national dissemination mechanisms **[Disaggregation]** Information dissemination mechanism (media, local) **[Additional Data]** Population of the country

G-4	**Percentage of local governments having a plan to act on early warnings.** **[Minimum data requirements]:** G-4a Number of local governments having a plan to act on early warnings **[Desirable additional data]** **Data for each local government:** G-4b Overall Score of the quality of Local plan in 5 levels from 0 to 1 (see methodology) Scores of 3 elements of Plans (G-4c Preparedness, G-4d Awareness, and G-4e Evaluation) **[Disaggregation]** Local Government **[Additional Data]** 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.** **[Minimum data requirements]:** G-5a Score of existence of accessible, understandable, usable and relevant disaster risk information and assessment available to the people at the national and local levels (1/0), calculated per hazard type. **[Desirable data]** **Data for each hazard type:** G-5b Score of the quality of risk information and assessment from 0 to 1 (see methodology on page 167-168) **[Recommended disaggregation]** Hazard type Local government
G-6	**Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning.** **[Minimum Requirement for disaggregation]** **Hazardous events** **[Desirable disaggregation]** Local government (sub-national administrative unit) * note in the OIEWG Report 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, exposure, and capacity 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**, Member States 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.

ANNEX I

Proposed Hazard Classification

FAMILY	Hazards
Geophysical	Earthquake, Tsunami
	Mass movement mostly triggered by geophysical events (overlaps with hydrological category) Landslide, avalanche, rock fall, mud flow, debris flow, subsidence)
	Volcanic activity, eruption, lava flow, ash fall, pyroclastic flow, lahar
Hydrological	Flood, riverine flood, coastal flood, ponding flood, urban flood, flash flood,
	Mass movement mostly triggered by hydrological events (overlaps with geophysical category) Landslide, avalanche, rock fall, mud flow, debris flow, subsidence
	Wave Action, coastal erosion, shoreline change.
Meteorological	Convective Storm, rain, wind, hail, snow, ice, blizzard, lightning, sand, dust, derecho, tornado
	Extra-tropical storm
	Extreme temperature, cold wave, heat wave, frost, freeze
	Fog
	Tropical cyclone, cyclonic wind, cyclonic rain, cyclone surge
Climatological	Drought
	Glacial lake outburst (GLOF)
	Wildfire
Extra-terrestrial	Impact
	Space weather
Environment degradation	Erosion
	Deforestation
	Salinization
	Sea Level Rise
	Desertification
	Asian Dust cloud
	Wetland loss/degradation
	Glacier retreat/melting

Biological hazards *	Epidemics
	Pandemics
	Epizootics
	Pest
	Insect infestation, plague
	Animal Incidents
	Pollution
Technological hazards	Industrial disaster
	Structural collapse
	Power outage
	Fire
	Explosion
	Mine disaster
	Chemical Spill
	Oil Spill
	Radiation contamination, Nuclear incident
	Aviation Accident
	Rail Accident
	Road Accident
	Navigation Accident
	Space Accident

ANNEX II

Example of a scoring table for scientific approach by types of risk assessments per hazard type

FAMILY	Hazards	Type of Assessment						
		Probabilistic Risk model	FTA FMEA	Expert opinion	Deterministic (Scenario based)	HAZOP	Com-munity based	Other
Geophysical	Earthquake, Tsunami (seismic)	1	0.75	0.5	0.5	n/a	0.25	0.25
	…							
Hydrological	Flood, riverine flood, coastal flood, ponding flood, urban flood, flash flood	1	0.75	0.5	0.5	n/a	0.25	0.25
Technological hazards	Industrial disaster	n/a	0.75	0.5	0.5	1	0.25	0.25

Please note that the given scientific approaches are not exhaustive.[36]

36 Probabilistic Risk model: characterized by inherent uncertainties, partly related to the natural randomness of hazards, and partly because of our incomplete understanding and measurement of the hazards, exposure and vulnerability under consideration;
FTA: Fault Tree Analysis;
FMEA: Failure Mode and Event Analysis;
Deterministic approaches: used to assess disaster impacts of a given hazard scenario, whereas probabilistic methods are used to obtain more refined estimates of hazard frequencies and damages.
HAZOP: Hazard and Operability study
https://www.preventionweb.net/risk/deterministic-probabilistic-risk

REFERENCES

Rogers, D. and Tsirkunov, V. 2011. Implementing Hazard Early Warning Systems, GFDRR WCIDS Report 11-03.
http://www.preventionweb.net/files/24259_implementingearlywarningsystems1108.pdf

IRDR (Integrated Research on Disaster Risk) 2014. Peril Classification and Hazard Glossary (Data Project Research No.1), Beijing
http://www.irdrinternational.org/wp-content/uploads/2014/04/IRDR_DATA-Project-Report-No.-1.pdf

United Nations. 2005. Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters
http://www.preventionweb.net/files/1037_hyogoframeworkforactionenglish.pdf

United Nations. 2006. Global Survey of Early Warning Systems: Third International Conference on Early Warning (EWC III). 27-29 March 2006, Bonn, Germany.
https://www.wmo.int/pages/prog/drr/events/EWSExpertmeeting/Documents/Global_Survey_EWS.pdf

United Nations. 2006. Report of the First Experts' Symposium on Multi-Hazard Early Warning Systems (MHEWS-I). May 2006.
https://www.wmo.int/pages/prog/drr/events/EWSExpertmeeting/Documents/EWSSymposium2006OutcomeReport.pdf

United Nations. 2015. The Sendai Framework for Disaster Risk Reduction 2015-2030
http://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

United Nations. 2016. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. Note by the Secretary-General. A/71/644. United Nations General Assembly, Seventy-first session, Agenda item 19 (c) Sustainable development: disaster risk reduction. 1 December 2016.

United Nations. 2017. *Resolution adopted by the General Assembly on 2 February 2017*. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. A/RES/71/276. United Nations General Assembly, Seventy-first session Agenda item 19 (*c*). 2 February 2017.

United Nations Office for Disaster Risk Reduction (UNISDR). 2006. Developing Early Warning Systems, A Checklist: Third International Conference on Early Warning (EWC III). 27-29 March 2006, Bonn, Germany.
http://www.unisdr.org/we/inform/publications/608

UNESCO. 2015. Tsunami Risk Assessment and Mitigation for the Indian Ocean: Knowing Your Tsunami Risk – and What to do about It. May 2017
http://unesdoc.unesco.org/images/0018/001847/184777e.pdf

UNISDR. 2009a. UNISDR Terminology on Disaster Risk Reduction. United Nations International Strategy for Disaster Reduction. Geneva, Switzerland.

UNISDR. 2009b. Global Assessment Report on Disaster Risk Reduction: Risk and Poverty in a Changing Climate. Geneva, Switzerland: UNISDR.

UNISDR. 2011. Global Assessment Report on Disaster Risk Reduction: Revealing Risk, Redefining Development. Geneva, Switzerland: UNISDR.

UNISDR. 2013. Global Assessment Report on Disaster Risk Reduction: From Shared Risk to

Shared Value: the Business Case for Disaster Risk Reduction. Geneva, Switzerland: UNISDR. http://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2014. Progress and Challenges in Disaster Risk Reduction: A contribution towards the development of policy indicators for the Post-2015 Framework on Disaster Risk Reduction. Geneva, Switzerland. UNISDR.

UNISDR. 2015a. Global Assessment Report on disaster risk reduction: Making development sustainable: The future of disaster risk management. Geneva, Switzerland: UNISDR. http://www.preventionweb.net/english/hyogo/gar/

UNISDR. 2015b. Support to National Implementation of the Sendai Framework 2015 -2013. Geneva.

UNISDR. 2015c. Information Note on Comments received on the Working Background Text on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2015d. Technical Collection of Issue Papers on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 23 December 2015.

UNISDR. 2016a. Technical Collection of Concept Notes on Indicators for the Seven Global Targets of the Sendai Framework for Disaster Risk Reduction. Geneva, Switzerland. 10 June 2016. http://www.preventionweb.net/documents/oiewg/Technical%20Collection%20of%20Concept%20Notes%20on%20Indicators.pdf

UNISDR. 2016b. *Results of the informal consultations of the Chair on indicators for global targets A, B, C, D, E, F and G of the Sendai Framework for Disaster Risk Reduction*. Issued on 12 November 2016.

UNISDR. 2016c. *Results of the Informal Consultations of the Chair on Terminology related to Disaster Risk Reduction*. Issued on 12 November 2016.
http://www.preventionweb.net/files/50683_resultsinformalconsultationstermino.pdf

UNISDR. 2017. *Words into Action Guideline: National disaster risk assessments - Governance System, Methodologies, and Use of Results-,* Issued October 2017
http://www.preventionweb.net/files/52828_nationaldisasterriskassessmentwiagu.pdf

Wisner, B. , Gaillard, J.C. and Kelman, I. 2012. Handbook of Hazards and Disaster Risk Reduction, Routledge, Oxon

WMO (World Meteorological Organization). 2008. Capacity Assessment of National Meteorological and Hydrological Services in Support of Disaster Risk Reduction: Analysis of the 2006 WMO Disaster Risk Reduction Country-level Survey, World Meteorological Organization, Geneva
https://www.wmo.int/pages/prog/drr/natRegCap_en.html

WMO. 2012: Institutional Partnerships in Multi-Hazard Early Warning Systems: A Compilation of Seven National Good Practices and Guiding Principles, Springer
Chapter 1 - An Overview: Building a Global Knowledge Base of Lessons Learned from Good Practices in Multi-Hazard Early Warning Systems
Chapter 3 - The Bangladesh Cyclone Preparedness Program. A Vital Component of the Nation's Multi-Hazard Early Warning System
Chapter 4 - The French Vigilance System. Contributing to the Reduction of Disaster Risks in France
Chapter 9 - Synthesis of Seven Good Practices in Multi-Hazard Early Warning Systems
http://www.wmo.int/pages/prog/drr/events/2016-EAG-MHEWS/documents/CH9-Synthesis.pdf

UNISRD December 2017
www.unisdr.org

NOTES

UNISDR

United Nations Office for Disaster Risk Reduction