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Sendai Framework for Disaster Risk Reduction 2015-2030

INFORM
INDEX FOR RISK MANAGEMENT

SUSTAINABLE DEVELOPMENT GOALS

Joint Research Centre

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Contents

Abstract

The objective of the present study is to review opportunities for the improvement of the multi-hazard risk assessment Index for Risk Management (INFORM) Global Risk Index (GRI) with new indicators produced by the monitoring system of the Sendai Framework for Disaster Risk Reduction (SFDRR) and the 2030 Agenda for Sustainable Development.

The implementation of both the agendas requires a solid framework of indicators to monitor the progress made on reducing disaster risk — Sendai Framework Monitor (SFM) — and achieving sustainable development — the Sustainable Development Goals (SDGs). The two monitoring frameworks will provide a unique set of reliable, consistent and comparable indicators required to understand the disaster risk reduction drivers and underlying risk factors linked to the sustainable development sought for. This creates a unique opportunity for enhancing the quality and the coverage of the underlying indicators used in the INFORM GRI while offering the possibility of cross-checking the results of these monitoring programmes with the assessment of the risk levels for humanitarian crisis calculated by the INFORM GRI.

This report describes the process towards the identification of the indicators from the SFM and SDGs that can be potentially included in the next releases of the INFORM GRI model in order to improve the quality of the assessment.

Many data gaps remain, especially on the SFM reporting, making the integration of most of the indicators diluted in time, and in some cases uncertain. Only seven indicators were considered ready to be included in the next release of the INFORM GRI, with a minimal influence on the model's results.

On the other hand, once available, the new indicators will help to fill some of the identified gaps due to data unavailability of the current INFORM GRI model. In particular, the SFM indicators will provide an essential contribution to assessing the capacity of countries towards risk reduction.

Roles of the authors

Karmen Poljanšek, as the editor of the report, was responsible for designing the concept and leading the development and the preparation of the report.

Montserrat Marin Ferrer, as the coordinator of the European Commission Disaster Risk Management Knowledge Centre projects, oversaw the whole process.

Luca Vernaccini, as the external consultant, reviewed scientific and technical solutions, performed all the analysis, computed and presented the results, and wrote the report.

Sepehr Marzi, as visiting scientist from Centro Euro-Mediterraneo sui Cambiamenti Climatici, performed the statistical analysis on the interindicator correlations within components.

Laura Messina, as trainee, contributed to the review of the report.

1. Introduction

The objective of the present study is to review opportunities for the improvement of the global multi-hazard risk assessment Index for Risk Management — **INFORM Global Risk Index (GRI)** — with new indicators produced by the monitoring system of the **Sendai Framework for Disaster Risk Reduction (SFDRR)** and the **2030 Agenda for Sustainable Development**.

In the 2017 annual meeting, the INFORM partners agreed to review the new data and indicators from the Sustainable Development Goals (SDGs) and SFDRR and propose if and how it can be used in future releases of the INFORM GRI (notably for indicators related to lack of coping capacity and/or vulnerability). The process is supported by the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) as part of the administrative agreement Scientific Support to Disaster Risk Management Actions (DRM2017-2019) AA34749.

The INFORM GRI is a composite indicator developed by the Joint Research Centre of the European Commission (JRC) that identifies countries at risk of humanitarian crisis and disaster. The INFORM GRI methodology is subject to periodical improvement: exploring new data sources; expanding to new thematic dimensions; liaising with disaster risk experts in the academic world; contributing to the literature in the disaster risk field; and applying new scientific insights in the model (Marin-Ferrer et al., 2017a,b; De Groeve et al., 2014, 2015).

The year 2015 was crucial for disaster risk management. Two international frameworks of the post-2015 development agenda were signed with clear targets to reduce disasters and humanitarian suffering for the world's population. In the Sendai Framework for Disaster Risk Reduction, adopted in March 2015, national governments engage themselves to prevent new and reduce existing disaster risk by reducing hazard exposure and vulnerability while increasing preparedness, all of which results in increased resilience. In September 2015, 17 Sustainable Development Goals were adopted at a UN summit, and disaster risk is particularly prominent in at least three of them: end poverty, build resilient cities and combat climate change. Both frameworks emphasise the role of science and objective data to monitor progress in risk reduction and sustainable development. As a consequence of the direct link with the INFORM GRI, this model has been widely promoted at world conferences (Marin-Ferrer et al., 2017b).

The implementation of both the agendas requires a solid framework of indicators to monitor the progress made on reducing disaster risk — **Sendai Framework Monitor (SFM)** — and achieving sustainable development — the **SDGs**:

- A set of 38 indicators tracks progress in implementing the seven targets of the SFM.
- The global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development includes 232 indicators organised in 17 goals and 169 targets.

The two monitoring frameworks provide a set of reliable, consistent and comparable indicators required to understand the disaster risk drivers and underlying risk factors. This creates a unique opportunity for enhancing the quality and the coverage of the underlying indicators used in the INFORM GRI while offering the possibility of cross-checking the results of these monitoring programmes with the assessment of the risk levels for humanitarian crisis calculated by the INFORM GRI.

This report describes the process towards the identification of the indicators from SFM and SDGs that can be potentially included in the next releases of the INFORM GRI model in order to improve the quality of the assessment.

The purpose is to improve the INFORM GRI, benefiting from the state of the art of the data on disaster risk and its drivers, without modifying its conceptual framework.

In Chapters 2 and 3 we introduce the INFORM GRI model and the two global monitoring frameworks.

In Chapter 4 we identify the main data weaknesses in the INFORM GRI model, such as the components that are not well covered by indicators, components not included for lack of available data, indicators that are indirect or approximate measure (proxy indicators), poor-quality indicators (e.g. self-assessment) and weakly performing indicators (poor coverage, not frequently updated).

A preliminary screening of the monitoring indicators based on their relevance to the INFORM GRI conceptual framework has been carried out. In total, more than 50 indicators have been identified as suitable to be included in the INFORM GRI. They include new indicators, possible replacements for existing ones or substitutes for deleted ones. Priority will go to the last two categories, and to new indicators that concern components of the model that are currently weakly covered or not even represented.

Finally, the indicators currently available are assessed against quantitative criteria for inclusion, such as coverage, frequency of update, time series availability and last update. Based on these criteria, the final decision will be made on which indicator could be included in the next release of the INFORM GRI. Up to now, only a reduced subset of the selected monitoring indicators from the two frameworks fulfils the minimum requirements.

In addition, we address if and how the INFORM GRI contributes to the post-2015 global frameworks. In particular, we show how the implementation of the INFORM GRI at national scale (INFORM Subnational Risk Index) is contributing to defining national and local disaster risk reduction strategies (SFDRR global target E), and to increasing the availability of and access to disaster risk information (SFDRR global target G). Furthermore, the INFORM GRI is presented as a tool for assessing and monitoring SFDRR and SDG progress towards risk reduction.

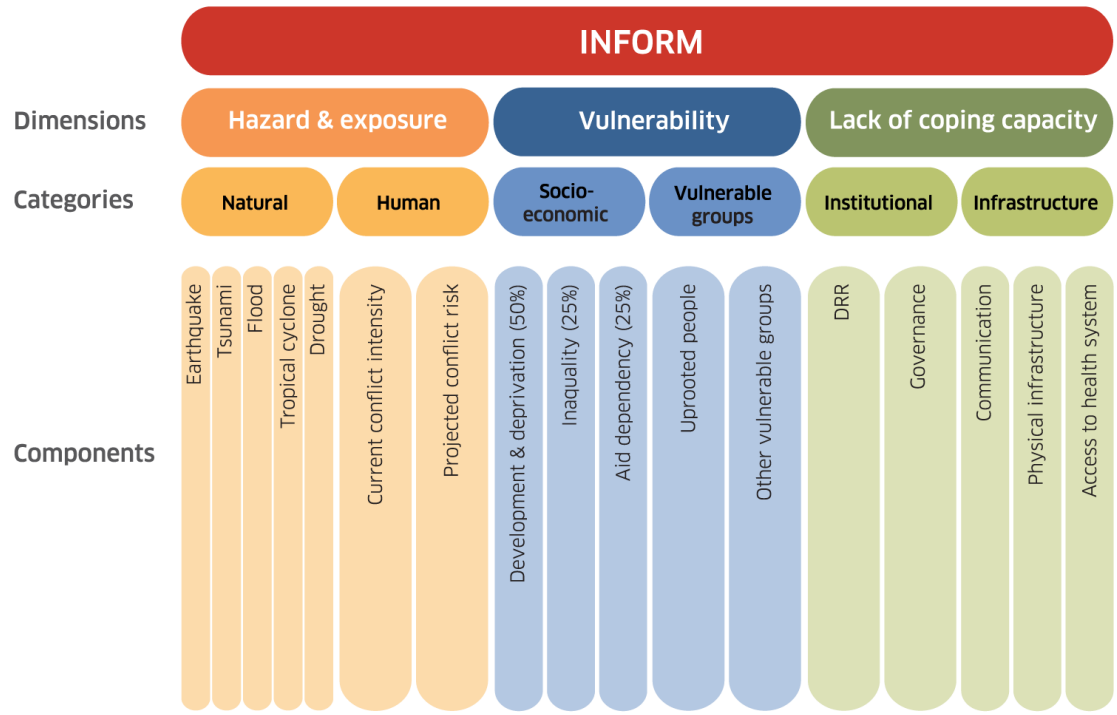
2. The Index for Risk Management INFORM GRI

The **INFORM Global Risk Index (GRI)** (De Groeve et al., 2014) has been developed to improve the common evidence basis for risk analysis so that all governments, development agencies, disaster risk reduction organisations can work together. The INFORM GRI is the first global, open-source, continuously updated, transparent and reliable tool for understanding risk of humanitarian crises and disasters. It covers 191 countries. All the results and data used are freely available and the INFORM partnership includes many organisations that provide data. The methodology is completely transparent and based on scientific concepts and methods.

The INFORM GRI is a way to understand and measure the risk of a humanitarian crisis. The initiative started in a workshop in October 2012 organised at the JRC. Since that time, INFORM has become a multi-stakeholder forum for developing shared analyses to help manage humanitarian crises and disasters. It now has partners from across the UN system, donors, civil society, the academic/technical community and the private sector.

The JRC is the main scientific leader in the INFORM GRI process, and has led the bottom-up process of building a consensus-based new methodology, taking into account the requirements of participating institutions as well as limitations of data availability. The INFORM initiative has an annual conference at which partners discuss strategic developments in response to the various needs and requirements expressed by the institutions using the INFORM GRI or associated products. Frequent teleconferences of the thematic working groups to discuss the implementation of the agreed methodological improvements and changes are also organised on a regular basis.

Figure 1: INFORM GRI conceptual framework



Source: De Groeve et al. (2014)

The INFORM GRI is a composite indicator developed by the JRC by combining more than 50 indicators into three dimensions of disaster risk (**Figure 1**): hazards (events that could occur) and exposure to them; vulnerability (the susceptibility of communities to those hazards); and lack of coping capacity (lack of resources that can alleviate the

impact). They give an overall risk score out of 10 for each country, and for each of the dimensions, categories and components of risk.

The purpose of the INFORM GRI is to provide an open, transparent, consensus-based methodology for analysing crisis risk at the global, regional or national level. The index results are published twice a year. This year will see the sixth edition of the the INFORM GRI.

The INFORM GRI methodology is subject to periodical improvement: exploring new data sources; expanding to new thematic dimensions; liaising with disaster risk experts in the academic world; contributing to the literature in the disaster risk field; and applying new scientific insights in the model.

The INFORM GRI is a widely recognised and valuable tool that supports the decision-making of INFORM partners and others. A recent survey conducted by the JRC (Messina et al., 2019) aimed to assess the current usage of the INFORM GRI, the impact its usage has had in decision-making, the support and promotion it has received, and the improvements and future endeavours that are considered necessary.

The INFORM risk analysis process and methodology have been extended to the regional and country levels and adapted to many scopes and targets. The **INFORM Subnational Risk Index (SRI)** uses the same risk assessment methodology and development process, but is adapted to regional- or national-level data availability and particular exigencies. The result is a risk model for humanitarian crises and disasters that has the same features and benefits as the global model, but is subnational in resolution and can be applied at the province, municipal or village level.

Both INFORM's approach and its products are increasingly recognised as supporting several key components of the post-2015 humanitarian, SFDRR and development agenda. Shared analysis and joint humanitarian and development action are principles recognised by the World Humanitarian Summit outcomes, SFDRR and SDGs (INFORM, 2018).

3. Sendai Framework for Disaster Risk Reduction and 2030 Agenda for Sustainable Development

The year 2015 saw the adoption of two major global frameworks: the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction 2015-2030. They are the successor instruments of, respectively, the Millennium Development Goals (MDGs) and the Hyogo Framework for Action (HFA).

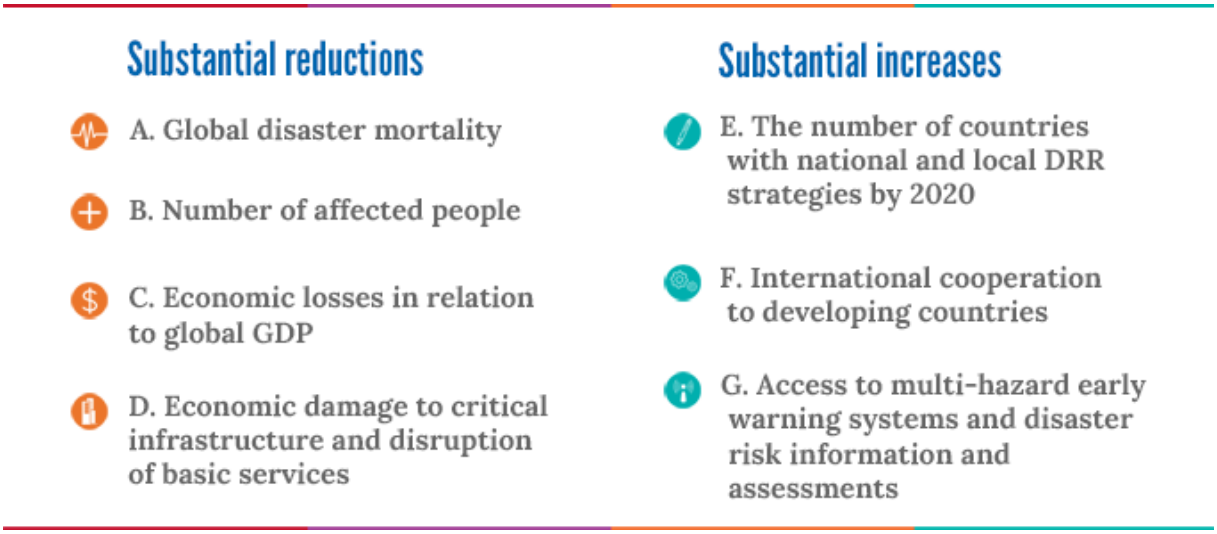
3.1. Sendai Framework for Disaster Risk Reduction

In the SFDRR, adopted in March 2015, national governments engage themselves to prevent new disaster risks and reduce existing ones by reducing hazard exposure and vulnerability and increasing preparedness and resilience (Marin-Ferrer et al., 2017b).

The SFDRR 2015-2030 (UNISDR, 2015), successor instrument to the HFA 2005-2015 (UNISDR, n.d.a), outlines four priorities for action and seven targets (**Figure 2**) to prevent new disaster risks and reduce existing ones. The priorities are:

1. understanding disaster risk;
2. strengthening disaster risk governance to manage disaster risk;
3. investing in disaster reduction for resilience;
4. enhancing disaster preparedness for effective response, and building back better in recovery, rehabilitation and reconstruction.

Figure 2. SFDRR seven global targets



Source: UNISDR, 2019

The SFDRR aims to achieve a substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries with a timeframe up to 2030.

3.1.1. Sendai Framework Monitor

Strong accountability is one of the cornerstones of the SFDRR and it is established by means of the SFM. It consists of a set of 38 indicators (**Table 1**), recommended by the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology (OIEWG), that is used to measure global progress in the implementation of the SFDRR. The indicators, which are intended to be objective and comparable, measure progress in achieving the global targets of the SFDRR, and determine global trends in the reduction

of risk and losses. UN Member States have to report against the indicators for measuring the global targets of the SFDRR using the online Sendai Framework Monitor.

Indicators for global targets A-D measure the outcomes, in terms of reducing losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

Global targets E, F and G follow the structure of the indicators proposed under the previous HFA, and are particularly related to the self-assessment of countries regarding their progress on governance and risk management (Marin Ferrer et al., 2018).

While the first four targets could allow double-checking of the trends on risk against the trends on recorded loses, the last three are the most interesting for the INFORM GRI framework, as they try to assess in the most objective way possible the implementation capacity on disaster risk reduction (DRR) of countries and communities.

Table 1. Sendai Framework Monitor indicators

Global target A: Substantially reduce global disaster mortality by 2030, aiming to lower average per 100 000 global mortality between 2020-2030 compared with 2005-2015	
A-1 (compound)	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

Global 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 with 2005-2015	
B-1 (compound)	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

Global target C: Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030	
C-1 (compound)	Direct economic loss attributed to disasters in relation to global gross domestic product
C-2	Direct agricultural loss attributed to disasters
C-3	Direct economic loss to all other damaged or destroyed productive assets attributed to disasters
C-4	Direct economic loss in the housing sector attributed to disasters
C-5	Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters
C-6	Direct economic loss to cultural heritage damaged or destroyed attributed to disasters

Global 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	
D-1 (compound D2-D4)	Damage to critical infrastructure attributed to disasters
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
D-5 (compound D6-D8)	Number of disruptions to basic services attributed to disasters
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

Global target E: Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020	
E-1	Number of countries that adopt and implement national disaster risk reduction strategies in line with the SFDRR 2015-2030
E-2	Percentage of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies

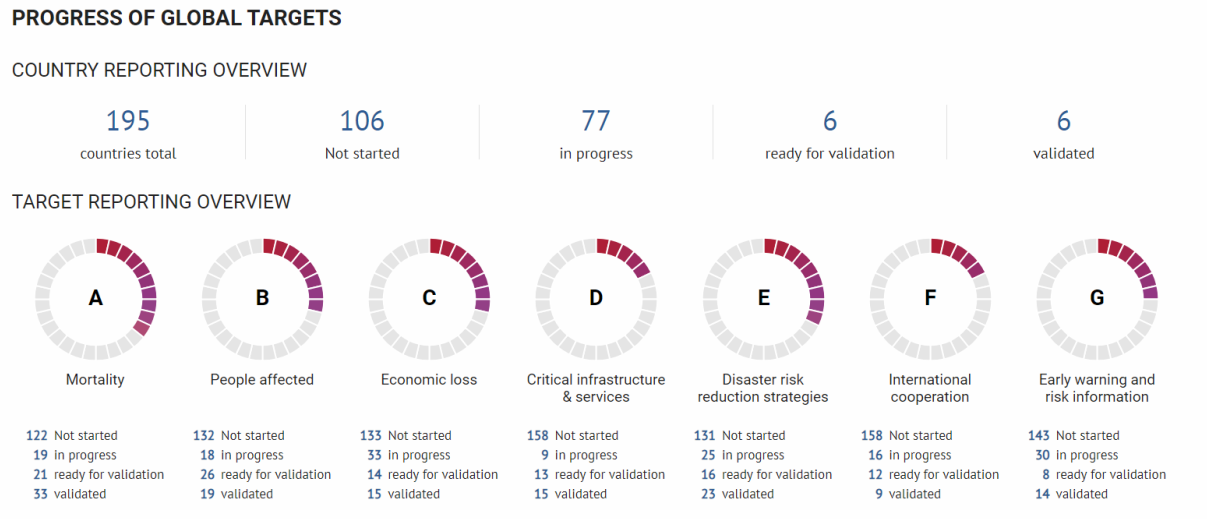
Global target F: Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030	
F-1	Total official international support (official development assistance (ODA) plus other official flows) for national disaster risk reduction actions
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

Global 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	
G-1 (compound G2-G5)	Number of countries that have multi-hazard early warning systems
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

Source: UNISDR, 2019

The level of reporting by countries on the SFM is still very low. At the time of writing, fewer than half of countries have started the process, and only 12 have completed it (**Figure 3**), which is a clear indication of the difficulties encountered at national level in collecting the required information.

Figure 3. Reporting progress on the Sendai Framework Monitor indicators (11 March 2019)



Source: UNISDR, 2019

3.2. **2030 Agenda for Sustainable Development**

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future.

The new agenda covers a broad set of 17 Sustainable Development Goals and 169 targets and serves as the overall framework to guide global and national development action for the next 15 years. The SDGs cover social and economic development issues including poverty, hunger, health, education, global warming, gender equality, water, sanitation, energy, urbanisation, environment and social justice (**Figure 4**).

The SDGs were developed to succeed the MDGs ([1]), which ended in 2015.

Figure 4. Sustainable Development Goals

Source: UN, https://www.un.org/sustainabledevelopment/news/communications-material/

3.2.1. Sustainable Development Goals indicator framework

The SDG indicator framework was adopted by the General Assembly on 6 July 2017 and is a solid framework of indicators and statistical data to monitor progress, inform policy and ensure accountability of all stakeholders. The list includes 232 indicators, developed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs).

Such systems around the world have been the source of many important initiatives to develop new tools and frameworks to integrate new data sources, with the aim of fully harnessing the power of the data revolution and achieving the goals and targets of the 2030 Agenda (UN Statistics Division, n.d.a).

With a change of approach from the MDGs, with the SDGs the UN clearly states (UN, 2015) that 'national ownership is key to achieving sustainable development' and therefore 'the global review will be primarily based on national official data sources'.

The national data provided to the international statistical system are often adjusted for international comparability and, where missing, are estimated. As decided by the Statistical Commission and in accordance with UN Economic and Social Council Resolution 2006/6, estimates used for the compilation of global indicators are to be produced in full consultation with national statistical authorities (UN Statistics Division, n.d.b).

The SDGs make a specific effort to identify those left furthest behind, promoting disaggregated data by income, sex, age, race, ethnicity, migratory status, disability, geographical location and other characteristics. This type of detailed information is very useful to identify hidden disaster risk drivers.

([1]) http://www.un.org/millenniumgoals/

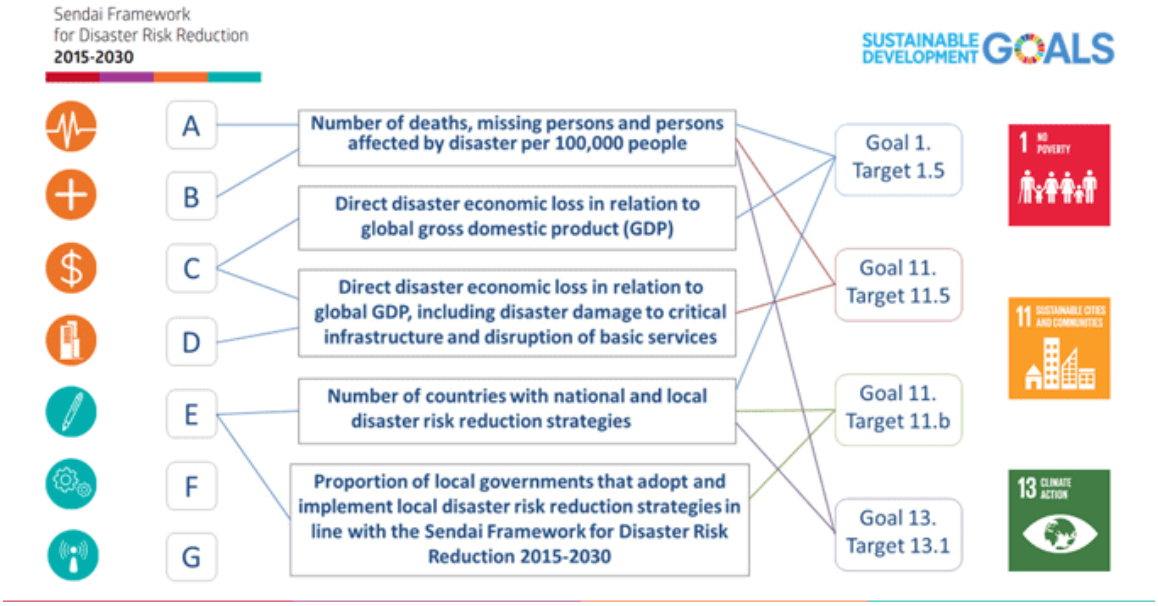
3.3. **Synergy between reporting on SFDRR and SDGs**

Sustainable development cannot be reached unless we can manage and reduce risk. Hence, the proposals for both the SDGs and the SFDRR recognise that their desired outcomes are a product of complex and interconnected social and economic processes, with overlap across the two agendas.

As a reflection of this, important synergies exist between reporting in the two frameworks. The SFM is intended to complement monitoring of the SDG indicators (UNISDR, n.d.b).

The Sendai Framework targets and indicators contribute to measuring disaster-related goals and targets of the 2030 Agenda for Sustainable Development, in particular SDGs 1, End poverty in all its forms everywhere; 11, Make cities and human settlements inclusive, safe, resilient and sustainable; and 13, Take urgent action to combat climate change and its impacts (**Figure 5**).

Figure 5. Integrated monitoring of the global targets of the SFDRR and the SDGs



Source: UNISDR, 2019

4. Analysis of the potential inclusion of the SFM and SDGs monitoring indicators in the INFORM GRI

The INFORM GRI methodology is constantly improved by including new relevant indicators, replacing the deleted ones, incorporating the most advanced techniques for imputation of missing values using machine learning models (e.g. Random Forest; Marin-Ferrer et al., 2017a) or ultimately adding new components (e.g. the epidemics hazard in the next release; Poljanšek et al., 2018). The goal is to maintain the quality of the index with the best suitable methods and data available at the time. On the other hand, the INFORM GRI model has proved to be statistically robust (Marin-Ferrer et al., 2017b).

The MDGs and the HFA Monitor have been the reference indicator frameworks for development and disaster risk. The MDGs contributed to the ongoing data revolution (UN, 2014) (UN 2014), dramatically improving the data from the developing countries (World Bank and International Monetary Fund, 2016). During the four reporting cycles to 2015, the HFA Monitor generated the world's largest repository of information on national DRR policy, inter alia.

The two pre-2015 monitoring frameworks provided the basis for the indicators used in the original version of the INFORM GRI. There is a close link between the pre- and post-2015 monitor frameworks; the experience of the former, and in particular the identification of their limitations (Le Quesne et al., 2016), have been used to design the new sets of monitoring indicators. In this chapter we are going to analyse how the INFORM GRI could benefit from this global effort of collecting information by including some of the agreed indicators in the current model.

4.1. Current representation of SFM and SDGs in the INFORM GRI

The INFORM GRI still includes many indicators coming from the pre-2015 global frameworks, the HFA and MDGs, the predecessors of the SFDRR and SDGs.

The current 'Disaster risk reduction' component in the 'Lack of coping capacity' dimension of the INFORM GRI is based on the scores of the HFA self-assessment reports.

Starting from the 2016 edition, the INFORM GRI uses the probabilistic hazard maps produced for the Global Assessment Report (GAR), under the HFA, as input for most of the indicators in the 'Natural Hazard' category. Specifically, hazard maps of floods, tsunamis, tropical cyclones and storm surges are derived from the GAR.

Overall, in the latest version of the INFORM GRI (INFORM GRI 2019), 11 of 54 indicators (Table 2, in bold) come from the UNISDR HFA:

- Hazard & Exposure:
    - Physical exposure to tsunamis (absolute)
    - Physical exposure to tsunamis (relative)
    - Physical exposure to flood (absolute)
    - Physical exposure to flood (relative)
    - Physical exposure to surge from tropical cyclone (absolute)
    - Physical exposure to surge from tropical cyclone (relative)
    - Physical exposure to tropical cyclone of Saffir-Simpson Category (SS) 1 (absolute)
    - Physical exposure to tropical cyclone of SS 1 (relative)
    - Physical exposure to tropical cyclone of SS 3 (absolute)
    - Physical exposure to tropical cyclone of SS 3 (relative);

- Lack of coping capacity:
    - HFA scores.

Most of the original indicators in the 'Vulnerability' and 'Lack of coping capacity' dimensions of the INFORM GRI come from the MDGs.

In the INFORM GRI 2019, 13 indicators (40 % of the total of the 'Vulnerability' and 'Lack of coping capacity' indicators) come from the MDGs (Table 2, in bold):

- Vulnerability:
    - MDG indicator 8.4 — Net ODA received (% of gross national income (GNI))
    - 4.1 — Under-5 mortality rate
    - 1.8 — Prevalence of underweight children under 5 years of age
    - 6.1 — HIV prevalence among adults aged 15-49 years
    - 6.6 — Death rates associated with malaria
    - 6.9 — Incidence of tuberculosis;
- Lack of coping capacity:
    - 7.8 — Proportion of population using an improved drinking water source
    - 7.9 — Proportion of population using an improved sanitation facility
    - 2.3 — Adult literacy rate
    - 8.15 — Mobile cellular subscriptions per 100 inhabitants
    - 8.16 — Internet users per 100 inhabitants
    - 5.1 — Maternal mortality ratio
    - 4.3 — Proportion of 1-year-old children immunised against measles.

Table 2. INFORM GRI 2019 core indicators

N.	Name of core indicator	Position in the INFORM model		
1	Physical exposure to earthquake MMI VI (absolute)	Earthquake	Natural	Hazard & Exposure
2	Physical exposure to earthquake MMI VI (relative)			
3	Physical exposure to earthquake MMI VIII (absolute)			
4	Physical exposure to earthquake MMI VIII (relative)			
5	**Physical exposure to tsunamis (absolute)**	Tsunami		
6	**Physical exposure to tsunamis (relative)**			
7	**Physical exposure to flood (absolute)**	Flood		
8	**Physical exposure to flood (relative)**			
9	**Physical exposure to surge from tropical cyclone (absolute)**			
10	**Physical exposure to surge from tropical cyclone (relative)**			
11	**Physical exposure to tropical cyclone of SS 1 (absolute)**	Tropical cyclone		
12	**Physical exposure to tropical cyclone of SS 1 (relative)**			
13	**Physical exposure to tropical cyclone of SS 3 (absolute)**			
14	**Physical exposure to tropical cyclone of SS 3 (relative)**			
15	People affected by droughts (absolute)	Drought		
16	People affected by droughts (relative)			
17	Frequency of drought events			
18	Agriculture drought probability			
19	Global Conflict Risk Index (GCRI) violent internal conflict probability	Projected conflict risk	Human	
20	GCRI high violent internal conflict probability			
21	Current national power conflict intensity	Current conflict intensity		
22	Current subnational conflict intensity			
23	Human Development Index	Poverty & development	Socioeconomic vulnerability	Vulnerability
24	Multidimensional Poverty Index			
25	Gender Inequality Index	Inequality		
26	Gini coefficient			
27	Public aid per capita	Aid dependency		
28	**Net ODA received (% of GNI)**			
29	Total persons of concern (absolute)	Uprooted people	Vulnerable groups	
30	Total persons of concern (relative)			
31	**Children underweight**	Other vulnerable groups Children under 5		
32	**Child mortality**			
33	**Prevalence of HIV/AIDS above 15 years**	Other vulnerable groups Health conditions		
34	**Tuberculosis prevalence**			
35	**Malaria mortality rate**			
36	Relative number of affected population by natural disasters in the last 3 years	Other vulnerable groups Recent shocks		
37	**Prevalence of undernourishment**	Other vulnerable groups Food security		
38	Average dietary energy supply adequacy			
39	Domestic Food Price Level Index			
40	Domestic Food Price Volatility Index			
41	**Hyogo Framework for Action**	DRR implementation	Institutional	Lack of coping capacity
42	Government effectiveness	Governance		
43	Corruption Perception Index			
44	Access to electricity (% of population)	Communication	Infrastructure	
45	**Internet users (per 100 people)**			
46	**Mobile cellular subscriptions (per 100 people)**			
47	**Adult literacy rate**			
48	Road density (km of road per 100 sq. km of land area)	Physical infrastructure		
49	**Access to improved water source (% of population with access)**			
50	**Access to improved sanitation facilities (% of population with access)**			
51	Physicians density	Access to health system		
52	Health expenditure per capita			
53	**Measles immunisation coverage**			
54	**Maternal mortality ratio**			

Source: INFORM, 2019

4.2. **Identified limitations of the INFORM GRI due to data availability**

In order to understand how and where it could be possible to improve the INFORM GRI model based on the additional and fresh data collected thanks to the SFM and SDGs, we first need to identify the main data gaps in the INFORM GRI model. This includes the analysis of the components that are weakly covered by indicators, components not included for lack of available data, indicators that are indirect or approximate measures (proxy indicators), poor-quality indicators (e.g. self-assessment) and weakly performing indicators (poor coverage, not updated).

In previous years, limitations of the INFORM GRI model due to data unavailability have been reported in the INFORM GRI methodology reports (Marin-Ferrer et al., 2017b; De Groeve et al., 2014, 2015):

- **Biological hazards (epidemic):** this component will be introduced in the next INFORM GRI release (Poljanšek et al., 2018).
- **Lower reliability of 'Disaster Risk Reduction implementation' component:** the component is currently based on the scores of HFA self-assessment reports of which the reliability is unknown. Self-assessment reports cover almost 80 % of the countries. But it is not a stand-alone indicator and its trustworthiness is estimated along with that of the governance component. However, to date there have been no other international frameworks for assessing the capacity to cope with humanitarian crises that would fit the scope so well. The SFDRR finally provides new indicators to monitor global targets (De Groeve et al., 2014).
- **Food security:** the 'Food security' subcomponent has been considered for improvement since the first release of the model (De Groeve et al., 2014). Even though the subcomponent is conceptually robust, as it is based on the Integrated Phased Food Security Classification (IPC) framework ([2]), the data availability and quality compromised the reliability of the subcomponent. Furthermore, two out of the four indicators used in the 'Food security' subcomponent (Domestic Food Price Level Index and Domestic Food Price Volatility Index) have been temporarily suspended by the Food and Agriculture Organisation of the United Nations (FAO) because of a review of the underlying methodology and the data used to produce these series ([3]).
- **Health-related components:** INFORM partners agreed to enhance the quantity and the quality of the health-related indicators in the INFORM GRI (Inform, 2017a). The SDGs particularly help with 21 health-related SDG targets and 35 indicators (WHO, 2017).

Furthermore, the experience with the INFORM SRI models suggested looking at components not yet included in the INFORM GRI because of the lack of global coverage of these datasets, such as:

- **Social protection and safety nets:** social protection and labour systems help individuals and families, especially the poor and vulnerable, to cope with crises and shocks, find jobs, invest in the health and education of their children, and protect the ageing population. Social protection is used increasingly for shock response and early action, and building resilience of vulnerable communities (Fuller, 2018). Social protection has been used as component in the INFORM LAC (Latin America and Caribbean) ([4]) and INFORM GHoA (Greater Horn of Africa) ([5]) subnational models.

([2]) http://www.ipcinfo.org/
([3]) Personal conversation with FAO Statistical Division (Nathalie Troubat, 15 January 2018).
([4]) http://www.inform-index.org/Subnational/LAC
([5]) http://www.inform-index.org/Subnational/Greater-Horn-of-Africa

- **Remittances:** dependency on remittances reflects a dependency on income from abroad and lack of local employment opportunities. It is also an indication of high vulnerability to global economic and financial crisis. On the other hand, the capacity to cope with shock is enhanced when people have access to financial resources, such as remittances sent from abroad. Indicators on remittances have been included in many INFORM SRI, such as INFORM LAC, INFORM Sahel ([6]), and INFORM GHoA.

Another data limitation is the country coverage. Some of the indicators used in the INFORM GRI have a weak country coverage (**Table 3**).

Table 3. INFORM GRI 2019 indicators with more than 10 % of countries missing

Indicator	**Number of missing countries**	**% of total**
Multidimensional Poverty Index (MPI)	95	50
Children underweight	61	32
Adult literacy rate	38	20
Gini coefficient	33	17
Gender Inequality Index	31	16
Average dietary energy supply adequacy	30	16
Prevalence of undernourishment	29	15
Physicians density	20	10

Source: INFORM, 2019

Finally, there are some indicators that are not regularly updated (**Table 4**).

Table 4. INFORM GRI 2019 indicators with less regular updates

Indicator	**Average years of reporting delay**
Physicians density	4.3
Children underweight	4.0
Multidimensional Poverty Index (MPI)	4.0
Gini coefficient	3.9

Source: INFORM, 2019

([6]) http://www.inform-index.org/Subnational/Sahel

4.3. **Analogies between the INFORM GRI model and the SDGs and SFDRR**

The SFM and SDGs are both collecting a massive amount of data that could provide additional information in those areas identified for improvement regarding the different risk dimensions, such as vulnerability and coping capacity.

The replacement of the HFA and MDG with the post-2015 agendas has involved a review of the previous monitoring indicators in accordance with the new frameworks' goals. Some indicators used in the INFORM GRI have been finally deleted or are no longer maintained, and therefore they need to be replaced.

The screening of the monitoring indicators is based on their relevance as humanitarian crisis and disaster risk drivers.

In order to identify potential suitable indicators, the SFDRR and SDGs have been assessed against the INFORM GRI conceptual framework.

The correspondence between the INFORM GRI and the SDGs was presented in the INFORM Report 2018 (INFORM, 2017b). The analysis showed that there is a strong relationship between the INFORM GRI conceptual framework and about 14 of the 17 SDGs. We extended the analysis to the SFDRR (**Table 5**).

Table 5. Correspondence of the INFORM GRI analytical framework with the SDG goals and SFDRR targets

HAZARD AND EXPOSURE	SDG GOALS	SFDRR TARGETS	VULNERABILITY	SDG GOALS	SFDRR TARGETS	LACK OF COPING CAPACITY	SDG GOALS	SFDRR TARGETS
Natural			**Socio-Economic**			**Institutional**		
Earthquake	1,11		Development & Deprivation	1		Disaster Risk Reduction	1,9,11,13	E,F,G
Tsunami	1,11		Inequality	1,4,5,10		Governance	16	
Flood	1,11,13		Aid Dependence	1,10,17	F	**Infrastructure**		
Tropical cyclone	1,11,13		**Vulnerable Groups**			Communications	4,7,9,17	
Drought	1,2,11, 13,15		Uprooted people	11,16		Physical connectivity	6,9,11	
Human			Other vulnerable groups			Access to health system	3	
Current conflict intensity	16		Health conditions	3				
Projected conflict risk	16		Children Under 5	2,3				
			Recent shocks	1,3,11,13	A,B,C,D			
			Food Security	2				

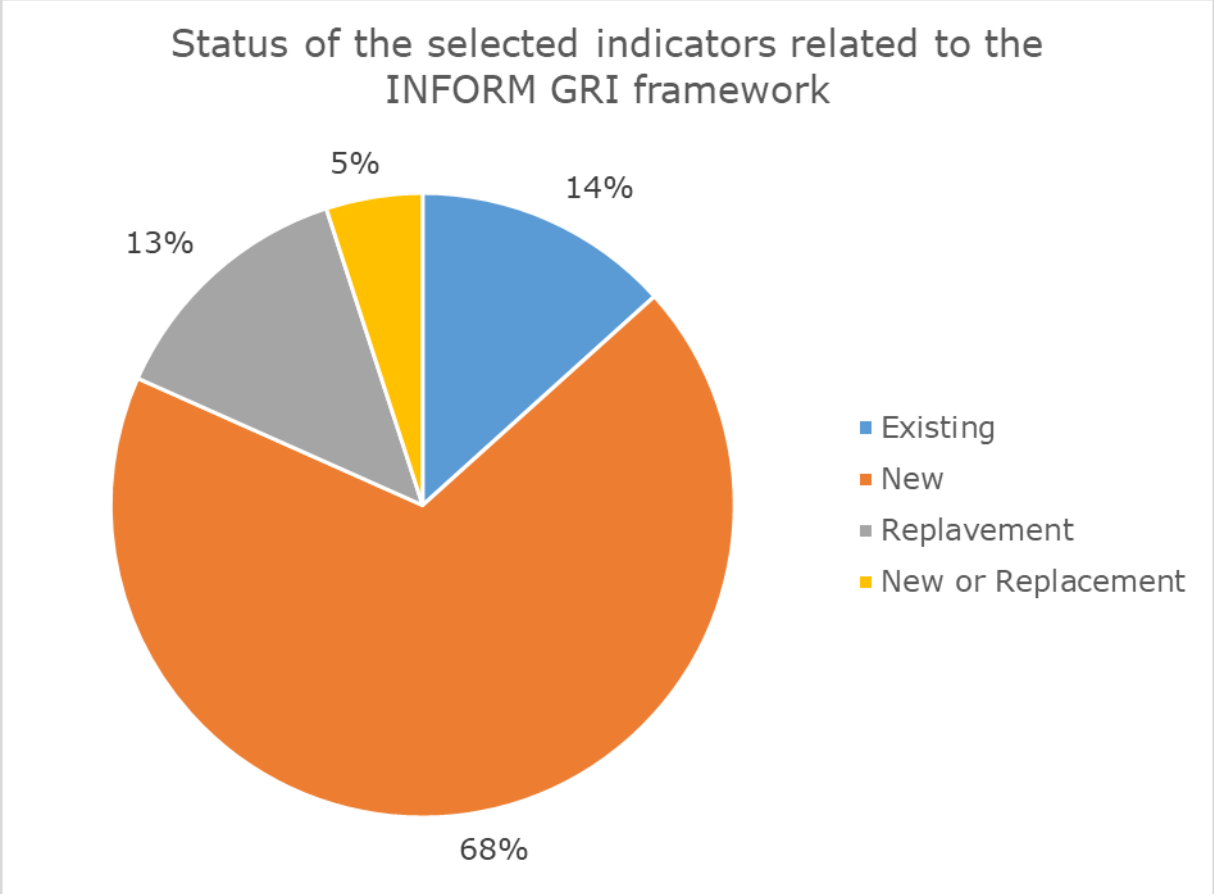
Source: adapted by the authors from INFORM Annual Report 2018, www.inform-index.org

4.4. **Identification of suitable indicators**

The map of the conceptual correspondence between the INFORM GRI analytical framework and the SDGs and SFDRR targets allows us to concentrate the analysis on the underlying indicators within the mapped SDGs and SFDRR targets.

In total, more than 50 indicators have been identified as suitable to be included in the INFORM GRI (**Table 6** and **Figure 6**). The list includes new indicators, already existing ones and substitutes for deleted ones (**Figure 7**). Priority will go to the last two categories, and to the new indicators that concern components of the model that are currently weakly covered (section 4.2).

Figure 6. Status of the selected indicators related to the INFORM GRI framework



Fewer than one fifth of the selected indicators have been identified as direct replacements or good proxies for deleted INFORM GRI indicators. More than two thirds are new indicators, while 14 % are indicators already included in the INFORM GRI.

Table 6. Correspondence of the selected SDG and SMF indicators with the INFORM GRI analytical framework

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions (No data currently available)	Vulnerability — Socio-economic vulnerability — Development & deprivation	New or replacement	Not available
1.3.1 Proportion of population covered by at least one social protection benefit (%)	Lack of coping capacity — Institutional; or Vulnerability — Socio-economic vulnerability — Development & deprivation	New	Social protection and labour systems help individuals and families, especially the poor and vulnerable cope with crises and shocks, find jobs, invest in the health and education of their children, and protect the ageing population.
1.3.1 Proportion of vulnerable population receiving social assistance cash benefit (%)	Lack of coping capacity — Institutional; or Vulnerability — Socio-economic vulnerability — Development & deprivation	New	As above.
1.3.1 Proportion of population covered by social assistance programs (%)	Lack of coping capacity — Institutional; or Vulnerability — Socio-economic vulnerability — Development & deprivation	New	As above.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
1.3.1 Poorest quintile covered by social assistance programs (%)	Lack of coping capacity — Institutional; or Vulnerability — Socio-economic vulnerability — Development & deprivation	New	As above.
1.3.1 Proportion of population covered by social insurance programs (%)	Lack of coping capacity — Institutional; or Vulnerability — Socio-economic vulnerability — Development & deprivation	New	As above.
1.3.1 Poorest quintile covered by social insurance programs (%)	Lack of coping capacity — Institutional; or Vulnerability — Socio-economic vulnerability — Development & deprivation	New	As above.
1.4.1 Proportion of population living in households with access to basic services (No data currently available)	Lack of coping capacity — Infrastructure — Physical infrastructures	New	Poverty is multidimensional and covers many aspects of life ranging from access to opportunities, livelihoods and means of survival.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
1.b.1 Proportion of government recurrent and capital spending to sectors that disproportionately benefit women, the poor and vulnerable groups (Methodology still under development)	Lack of coping capacity — Institutional — Governance	New	Not available
2.1.1 Prevalence of undernourishment (%)	Vulnerability — Vulnerable groups — Other vulnerable groups — Food security — Food utilisation	Existing	
2.1.2 Prevalence of moderate or severe food insecurity in the adult population (%); Prevalence of severe food insecurity in the adult population (%)	Vulnerability — Vulnerable groups — Other vulnerable groups — Food security — Food utilisation	New	Food insecurity at moderate levels of severity is typically associated with the inability to regularly eat healthy, balanced diets. Accordingly, high prevalence of food insecurity at moderate levels can be considered a predictor of various forms of diet-related health conditions in the population, associated with micronutrient deficiency and unbalanced diets. Severe levels of food insecurity, on the other hand, imply a high probability of reduced food intake and therefore can lead to more severe forms of undernutrition, including hunger.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
2.2.1 Proportion of children moderately or severely stunted (%)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health of children under 5	Existing	
2.2.2 Proportion of children moderately or severely wasted (%)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health of children under 5	New	A child who is moderately or severely wasted has an increased risk of death, but treatment is possible.
2.c.1 Indicator of Food Price Anomalies (IFPA), by type of product	Vulnerability — Vulnerable groups — Other vulnerable groups — Food security — Food access	Replacement	Food price refers to the economic aspect of the 'Food Access' component.
3.1.1 Maternal mortality ratio	Lack of coping capacity — Infrastructure — Access to health system	Existing	
3.2.1 Under-5 mortality rate, by sex (deaths per 1 000 live births)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health of children under 5	Existing	
3.3.1 Number of new HIV infections per 1 000 uninfected population, by sex and age (per 1 000 uninfected population)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health conditions	Replacement	This measures the spread of HIV and the ability of countries to provide treatment and services to those who are living with HIV.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
3.3.2 Tuberculosis incidence (per 100 000 population)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health conditions	Existing	
3.3.3 Malaria incidence per 1 000 population at risk (per 1 000 population)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health conditions	Replacement	The aim is to measure trends in malaria morbidity and to identify locations where the risk of disease is highest.
3.3.5 Number of people requiring interventions against neglected tropical diseases (number)	Vulnerability — Vulnerable groups — Other vulnerable groups — Health conditions	New	This can be interpreted as the number of people at a level of risk requiring medical intervention.
3.8.1 Universal health coverage (UHC) service coverage index	Lack of coping capacity — Infrastructure — Access to health system	New or replacement	Countries provide many essential services for health protection, promotion, prevention, treatment and care. Indicators of service coverage — defined as people receiving the service they need — are the best way to track progress in providing services. Taken together, indicators 3.8.1 and 3.8.2 are meant to capture the service coverage and financial protection dimensions.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
3.8.2 Proportion of population with large household expenditures on health (greater than 10 or 25 %) as a share of total household expenditure or income (%)	Lack of coping capacity — Infrastructure — Access to health system	Replacement	This focuses on health expenditures in relation to a household's budget, to identify financial hardship caused by direct health system payments. Taken together, indicators 3.8.1 and 3.8.2 are meant to capture the service coverage and financial protection dimensions.
3.b.1 Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%)	Lack of coping capacity — Infrastructure — Access to health system	New	Coverage of DTP-containing vaccine measures the overall strength of the system to deliver infant vaccination.
3.b.1 Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%)	Lack of coping capacity — Infrastructure — Access to health system	New	Coverage of measles-containing-vaccine measures the ability to deliver vaccines beyond first year of life through routine immunisation services.
3.b.1 Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%)	Lack of coping capacity — Infrastructure — Access to health system	New	Coverage of pneumococcal conjugate vaccine measures the adaptation of new vaccines for children.
3.c.1 Health worker density, by type of occupation (per 1 000 population)	Lack of coping capacity — Infrastructure — Access to health system	Replacement	Preparing the health workforce to work towards the attainment of a country's health objectives represents one of the most important challenges for its health system.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
3.d.1 Average of 13 International Health Regulations (IHR) core capacities	Lack of coping capacity — Infrastructure — Access to health system	New	This assess the country's core capacity to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks.
6.1.1 Proportion of population using safely managed drinking water services, by urban/rural (%)	Lack of coping capacity — Infrastructure — Physical infrastructures	Replacement	This goes go beyond the basic level of access (MDG target 7.c) and addresses safe management of drinking water services, including dimensions of accessibility, availability and quality.
6.2.1 Proportion of population using safely managed sanitation services, by urban/rural (%)	Lack of coping capacity — Infrastructure — Physical infrastructures	Replacement	This goes go beyond the basic level of access (MDG target 7.c) and addresses safe management of sanitation services, including dimensions of accessibility, availability and quality.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (%)	Vulnerability — Vulnerable groups — Other vulnerable groups	New	This measures a country's pressure on its water resources and therefore the challenge to the sustainability of its water use. It indicates the likelihood of increasing competition and conflict between different water uses and users in a situation of increasing water scarcity. Increased water stress, shown by an increase in the value of the indicator, has potentially negative effects on the sustainability of the natural resources and on economic development.
7.1.1 Proportion of population with access to electricity	Lack of coping capacity — Infrastructure — Communication	Existing	
9.c.1 Proportion of population covered by a mobile network, by technology	Lack of coping capacity — Infrastructure — Communication	Existing	
10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 % of the population (%)	Vulnerability — Socio-economic vulnerability — Inequality	New or replacement	Shared prosperity explicitly recognises that, while growth is necessary for improving economic welfare in a society, progress is measured by how those gains are shared with its poorest members.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
10.2.1 Proportion of people living below 50 % of median income, by sex, age and persons with disabilities (No data currently available)	Vulnerability — Socio-economic vulnerability — Inequality	New or replacement	Addressing social inclusion and inequality is important on the global development agenda as well as on the national development agenda of many countries. It is useful for monitoring the levels of and trends in social inclusion, relative poverty and inequality within a country.
11.1.1 Proportion of urban population living in slums (%)	Vulnerability — Vulnerable groups — Other vulnerable groups; or Vulnerability — Socio-economic vulnerability — Inequality	New	Slums tend to be located in hotspots for natural hazards such as floods, fire, earthquakes and tsunamis. The devastating impacts of these natural hazards on such settlements can be attributed to the higher levels of physical, economic, social and environmental vulnerability in conjunction with inadequate and poor levels of disaster preparedness.
16.5.1 Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months (No data currently available)	Lack of coping capacity — Institutional — Governance	New	By providing a direct measure of the experience of bribery, this indicator provides an objective metric of corruption, a yardstick to monitor progress in the fight against corruption.

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
16.5.2 Bribery incidence (% of firms experiencing at least one bribe payment request)	Lack of coping capacity — Institutional — Governance	New	The rationale for this indicator is to ascertain if firms are solicited for gifts or informal payments (i.e. bribes) when meeting with tax officials. Paying taxes are required of formal forms in most countries and hence the rationale for this indicator is to measure the incidence of corruption during this routine interaction.
16.6.1 Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar) (No data currently available)	Lack of coping capacity — Institutional — Governance	New	The indicator attempts to capture the reliability of government budgets: do governments spend what they intend to and do they collect what they set out to collect? It is a simple and intuitive indicator that is easily understood, the methodology is transparent and every rating is easily verifiable.
16.6.2 Proportion of population satisfied with their last experience of public services (Methodology still under development)	Lack of coping capacity — Institutional — Governance	New	—

SDG	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
17.3.2 Volume of remittances (in United States dollars) as a proportion of total GDP (%)	Vulnerability — Socio-economic vulnerability — Economic dependency — Aid dependency	New	Dependency on remittances reflects a dependency on income from abroad and lack of local employment opportunities. It is also an indication of higher vulnerability to global economic and financial crises.
17.8.1 Internet users per 100 inhabitants	Lack of coping capacity — Infrastructure — Communication	Existing	

Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
B-1 Number of directly affected people attributed to disasters, per 100 000 population	Vulnerability — Vulnerable groups — Other vulnerable groups — Recent shocks	Replacement	The population affected by recent natural disasters are considered more vulnerable than the rest of the population. The indicator identifies the countries that are recovering from humanitarian crisis situations.

Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
C-1 Direct economic loss attributed to disasters relative to GDP (%)	Vulnerability — Vulnerable groups — Other vulnerable groups — Recent shocks	New	Economic losses from recent disasters could complement the human losses.
E-1 Score of adoption and implementation of national DRR strategies in line with the Sendai Framework	Lack of coping capacity — Institutional — DRR	New	Target E aims to quantify the quality of public policy, i.e. DRR strategies, that would quantify improvement of the policy over time. National DRR strategies serve a normative function, providing, inter alia, guiding principles and an overarching framework for disaster risk reduction.
E-2 Proportion of local governments that adopt and implement local DRR strategies in line with national disaster risk reduction strategies (%)	Lack of coping capacity — Institutional — DRR	New	Target E aims to quantify the quality of public policy, i.e. DRR strategies, that would quantify improvement of the policy over time. Local strategies, aligned with the national strategy, are generally more specific, reflecting local contexts and hazard profiles, and tend to focus on planning and implementation with clear roles and tasks assigned at local level.

Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
F-1 Total official international support, (official development assistance (ODA) plus other official flows), for national disaster risk reduction actions	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure different types and flows, in support of national actions for disaster risk reduction in developing countries.
F-2 Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided by multilateral agencies	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure different types and flows, in support of national actions for disaster risk reduction in developing countries.
F-3 Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided bilaterally	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure different types and flows, in support of national actions for disaster risk reduction in developing countries.

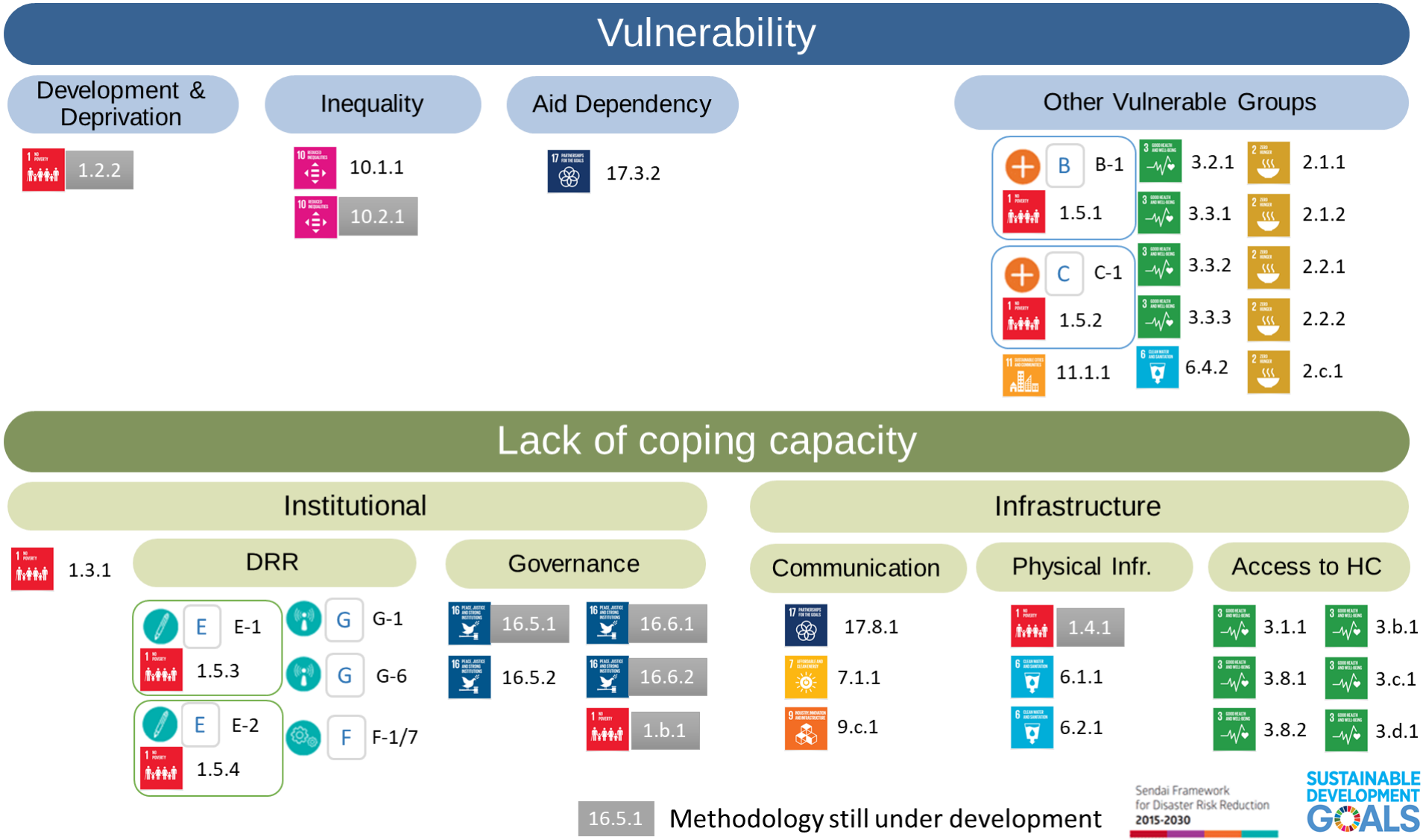
Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
F-4 Total official international support (ODA plus other official flows) for the transfer and exchange of disaster risk reduction-related technology	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure flows in activity, in support of the transfer and exchange of science, technology and innovation for disaster risk reduction for developing countries.
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	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure trend in activity, in support of the transfer and exchange of science, technology and innovation for disaster risk reduction for developing countries.

Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
F-6 Total official international support (ODA plus other official flows) for disaster risk reduction capacity-building	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure flows in activity, in support of DRR-related capacity, including statistical capacity, for developing countries.
F-7 Number of international, regional and bilateral programmes and initiatives for disaster risk reduction-related capacity-building in developing countries	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure trends in activity, in support of DRR-related capacity, including statistical capacity, for developing countries.
F-8 Number of developing countries supported by international, regional and bilateral initiatives to strengthen their disaster risk reduction-related statistical capacity	Lack of coping capacity — Institutional — DRR	New	Target F aims to measure progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. This indicator aims to measure trends in activity, in support of DRR-related capacity, including statistical capacity, for developing countries.

Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
G-1 Number of countries that have multi-hazard early warning systems (compound G2-G5)	Lack of coping capacity — Institutional — DRR	New	G-1 is a compound indicator, which is computed based on subindicators G-2 to G-5 of the four interrelated key elements of effective functioning multi-hazard early warning systems (MHEWSs).
G-2 Number of countries that have multi-hazard monitoring and forecasting systems	Lack of coping capacity — Institutional — DRR	New	Detection, monitoring, analysis and forecasting of the hazards and possible consequences is one of the four key elements of MHEWSs.
G-3 Number of people per 100 000 that are covered by early warning information through local governments or through national dissemination mechanisms	Lack of coping capacity — Institutional — DRR	New	Dissemination and communication, by an official source, of authoritative, timely, accurate and actionable warnings and associated information on likelihood and impact is one of the four key elements of MHEWSs.
G-4 Percentage of local governments having a plan to act on early warnings	Lack of coping capacity — Institutional — DRR	New	Preparedness at all levels to respond to the warnings received is one of the four key elements of MHEWSs.

Sendai Framework Monitor	**INFORM GRI**		
Indicator	***Dimension — Category — Component — Subcomponent***	***Status***	***Rationale***
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	Lack of coping capacity — Institutional — DRR	New	Disaster risk knowledge based on the systematic collection of data and disaster risk assessments is one of the four key elements of MHEWSs.
G-6 Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning	Lack of coping capacity — Institutional — DRR	New	This output indicator quantifies the impact and effectiveness of early warning information.

Figure 7. Infographic of the correspondence of the selected SDG and SMF indicators to the INFORM GRI analytical framework



4.5. Main challenges regarding the values of the indicators

There are concerns about the international comparability of the SDG and SFM indicators, due to the lack of robustness and completeness (Maini et al., 2017), or to the subjectivity in the data collection methods despite the existence of guidelines published by the UN (UNISDR, 2018; UN Development Group, 2017).

The OIEWG proposal recognises the subjective nature of the proposed indicators in Sendai targets E to G, and therefore aims to balance precision and practicality through a method of weighted hazard types and levels of achievement.

These methodologies were derived from UN-related work and participative forums, and focus particularly on assessing the progress and achievements of reporting countries in relation to the global targets. As the proposed metadata are even more prone to subjectivity, these methodologies do not facilitate comparison between different countries but still provides a very good tool to analyse progress within a country. Consistency of information and double counting are quite important issues in this set of indicators, and should be appropriately acknowledged. For instance, there is clear scope for overlapping with target E indicators (Marin Ferrer et al., 2018).

Another issue specifically important for the purpose of this report is data availability. Data are largely incomplete, often having weak geographical coverage, lacking time series and not having been recently updated.

This is especially true of the SFM indicators, for which the country collection and reporting are still at the embryonal stage (section 3.1.1).

4.6. Criteria for inclusion of the indicators in the INFORM GRI

Indicators have to match the INFORM principles (De Groeve et al., 2014):

- reliable and open-source;
- continuous, consistent, historical time series (at least 5 years), global coverage;
- potentially scalable from national to subnational, from yearly to seasonal (monthly).

Indicators are very various in nature, for which reason the criteria presented could assume different meanings. A structural indicator, with a low temporal variance, does not need to be updated very often, and its score can be still representative years after the last update. On the other hand, dynamic data, such as the number of refugees hosted, need to be updated very frequently in order to be reliable.

Furthermore, they can assume a different relevance in the context of the INFORM GRI model. If a component is not represented by many indicators, it may be justified to accept an indicator that performs poorly on its inclusion criteria.

We introduce a multi-criteria evaluation for assessing the inclusion of the identified indicators in the next releases of the INFORM GRI. For each of the listed criteria, we defined a traffic light categorisation based on quantitative criteria (**Table 7**). A red score in one of the criteria is sufficient to (currently) exclude the indicator from the INFORM GRI model.

Table 8 shows the inclusion criteria applied to the selected SFM and SDG indicators based on the availability status at the time of the preparation of this report (11 February 2019).

Table 7. Quantitative criteria for inclusion in the INFORM GRI

Criteria	Green	Orange	Red
Coverage	> 80 %	≥ 50 %	< 50 %
Time series	> 10 years	≥ 5 years	< 5 years
Update frequency	≤ 1 year	≤ 2 years	> 2 years
Timeless	≤ 1 year	≤ 3 years	> 3 years

Table 8. Inclusion criteria applied to the selected SFM and SDG indicators based on the availability status at the time of the preparation of this report (11 February 2019)

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SDG 1.3.1	Proportion of population covered by at least one social protection benefit (%)	37 % (71/191)	No	2 years	2016
SDG 1.3.1	Proportion of vulnerable population receiving social assistance cash benefit (%)	35 % (66/191)	No	2 years	2016
SDG 1.3.1	Proportion of population covered by social assistance programs (%)	56 % (109/191)	2000-2016	Various: 1 to 20 years	2016
SDG 1.3.1	Poorest quintile covered by social assistance programs (%)	56 % (109/191)	2000-2016	Various: 1 to 20 years	2016
SDG 1.3.1	Proportion of population covered by social insurance programs (%)	55 % (106/191)	2000-2016	Various: 1 to 20 years	2016
SDG 1.3.1	Poorest quintile covered by social insurance programs (%)	55 % (106/191)	2000-2016	Various: 1 to 20 years	2016

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SDG 1.5.1 **11.5.1** **13.1.1** **SFM B-1**	Number of directly affected people attributed to disasters, per 100 000 population	62 % (118/191)	2005-2017 (depending on country)	1 year	2017
SDG 1.5.2 **11.5.2** **SFM C-1**	Direct economic loss attributed to disasters relative to GDP (%)	60 % (115/191)	2005-2017 (depending on country)	1 year	2017
SDG 1.5.3 **11.b.1** **13.1.2** **SFM E-1**	Score of adoption and implementation of national DRR strategies in line with the Sendai Framework	8 % (15/191)	1 year (from 2015)	1 year	2017
SDG 1.5.4 **11.b.2** **13.1.3** **SFM E-2**	Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies (%)	8 % (15/191)	1 year (from 2015)	1 year	2017
SDG 1.b.1	Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions	Not available	Not available	Not available	Not available
SDG 2.1.1	Prevalence of undernourishment (%)	87 % (167/191)	2000-2015	1 year	2015

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SDG 2.1.2	Prevalence of moderate or severe food insecurity in the adult population (%); Prevalence of severe food insecurity in the adult population (%)	31 % (59/191)	2000-2016	1 year	2016
SDG 2.2.1	Proportion of children moderately or severely stunted (%)	75 % (144/191)	2000-2016 (depending on country)	1 year	2016
SDG 2.2.1	Proportion of children moderately or severely wasted (%)	75 % (144/191)	2000-2016 (depending on country)	1 year	2016
SDG 2.c.1	Indicator of Food Price Anomalies (IFPA), by type of product	41 % (78/191)	No	Unknown	2016
SDG 3.1.1	Maternal mortality ratio	95 % (182/191)	2000-2015	1 year	2015
SDG 3.2.1	Under-5 mortality rate, by sex (deaths per 1 000 live births)	99 % (190/191)	2000-2017	1 year	2017
SDG 3.3.1	Number of new HIV infections per 1 000 uninfected population, by sex and age (per 1 000 uninfected population)	69 % (131/191)	2000-2016	1 year	2016

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SDG 3.3.2	Tuberculosis incidence (per 100 000 population)	100 % (191/191)	2000-2016	1 year	2016
SDG 3.3.3	Malaria incidence per 1 000 population at risk (per 1 000 population)	52 % [a] (99/191)	2000, 2005, 2010, 2015, 2016	1 year	2016
SDG 3.3.5	Number of people requiring interventions against neglected tropical diseases (number)	99 % (189/191)	2010-2016	1 year	2016
SDG 3.8.1	Universal health coverage (UHC) service coverage index	95 % (182/191)	2015	2 years	2015
SDG 3.8.2	Proportion of population with large household expenditures on health (greater than 10/25 %) as a share of total household expenditure or income (%)	62 % (119/191)	2000-2015	From 1 year to 5 years	2015
SDG 3.b.1	Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%)	99 % (190/191)	2000-2016	1 year	2016

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SDG 3.b.1	Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%)	82 % (157/191)	2000-2016 (depending on country)	1 year	2016
SDG 3.b.1	Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%)	68 % (130/191)	2008-2016 (depending on country)	1 year	2016
SDG 3.c.1	Health worker density, by type of occupation (per 1 000 population) ([b])	99 % (190/191)	2000-2016 (depending on country)	1 year	2016
SDG 3.d.1	Average of 13 International Health Regulations (IHR) core capacities	97 % (186/191)	2010-2017 (depending on country)	1 year	2017
SDG 6.1.1	Proportion of population using safely managed drinking water services, by urban/rural (%)	45 % (86/191)	2000-2015 (depending on country)	1 year	2015
SDG 6.2.1	Proportion of population using safely managed sanitation services, by urban/rural (%)	40 % (76/191)	2000-2015 (depending on country)	1 year	2015
SDG 6.4.2	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (%)	95 % (181/191)	No	1 year	2015

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SDG 7.1.1	Proportion of population with access to electricity	100 % (191/191)	2000-2016	1 year	2016
SDG 9.c.1	Proportion of population covered by a mobile network, by technology	100 % (191/191)	2000-2016	1 year	2016
SDG 10.1.1	Growth rates of household expenditure or income per capita among the bottom 40 % of the population (%)	49 % (94/191)	1 year	Unknown	2016
SDG 11.1.1	Proportion of urban population living in slums (%)	49 % (93/191)	2000-2014 (depending on country)	5 years	2014
SDG 16.5.2	Bribery incidence (% of firms experiencing at least one bribe payment request)	72 % (137/191)	1 year	Unknown	2017
SDG 17.3.2	Volume of remittances (in United States dollars) as a proportion of total GDP (%)	92 % (176/191)	2000-2016	1 year	2016
SDG 17.8.1	Internet users per 100 inhabitants	100 % (191/191)	2000-2016	1 year	2016
SFM F-1	Total official international support, (official development assistance (ODA) plus other official flows), for national disaster risk reduction actions	8 % (16/191)	2015-2017	1 year	2017

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SFM F-2	Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided by multilateral agencies	7 % (13/191)	2015-2017	1 year	2017
SFM F-3	Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided bilaterally	8 % (15/191)	2015-2017	1 year	2017
SFM F-4	Total official international support (ODA plus other official flows) for the transfer and exchange of DRR-related technology	7 % (14/191)	2015-2017	1 year	2017
SFM 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	8 % (15/191)	2015-2017	1 year	2017
SFM F-6	Total official international support (ODA plus other official flows) for disaster risk reduction capacity-building	8 % (16/191)	2015-2017	1 year	2017

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SFM F-7	Number of international, regional and bilateral programmes and initiatives for disaster risk reduction-related capacity-building in developing countries	8 % (15/191)	2015-2017	1 year	2017
SFM F-8	Number of developing countries supported by international, regional and bilateral initiatives to strengthen their disaster risk reduction-related statistical capacity	8 % (15/191)	2015-2017	1 year	2017
SFM G-1 (compound G2-G5)	Number of countries that have multi-hazard early warning systems	7 % (14/191)	2015-2017	1 year	2017
SFM G-2	Number of countries that have multi-hazard monitoring and forecasting systems	9 % (17/191)	2015-2017	1 year	2017
SFM G-3	Number of people per 100 000 that are covered by early warning information through local governments or through national dissemination mechanisms	9 % (17/191)	2015-2017	1 year	2017
SFM G-4	Percentage of local governments having a plan to act on early warnings	8 % (15/191)	2015-2017	1 year	2017

Indicator		Data availability			
Number	**Indicator name**	**Coverage**	**Time series**	**Update frequency**	**Last year available**
SFM 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	8 % (16/191)	2015-2017	1 year	2017
SFM G-6	Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning	4 % (6/191)	2015-2017	1 year	2017

([a]) Malaria is not present in all the countries; therefore, not all countries cover this indicator.

([b]) The statistics include all types of health worker.

Some of the indicators that meet all the criteria and therefore are eligible for inclusion in the next release are already included in the INFORM GRI (as they have been maintained from the MDGs):

- Prevalence of undernourishment (%);
- Maternal mortality ratio;
- Under-5 mortality rate;
- Tuberculosis incidence;
- Proportion of population with access to electricity;
- Internet users per 100 inhabitants;
- Proportion of population covered by a mobile network.

The new indicators that fulfilled all the minimum requirements are:

- Number of people requiring interventions against neglected tropical diseases;
- Malaria incidence per 1 000 population at risk;
- Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%);
- Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%);
- Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%);
- Health worker density, by type of occupation;

- Average of 13 International Health Regulations (IHR) core capacities;
- Volume of remittances as a proportion of total GDP (%).

4.7. Indicators to be included in the next INFORM GRI release

The priority for inclusion of new indicators in the INFORM GRI will go to the new indicators, possible replacements for existing ones or substitutes for deleted ones, and new indicators that concern components of the model that are currently weakly covered or not even represented.

In the previous section we presented the list of the indicators that already meet the minimum requirements for inclusion in the INFORM GRI. Of those, only seven are indicators not already present in the model.

In the next sections we present in detail the new INFORM GRI model by category, including the indicators that will be part of the next release of the model, as well as the ones that will be part of the next releases once they become available (i.e. meeting the inclusion criteria).

4.7.1. Dimension: Vulnerability

Category: Socio-economic vulnerability

Development & deprivation: the methodology for SDG indicator 1.2.2, 'Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions', has not yet been defined, and therefore it cannot yet be considered to be part of the 'Development & deprivation' component.

Inequality: the current indicators 'Gini Index' and 'Gender Inequality Index' suffer from weak coverage, irregular update and lack of time series (section 4.2). Furthermore, several studies (Chitiga et al., n.d.; Afonso et al., 2015; Corporate Finance Institute, n.d.; Mellor, 1989; Bellù and Liberati, 2006) have shown that the 'Gini Index' as a measure of income inequality has some limitations.

SDG indicator 10.1.1, 'Growth rates of household expenditure or income per capita among the bottom 40 % of the population (%)', will be aggregated with the 'Gini Index' forming an 'Economic inequality' subcomponent once the data availability meets the inclusion requirements (**Table 9**).

SDG indicator 11.1.1, 'Proportion of urban population living in slums (%)', can be considered an indicator for 'Inequality' as well as for 'Vulnerable groups'. However, the lack of coverage and especially the low frequency of update (every 5 years) flag it as an unsuitable indicator for the INFORM GRI.

SDG indicator 10.2.1, 'Proportion of people living below 50 % of median income', has not yet been methodologically defined, so it is not possible to understand if it would be suitable to complement or replace the 'Gini Index' as an economic inequality measure.

Economic dependency: remittances have been identified as one of the missing indicators in the INFORM GRI methodology (section 4.2). SDG indicator 17.3.2, 'Volume of remittances as a proportion of total GDP (%)', will well complement the 'Aid dependency' component (**Table 9**). With the inclusion of remittances, we also need to rename the component 'Economic dependency', since the underlying indicators no longer cover only international aid.

Table 9. Aggregation of the 'Socio-economic vulnerability' category

Category	Socio-economic vulnerability								
Aggregation	ARITHMETIC AVERAGE 50/25/25								
	50 %		25 %			25 %			
Component	Development & deprivation		Inequality			(Aid) Economic dependency			
	GEOMETRIC AVERAGE		ARITHMETIC AVERAGE			ARITHMETIC AVERAGE			
			Economic inequality			Public aid per capita			
			AVERAGE			SUM			
Core indicator	Human Development Index	Multidimensional Poverty Index	Gini Index	*Growth rates of household expenditure or income per capita among the bottom 40 % of the population (%)*	Gender Inequality Distribution	Total ODA in the last 2 years per capita	Total humanitarian funding in the last 2 years per capita	Net ODA received (% of GNI)	**Volume of remittances as a proportion of total GDP (%)**

Bold: new indicators.
Italic: indicators not ready to be included because of data unavailability.

Category: Vulnerable groups

Health condition: all the current indicators were part of the MDGs (Goal 6: Combat HIV/AIDS, malaria and other diseases) and are also included in the SDGs (Goal 3: Ensure healthy lives and promote well-being for all at all ages). However, some of them have been revised:

- SDG indicator 3.3.1, 'Number of new HIV infections per 1 000 uninfected population, by sex and age', replaced 'HIV prevalence among adults aged 15-49 years (%)';
- SDG indicator 3.3.3, 'Malaria incidence per 1 000 population at risk', replaced 'Deaths due to malaria (per 100 000 population)'.

SDG indicator 3.3.1 has been defined to provide a measure of progress towards preventing onward transmission of HIV, while the 'Health condition' subcomponent refers to people with poor health conditions. Therefore, the current indicator remains more compliant with the scope of the 'Health condition' subcomponent, and in line with the other indicators within the same subcomponent. Even though 'HIV prevalence among adults aged 15-49 years (%)' is not included in the SDG, the indicator is still maintained by the Joint United Nations Programme on HIV and AIDS (UNAIDS) ([7]).

SDG indicator 3.3.5, 'Number of people requiring interventions against neglected tropical diseases', is a new indicator, which will complement the other three.

([7]) http://aidsinfo.unaids.org/

Food security: this subcomponent has been identified as one of the needed improvements (section 4.2). Recently the FAO revised the selection of food security indicators based on the SDGs' monitoring requirement and data availability. A new indicator for measuring severe food insecurity based on the Food Insecurity Experience Scale (FIES) (FAO, n.d.a) is included. This indicator was first launched in the State of Food Security and Nutrition 2017 report. SDG indicator 2.1.2, 'Prevalence of severe food insecurity in the adult population (%)', is expected to be highly correlated, across countries, with 'Prevalence of undernourishment' (FAO, n.d.b). Indicator 2.1.2 will be aggregated with 'Prevalence of undernourishment' to form the 'Utilisation' subcomponent once data availability meets the inclusion requirements (**Table 10**).

SDG indicator 2.c.1, 'Indicator of Food Price Anomalies (IFPA), by type of product', has been considered as a candidate for replacing the two deleted (section 4.2) indicators on food price included in the 'Access' subcomponent of 'Food security': 'Domestic Food Price Level Index' and 'Domestic Food Price Volatility Index'. Unfortunately, the indicator is very difficult to normalise, being disaggregated by the type of product.

Recent shocks: the current INFORM GRI indicator 'Number of people affected by natural disaster' is provided by the international loss database EM-DAT, which includes only major events. The SFM and SDG indicator 'Number of directly affected people attributed to disasters, per 100 000 population' is based on national loss databases, and it should include both large and small-scale disasters, giving a more comprehensive identification of the impacts of the disasters.

In addition, the economic losses of recent disasters (SFM C-1, 'Direct economic loss attributed to disasters relative to GDP (%)') could be considered to complement the human losses.

The data coverage does not currently allow the use of these indicators in the model.

Furthermore, there is uncertainty regarding the frequency of the updates of the national loss databases. Recent data are essential for such indicators.

Children under 5: this subcomponent is well covered, as it includes two of the most used and referenced indicators for development, coming from the MDGs and adopted also in the SDGs.

Malnutrition is often considered in the INFORM SRI models (INFORM Sahel, INFORM LAC). SDG indicator 2.2.2, 'Proportion of children moderately or severely wasted (%)', is the proposed one for prevalence of malnutrition among children.

The 'U5 under-weight' indicator has weak coverage and is not very recently updated (**Table 3** and **Table 4**). It could be replaced or used in combination with SDG indicator 2.2.1, 'Proportion of children moderately or severely stunted (%)'.

Neither indicator currently meets the inclusion criteria, and they will be reviewed in the coming years for possible inclusion.

Water stress is considered one of the more important drivers for future crisis, especially regarding the effects of climate change. SDG indicator 6.4.2, 'Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (%)', shows to what extent water resources are already used. It indicates the likelihood of increasing competition and conflict between different water uses and users in a situation of increasing water scarcity. The indicator does not have time series and the frequency of update is not defined, so it cannot be considered for the moment.

Table 10. Aggregation of the 'Other vulnerable groups' component

Component	Other vulnerable groups												
Aggregation	GEOMETRIC AVERAGE												
	Health conditions				Children under 5		Recent shocks		Food security				
	ARITHMETIC AVERAGE				ARITHMETIC AVERAGE		ARITHMETIC AVERAGE		ARITHMETIC AVERAGE				
									Utilisation		Availability	Access	
									ARITHMETIC AVERAGE			ARITHMETIC AVERAGE 80/20	
												80 %	20 %
Core indicator	HIV prevalence	Tuberculosis incidence	**Malaria incidence per 1 000 population at risk**	**% of people requiring interventions against neglected tropical diseases**	Children underweight	Child mortality	Relative number of affected population by natural disasters in the last 3 years	*Direct economic loss attributed to disasters relative to GDP (%) in the last 3 years*	Prevalence of undernourishment	*Prevalence of severe food insecurity in the adult population (%)*	Average dietary energy supply adequacy	Domestic Food Price Index	Domestic Food Price Volatility Index

Bold: new indicators.
Italic: indicators not ready to be included for lack of data.

4.7.2. Dimension: Lack of coping capacity

Category: Institutional

Disaster Risk Reduction: reporting of the HFA Monitor and the succeeding SF Monitor forms the only global dataset collecting DRR policy information.

The 'Disaster Risk Reduction' component is currently based on the scores of HFA self-assessment reports, the reliability of which is unknown. The SFDRR tried to address this limitation by developing a set of quantitative indicators for monitoring the Sendai targets, and providing technical guidance to Member States on how to compile them (UNISDR, 2018).

SFDRR global targets E, F and G follow the structure of the indicators proposed under the previous HFA. All the SFM indicators available for these targets are very suitable for the DRR component.

The most convenient approach would be to aggregate the indicators within the three targets using the arithmetic average, and then aggregate the three subcomponents again using the arithmetic average (**Table 11**).

Table 11. Aggregation of the 'Institutional' category

Category	Institutional												
Component	ARITHMETIC AVERAGE												
	Disaster risk reduction			Governance									
Aggregation	ARITHMETIC AVERAGE			ARITHMETIC AVERAGE									
				Government effectiveness			Corruption			*Social protection*			
				ARITHMETIC AVERAGE			ARITHMETIC AVERAGE			ARITHMETIC AVERAGE			
Core indicator	*SFDRR target E*	*SFDRR target F*	*SFDRR target G*	Government effectiveness	SDG 16.6.1	SDG 16.6.2	Corruption Perception Index	*Bribery incidence*	SDG 16.5.2	*SDG 1.3.1*	*SDG 1.3.1*	*SDG 1.3.1*	*SDG 1.3.1*

Italic: indicators not ready to be included for lack of data.
Underline: indicator methodology still under development.

Target E aims to capture how consistent national and local DRR strategies are with the SFDRR, and to contribute to policy improvement. Achieving the goal and outcome of the SFDRR means Member States preventing the creation of new risks, reducing existing risks, and strengthening economic, social, health and environmental resilience. The two indicators E-1 and E-2 will be aggregated with the arithmetic average (**Table 12**).

Table 12. Aggregation of 'Disaster risk reduction' component

Component	Disaster risk reduction											
Subcomponent	ARITHMETIC AVERAGE											
	Target E		Target F								Target G	
Aggregation	ARITHMETIC AVERAGE		ARITHMETIC AVERAGE								ARITHMETIC AVERAGE	
			Financial resources			Technology development and transfer		Capacity-building				
			ARITHMETIC AVERAGE			ARITHMETIC AVERAGE		ARITHMETIC AVERAGE				
Core indicator	*SFDRR indicator E-1*	*SFDRR indicator E-2*	*SFDRR indicator F-1*	*SFDRR indicator F-2*	*SFDRR indicator F-3*	*SFDRR indicator F-4*	*SFDRR indicator F-5*	*SFDRR indicator F-6*	*SFDRR indicator F-7*	*SFDRR indicator F-8*	*Revised SFDRR indicator G-1*	*SFDRR indicator G-6*

Italic: indicators not ready to be included due to data unavailability.

Target F focuses on measuring of progress in enhancing international cooperation with developing countries in support of national actions for disaster risk reduction. The indicators for target F can be organised using the three categories that encompass all the aspects of international cooperation: (a) Financial Resources, (b) Technology Development and Transfer, and (c) Capacity-Building (UNISDR, 2018).

Specifically, these indicators can be classified in the abovementioned 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 of support for national actions for disaster risk reduction in developing countries.

(b) Technology Development and Transfer: includes indicators F-4 and F-5, which aim to measure flows and trends in activity, respectively, 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 DRR-related capacity, including statistical capacity, for developing countries.

The eight indicators will be aggregated according to the three categories with the arithmetic average and then finally the three resulting scores will be aggregated again, with the arithmetic average forming the subcomponent (**Table 12**). Indicators F-4 and F-6 will be assigned to categories (b) and (c), respectively, in order to avoid double counting.

There are particular methodological challenges in regard to capturing the financial aspects of international cooperation in support of the national disaster risk reduction actions of developing countries (indicators F-1, F-2, F-3, F-4 and F-6; UNISDR, 2018). Current methodologies and data (e.g. those of the Organisation for Economic Cooperation and Development's (OECD's) Development Assistance Committee) fail to capture integrated disaster risk reduction. UNISDR advises that measurement of some indicators will be challenging in the short term (UNISDR, 2018).

Target G aims to increase the availability of and access to multi-hazard early warning systems (MHEWSs) and disaster risk information and assessments.

The hazards considered for target G cover a larger spectrum than the ones included in the INFORM GRI 'Natural Hazard' category (flood, earthquake, tsunami, tropical cyclone and drought). Therefore, countries may have installed early warning systems (EWSs) for hazards not considered in the INFORM GRI model. Nonetheless, if the country has managed to develop and implement EWSs for some hazards, this would be a good indication in any case for the rest of the hazards.

Indicator G-1 is a compound indicator for MHEWSs, calculated as an index using the arithmetic average of the scores of the four indicators G-2 to G-5.

According to the OIEWG (UNISDR, 2018), a complete and effective MHEWS should meet all the four key elements of MHEWSs. Indicators G-2 to G-5 each correspond to one of the key elements:

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).

We argue that the official aggregation method for computing G-1 is not consistent with the assumption that all the four elements of MHEWSs should be interrelated and the 'failure in one component or a lack of coordination across them could lead to the failure of the whole system' (UNISDR, 2018, pp. 157). The arithmetic average is an aggregation method that implies the full compensation of the underlying indicators. Bad performance in one of them will be compensated by good performance in the others, which is contrary to the rationale of indicator G-1. We propose instead to use the geometric average for calculating indicator G-1. With the geometric average, the compensation is lower and the indicators with bad performance have more weight (De Groeve et al., 2014), preserving the interrelation between the indicators. This approach is largely used in the INFORM GRI model (**Table 13**).

Table 13. Different aggregation methods: arithmetic versus geometric average

	Natural Hazard	Human Hazard	Hazard & Exposure	
			Arithmetic Average	Geometric Average
Ethiopia	5.4	6.7	6.0	6.1
Nigeria	2.4	9.6	6.0	7.3

Source: De Groeve et al. (2014)

The revised indicator G-1 will be aggregated with indicator G-6 using the arithmetic average (**Table 12**).

Governance: it is hard to quantify the level of the quality of the country's governance; therefore, most of the indicators used for its estimation are qualitative, as they are based on people's perceptions. In order to reinforce the robustness of such qualitative indicators, it is desirable to combine them with indicators using different sources and methods.

Some of the SDG indicators for targets 16.5 (Substantially reduce corruption and bribery in all their forms) and 16.6 (Develop effective, accountable and transparent institutions at all levels) have been designed to address two of the concepts behind the 'Governance' component of the INFORM GRI: 'Government Effectiveness' and 'Corruption'.

For some of them, the methodology for measuring the indicators have not yet been defined:

- SDG 16.5.1, 'Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by that public official, during the previous 12 months';
- SDG 16.6.1, 'Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar)';
- SDG 16.6.2, 'Proportion of population satisfied with their last experience of public services'.

Only SDG indicator 16.5.2, 'Bribery incidence (% of firms experiencing at least one bribe payment request)', has been defined, but not having time series disqualifies it from being considered for inclusion in the next release of the INFORM GRI.

'Social protection' has been identified as one of the components relevant to disaster risk that are not yet included in the INFORM GRI (section 4.2). SDG 1.3.1 offers a suite of related subindicators provided by the World Bank:

- Proportion of population covered by social assistance programs (%)
- Poorest quintile covered by social assistance programs (%)
- Proportion of population covered by social insurance programs (%)
- Poorest quintile covered by social insurance programs (%);

and the International Labour Organisation:

- Proportion of population covered by at least one social protection benefit (%)
- Proportion of vulnerable population receiving social assistance cash benefit (%).

The current availability of data for all the indicators is quite weak (**Table 8**), and hardly any but developed countries are covered (especially for the International Labour Organisation indicators). The decision about which of the SDG 1.3.1 indicators will be included and how to aggregate them will be postponed to when (if ever) the data are fully available.

Category: Infrastructure

Communication: the SDG indicators selected are already included in the INFORM GRI, from the same data providers.

Physical infrastructure: the MDG indicators on access to water and sanitation have been replaced in the SDGs by slightly different indicators:

- SDG 6.1.1, 'Proportion of population using safely managed drinking water services (%)';

- SDG 6.2.1, 'Proportion of population using safely managed sanitation services (%)'.

The current poor coverage of the data (less than 50 %) does currently not allow it to replace the current indicators, but this should urgently be done, since the MDG indicators are not maintained any more.

Access to health system: SDG indicator 3.b.1, 'Proportion of the target population covered by all vaccines included in their national programme', is composed of three individual subindicators:

- Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%);
- Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%);
- Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%).

The combination of vaccination coverage against different viruses will provide a broader and more comprehensive picture.

SDG indicator 3.d.1, 'Average of 13 International Health Regulations (IHR) core capacities', is relevant to essential public health capacity of the countries. Note that the indicator is based on self-reporting by the State Party, and therefore naturally politically and strategically biased (Poljanšek et al., 2018). In order to reduce the arbitrariness of the IHR self-evaluation, we combine it with the other quantitative indicators under the 'Access to health service' component.

Three other indicators have been identified as suitable for the 'Access to health system' component.

Target 3.8 is defined as 'Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all'. The concern is with all people and communities receiving the quality health services they need (including medicines and other health products), without financial hardship. Two indicators have been chosen to monitor target 3.8 within the SDG framework. Indicator 3.8.1, 'Universal health coverage (UHC) service coverage index', is for health service coverage, and indicator 3.8.2, 'Proportion of population with large household expenditures on health as a share of total household expenditure or income', focuses on health expenditures in relation to a household's budget, to identify financial hardship caused by direct health system payments. Taken together, indicators 3.8.1 and 3.8.2 are meant to capture, respectively, the service coverage and financial protection dimensions. These two indicators should be always monitored jointly (UN Statistics Division, 2018). The 'UHC service coverage index' is a composite indicator computed as the geometric means of 14 tracer indicators, covering four broad categories of service coverage: (1) reproductive, maternal, newborn and child health; (2) infectious diseases; (3) non-communicable diseases; and (4) service capacity and access. It includes all of the indicators belonging to 'Access to health system', except the 'Maternal mortality rate'.

The lack of time series for indicator 3.8.1 and the weak coverage for indicator 3.8.2 (**Table 8**) prevent them from being included in the model currently. Ultimately, these two indicators might replace all the indicators included in the component.

SDG indicator 3.c.1, 'Health worker density, by type of occupation', includes the MDG indicator 'Physicians density', but also density of nursing and midwifery, dentistry and

pharmaceutical personnel. Knowing the weak coverage, frequency of update and availability of time series of 'Physicians density', the combination of the abovementioned indicators might reduce the data limitations, covering almost all the countries (190 of the 191 countries included in the INFORM GRI will be covered by at least one of the four subindicators). However, a problem of comparability across countries will remain, since not all the four indicators are consistently available for all the countries and all years. The individual country coverage for each of the four subindicators is very weak, varying from 37 % for 'Physicians density' to 30 % for 'Pharmaceutical personnel density'. Therefore, it was decided not to include the new SDG subindicators, and to wait for the replacement of the whole component with SDG indicators 3.8.1 and 3.8.2.

Table 14. Aggregation of the 'Infrastructure' category

Category	Infrastructure										
Component	ARITHMETIC AVERAGE										
	Communication				Physical infrastructure			Access to health system			
Core indicator	ARITHMETIC AVERAGE				ARITHMETIC AVERAGE			ARITHMETIC AVERAGE			
	Access to electricity	Internet users	Mobile cellular subscriptions	Adult literacy rate	Roads density	*Proportion of population using safely managed drinking water services (%)*	*Proportion of population using safely managed sanitation services (%)*	Physicians density	Health expenditure per capita	**Immunisation coverage (DTP3, MCV2, PCV3)**	Maternal mortality rate	**Average of 13 IHR core capacities**

Bold: new indicators.
Italic: indicators not ready to be included for lack of data.

4.8. **Data processing**

Before the indicators can be integrated in the model, they need to be pre-processed by imputing the missing values, transforming data into non-dimensional units (per cent, per capita etc.), removing outliers and/or log scaling to reduce their effects, and setting minimum and maximum values. All the indicators are then numbered on the same scale (0-10, with 10 being highest risk; Marin-Ferrer et al., 2017b).

Table 15 summarises the main statistical characteristics calculated on the available complete time series of the selected indicators. The skewness and kurtosis scores help to identify indicators with outliers. Skewness scores higher than 2 and kurtosis scores higher than 3.5 (in bold) indicate the presence of outliers in the dataset.

Table 15. Statistical characteristics of the new indicators

Indicator	Min.	Max.	Average	Median	Skewness	Kurtosis
Volume of remittances (in US dollars) as a proportion of total GDP (%)	0	53.83	4.61	1.77	**2.55**	**8.21**
Malaria incidence per 1 000 population at risk	0	2 003	130.79	30.69	**3.75**	**26.24**
Number of people requiring interventions against neglected tropical diseases	0	683 421 629	9 463 694	103 058	**11.31**	**144.2**
Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%)	3	99	86.51	93	-1.89	3.46
Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%)	2	99	84.42	92	-2.0	**3.91**
Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%)	1	99	77.80	89	-1.51	1.37
Average of 13 International Health Regulations (IHR) core capacities	1	100	69.71	73	-0.58	-0.35

The indicators 'Volume of remittances (in US dollars) as a proportion of total GDP (%)' and 'Number of people requiring interventions against neglected tropical diseases' have been transformed by using the logarithm and dividing by the total population, respectively. The indicator 'Malaria incidence per 1 000 population at risk' is highly influenced by few data points with high values, and a simple cut-off is enough to obtain a proper distribution of the data.

Finally, **Table 16** shows the parameters used for the normalisation of the new indicators.

Table 16. Normalisation parameters for the selected indicators

Indicator	Transformation	Min.	Max.
Volume of remittances (in US dollars) as a proportion of total GDP (%)	Log	-1.5	1.5
Malaria incidence per 1 000 population at risk		0	400
Number of people requiring interventions against neglected tropical diseases	Divided by the total population	0	90
Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%)		40	99
Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%)		40	99
Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%)		40	99
Average of 13 International Health Regulations (IHR) core capacities		40	100

Complete information about the selected data, including the distribution charts and the ranking chart, is presented in Annex 3.

4.9. **Results: the upgraded INFORM GRI 2019**

The inclusion of SDG and SFM indicators in the INFORM GRI has a direct effect on the 'Vulnerability' and 'Lack of coping capacity' dimensions.

Figures 8-10 show the INFORM GRI 2019 results upgraded with the inclusion of the new SDG indicators.

Figure 8. Upgraded INFORM 2019 with new SDGs indicators — Risk

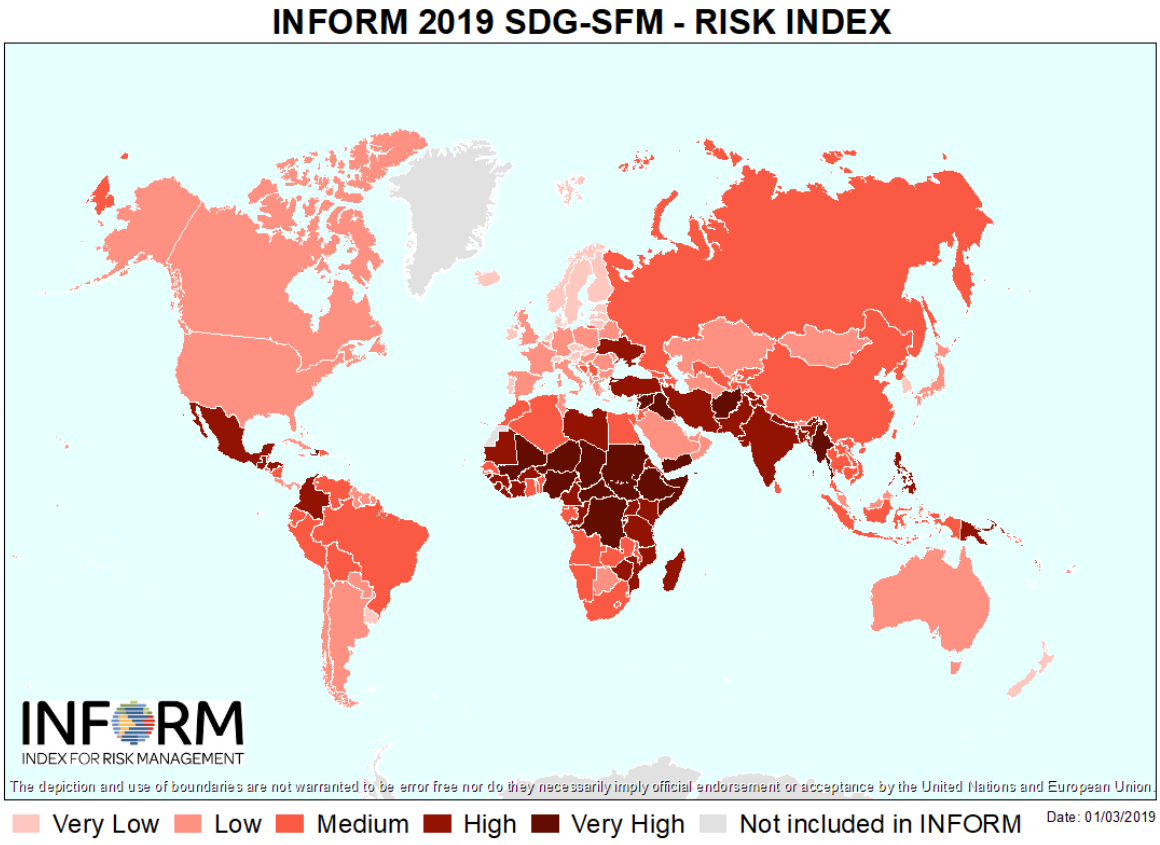


Figure 9. Upgraded INFORM 2019 with new SDG indicators — Vulnerability

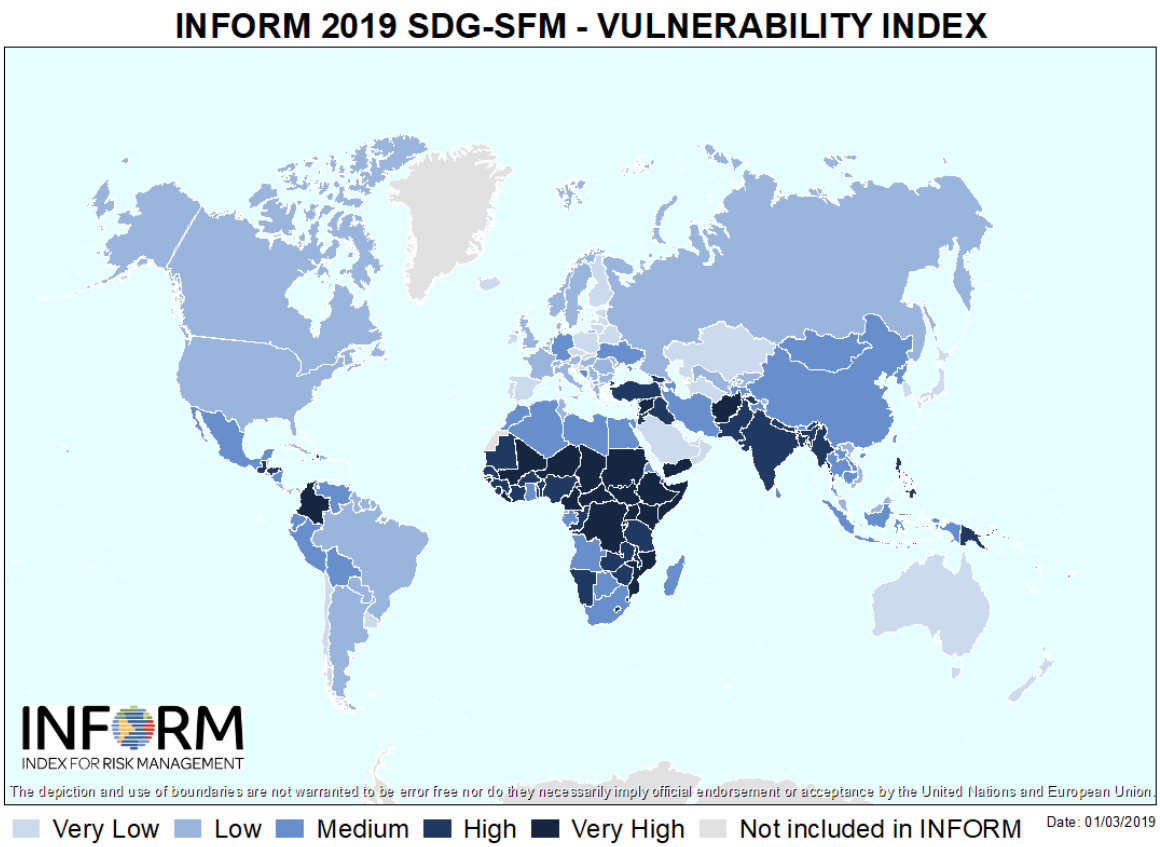
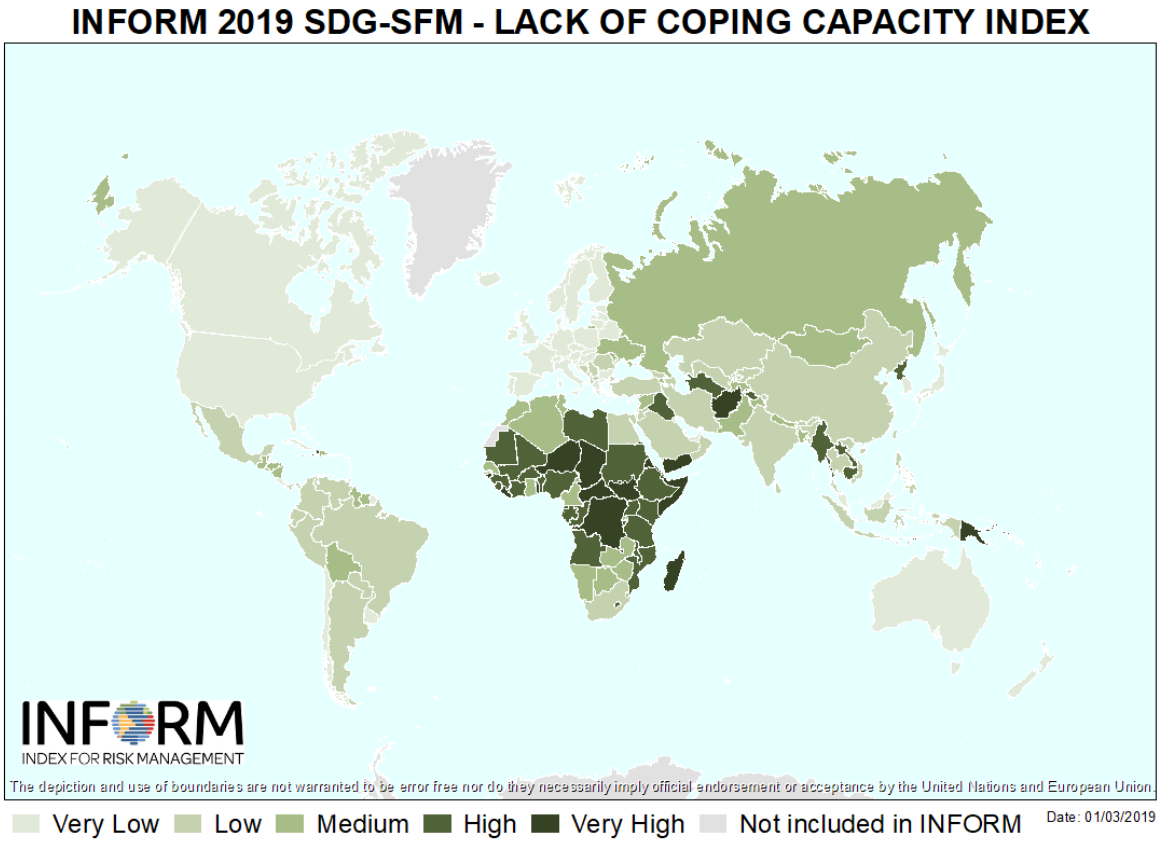
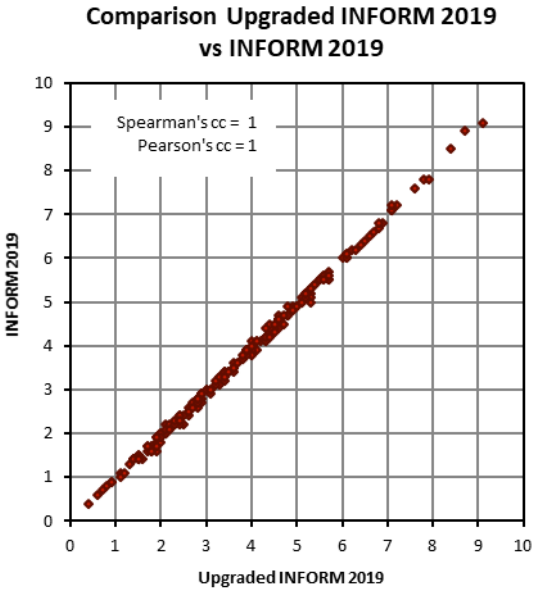


Figure 10. Upgraded INFORM 2019 with new SDG indicators — Lack of coping capacity



Spearman's correlation coefficient (CC) is a non-parametric measure of statistical dependence between two ranked variables, while Pearson's correlation coefficient is a measure of a linear relationship between the scores of the two variables. The two versions of the INFORM GRI are identical in ranking (Spearman's CC = 1) and in the scores (Pearson's CC = 1) (**Figure 11**).

Figure 11: Comparison of INFORM 2019 Risk Index with the version including SDG indicators



No significant differences could be noticed in the 'Vulnerability' and 'Lack of coping capacity' dimensions either, where in fact the new indicators were inserted. The minimal impact on the results is mostly explained by the relative importance of the new indicators in the INFORM GRI model. In fact, they are included in components of the model that are already well covered, and do not help to fill the most important data gap described in section 4.2.

The full ranking of the upgraded INFORM GRI 2019 with the addition of the new SDG indicators is available in Annexes 1 and 2.

4.10. **Statistical analysis**

4.10.1. Correlation analysis

A square of a Pearson's correlation coefficient between the subindices and one-level-up aggregate index (component/category/dimension) can measure the influence of a subindex on the aggregate index due to correlation (Paruolo et al., 2013). The relative differences among those correlations explain the influence of a given subindex on the aggregate index. In weighted arithmetic or geometric averages (including cases of equal weights), nominal weights are defined by the methodology. However, the relative influence of indices on the aggregated index depends on their distribution after normalisation as well as their correlation structure. So it can be the case that the nominal weighting scheme of the composite index does not reflect the statistical importance of individual indices within the structure.

The results of the correlation analysis are shown in **Table 17**. Similar Pearson's correlation coefficients (always squared) of the categories within the same dimension justify the equal weighting imposed in the INFORM GRI methodology. The present INFORM GRI model is well structured and balanced in the dimensions and categories, as well as in the underlying components (Marin-Ferrer et al., 2017b).

The addition of the seven new indicators preserved the quality of the overall index (**Table 17**).

Table 17. Correlation matrix ([8])

	Earthquakes	*Floods*	*Tsunamis*	*Tropical cyclones*	*Droughts*	**Natural**	*Conflict Probability*	*Current Highly violent conflicts*	**Human**	*Development & Deprivation*	*Inequality*	*Economic Dependency*	**Social-Economics Vulnerability**	*Uprooted people*	Health Conditions	Children U5	Recent Shocks	Food Security	*Other Vulnerable Groups*	**Vulnerable Groups**	*DRR*	*Governance*	**Institutional**	*Communication*	*Physical infrastructure*	*Access to health care*	**Infrastructure**	**HAZARD**	**VULNERABILITY**	**COPING CAPACITY**	**RISK**
Earthquakes	1.00	0.09	0.07	0.03	0.05	0.49	0.07	0.02	0.06	0.02	0.01	0.01	0.02	0.05	0.10	0.03	0.00	0.02	0.05	0.01	0.02	0.00	0.00	0.04	0.00	0.04	0.02	0.23	0.00	0.01	0.03
Floods	0.09	1.00	0.00	0.00	0.13	0.25	0.30	0.10	0.28	0.08	0.02	0.05	0.02	0.16	0.01	0.08	0.00	0.04	0.02	0.12	0.00	0.09	0.00	0.06	0.00	0.14	0.02	0.08	0.37	0.08	0.24
Tsunamis	0.07	0.00	1.00	0.19	0.00	0.41	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00
Tropical cyclones	0.03	0.00	0.19	1.00	0.01	0.25	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.10	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.01	0.00
Droughts	0.05	0.13	0.00	0.01	1.00	0.20	0.16	0.02	0.14	0.13	0.09	0.01	0.12	0.06	0.03	0.09	0.04	0.05	0.08	0.11	0.01	0.09	0.11	0.18	0.06	0.06	0.13	0.21	0.48	0.14	0.13	0.23
Natural	0.49	0.25	0.41	0.25	0.20	1.00	0.13	0.04	0.12	0.01	0.02	0.00	0.01	0.03	0.01	0.00	0.04	0.01	0.01	0.04	0.00	0.08	0.02	0.03	0.00	0.00	0.01	0.05	0.11	0.03	0.02	0.19
Conflict Probability	0.07	0.30	0.00	0.00	0.16	0.13	1.00	0.37	0.96	0.28	0.14	0.00	0.20	0.39	0.09	0.29	0.01	0.14	0.14	0.44	0.04	0.33	0.22	0.32	0.25	0.19	0.29	0.78	0.39	0.30	0.30	0.67
Current Highly violent conflicts	0.02	0.10	0.00	0.00	0.02	0.04	0.37	1.00	0.56	0.09	0.04	0.02	0.08	0.29	0.01	0.13	0.00	0.06	0.04	0.30	0.03	0.12	0.09	0.29	0.09	0.08	0.09	0.48	0.23	0.13	0.13	0.36
Human	0.06	0.28	0.00	0.00	0.14	0.12	0.96	0.56	1.00	0.26	0.13	0.00	0.20	0.43	0.08	0.29	0.00	0.14	0.13	0.48	0.05	0.23	0.34	0.29	0.19	0.19	0.28	0.82	0.41	0.30	0.69	0.69
Development & Deprivation	0.02	0.08	0.00	0.00	0.13	0.01	0.28	0.09	0.26	1.00	0.50	0.16	0.91	0.04	0.59	0.80	0.29	0.65	0.69	0.27	0.22	0.50	0.60	0.86	0.75	0.78	0.91	0.19	0.70	0.83	0.83	0.66
Inequality	0.01	0.02	0.01	0.01	0.09	0.02	0.14	0.04	0.13	0.50	1.00	0.06	0.61	0.02	0.31	0.34	0.07	0.37	0.41	0.13	0.19	0.36	0.37	0.37	0.41	0.48	0.47	0.11	0.42	0.48	0.15	0.38
Economic Dependency	0.01	0.05	0.02	0.00	0.01	0.00	0.00	0.02	0.00	0.16	0.06	1.00	0.38	0.01	0.12	0.07	0.06	0.14	0.18	0.10	0.17	0.15	0.15	0.15	0.03	0.20	0.15	0.00	0.29	0.12	0.12	0.10
Social-Economics Vulnerability	0.02	0.02	0.00	0.00	0.12	0.01	0.20	0.08	0.20	0.91	0.61	0.38	1.00	0.04	0.56	0.66	0.08	0.62	0.69	0.28	0.29	0.59	0.52	0.77	0.53	0.78	0.80	0.15	0.76	0.77	0.52	0.91
Uprooted people	0.05	0.16	0.00	0.00	0.06	0.03	0.39	0.29	0.43	0.04	0.02	0.01	0.04	1.00	0.00	0.07	0.01	0.03	0.01	0.79	0.00	0.04	0.23	0.06	0.06	0.06	0.06	0.34	0.39	0.06	0.04	0.34
Health Conditions	0.10	0.01	0.00	0.00	0.03	0.01	0.09	0.02	0.08	0.59	0.31	0.12	0.56	0.00	1.00	0.51	0.03	0.36	0.62	0.14	0.10	0.25	0.22	0.60	0.48	0.60	0.78	0.03	0.41	0.59	0.06	0.39
Children U5	0.03	0.08	0.01	0.00	0.09	0.00	0.01	0.00	0.00	0.80	0.34	0.07	0.66	0.07	0.51	1.00	0.04	0.51	0.64	0.29	0.17	0.44	0.38	0.78	0.70	0.70	0.68	0.20	0.59	0.67	0.52	0.76
Recent Shocks	0.00	0.00	0.04	0.10	0.04	0.04	0.00	0.00	0.00	0.05	0.07	0.06	0.08	0.01	0.03	0.04	1.00	0.03	0.36	0.05	0.02	0.04	0.03	0.06	0.03	0.03	0.05	0.01	0.07	0.05	0.05	0.05
Food Security	0.02	0.04	0.01	0.00	0.05	0.01	0.14	0.04	0.14	0.05	0.02	0.00	0.01	0.03	0.00	0.01	0.03	1.00	0.62	0.23	0.23	0.46	0.42	0.60	0.47	0.54	0.61	0.11	0.52	0.60	0.62	0.45
Other Vulnerable Groups	0.05	0.16	0.00	0.00	0.06	0.03	0.39	0.29	0.43	0.04	0.02	0.01	0.04	1.00	0.00	0.07	0.01	0.03	1.00	0.79	0.00	0.04	0.23	0.06	0.06	0.06	0.06	0.34	0.39	0.06	0.04	0.34
Vulnerable Groups	0.01	0.12	0.00	0.00	0.11	0.04	0.44	0.30	0.48	0.27	0.13	0.10	0.28	0.79	0.14	0.29	0.05	0.23	0.28	1.00	0.04	0.20	0.15	0.31	0.25	0.20	0.29	0.23	0.76	0.31	0.26	0.50
DRR	0.02	0.00	0.00	0.00	0.01	0.00	0.04	0.03	0.05	0.22	0.19	0.17	0.29	0.00	0.10	0.17	0.02	0.23	0.18	0.04	1.00	0.33	0.17	0.17	0.16	0.29	0.23	0.02	0.38	0.17	0.50	0.80
Governance	0.00	0.09	0.00	0.00	0.15	0.08	0.33	0.14	0.34	0.60	0.38	0.14	0.59	0.04	0.25	0.44	0.04	0.46	0.41	0.20	0.33	1.00	0.83	0.46	0.47	0.57	0.57	0.32	0.47	0.40	0.80	0.83
Institutional	0.00	0.04	0.00	0.00	0.09	0.02	0.22	0.12	0.23	0.50	0.36	0.15	0.52	0.02	0.22	0.38	0.03	0.42	0.37	0.15	0.79	0.83	1.00	0.40	0.40	0.53	0.51	0.19	0.53	0.51	0.83	0.53
Communication	0.04	0.06	0.00	0.00	0.11	0.01	0.25	0.09	0.24	0.86	0.37	0.15	0.77	0.06	0.60	0.78	0.06	0.60	0.71	0.31	0.17	0.46	0.40	1.00	0.72	0.70	0.91	0.17	0.67	0.76	0.76	0.61
Physical infrastructure	0.00	0.14	0.00	0.00	0.01	0.03	0.32	0.08	0.29	0.75	0.41	0.03	0.59	0.06	0.48	0.70	0.03	0.47	0.53	0.25	0.16	0.47	0.41	0.72	1.00	0.57	0.88	0.24	0.52	0.75	0.61	0.61
Access to health care	0.04	0.02	0.00	0.00	0.06	0.00	0.19	0.08	0.19	0.78	0.48	0.20	0.78	0.02	0.53	0.68	0.05	0.54	0.61	0.20	0.29	0.57	0.53	0.70	0.57	1.00	0.85	0.13	0.57	0.81	0.56	0.56
Infrastructure	0.02	0.08	0.00	0.00	0.13	0.01	0.29	0.09	0.28	0.91	0.47	0.12	0.80	0.06	0.61	0.82	0.05	0.61	0.69	0.20	0.23	0.57	0.51	0.91	0.88	0.85	1.00	0.21	0.66	0.88	0.68	0.68
HAZARD	0.23	0.37	0.08	0.04	0.21	0.48	0.78	0.48	0.82	0.19	0.11	0.00	0.15	0.34	0.03	0.20	0.01	0.11	0.10	0.38	0.02	0.19	0.19	0.17	0.24	0.13	0.21	1.00	0.32	0.23	0.69	0.69
VULNERABILITY	0.00	0.08	0.00	0.01	0.14	0.03	0.39	0.23	0.41	0.70	0.42	0.29	0.76	0.39	0.41	0.59	0.07	0.52	0.58	0.76	0.18	0.40	0.40	0.67	0.52	0.57	0.66	0.32	1.00	0.62	0.79	0.79
COPING CAPACITY	0.01	0.07	0.00	0.00	0.13	0.02	0.30	0.13	0.30	0.83	0.48	0.15	0.78	0.04	0.48	0.70	0.05	0.60	0.62	0.26	0.50	0.83	0.83	0.76	0.75	0.81	0.88	0.23	0.62	1.00	0.71	0.71
RISK	0.03	0.24	0.02	0.00	0.23	0.19	0.67	0.36	0.69	0.66	0.38	0.12	0.63	0.33	0.30	0.59	0.05	0.45	0.48	0.61	0.20	0.65	0.53	0.61	0.61	0.56	0.68	0.69	0.79	0.79	1.00	1.00

([8]) Element *i*,*j* equals the Pearson's correlation coefficient between the *i*th row and the *j*th column variable.

4.10.2. Inter-indicator correlations within components

In order to investigate the internal reliability of the new indicators at each component (for both the INFORM GRI 2019 and the upgraded INFORM GRI 2019), we computed the Cronbach's Alpha coefficient (C-alpha) suggested by the OECD (2008) and Lafortune et al. (2018). Cronbach's Alpha evaluates the degree to which a set of items (indicators) measures an analogous unidimensional object (Cronbach, 1951; Dočekalová and Kocmanová, 2016; OECD, 2008). In statistical terms, C-alpha is a measure of the portion of total variability within individual indicators based on correlations, and computed as:

$$\alpha_c = \left(\frac{Q}{Q-1}\right)\left(1 - \frac{\sum_j var(x_j)}{var(x_0)}\right) \; c = 1, \dots, M, j = 1, \dots, Q$$

where *M* is the number of alternatives considered, *Q* indicates the number of individual indicators and x_0 is the sum of all individual indicators in the same scale. C-alpha values above 0.7 have been considered an acceptable range to measure reliability (Dadfar and Lester, 2017; de Vet et al., 2017; Lafortune et al., 2018; OECD, 2008)0000. C-alpha has been computed for three components (health conditions, economic dependency and immunisation) containing the new indicators. For the purpose of performing the C-alpha test, MCAR (Missing Completely At Random) values were explicitly imputed using the average index of the remaining indicators in each scale (JRC, 2019; Marin-Ferrer et al., 2017a; Nardo et al., 2005).

Table 18 illustrates the results obtained from the reliability analysis performed using Statistical Package for Social Science (SPSS) ([9]) software. The reliability results for each item are shown in two forms. (1) Corrected Indicator-Total Correlation is the correlation between the indicator of interest and a composite score of all the other remaining indicators when the item is excluded (scale scores minus the indicator of interest). The lower the value of the correlation, the less the impact on the composite construct. Correlations over 0.7 indicate that the indicator itself presents the whole construct, which should be avoided. (2) Cronbach's Alpha if Indicator Deleted shows the extent of the impacts the individual indicator has on the reliability test. If the value is smaller than the initial estimate of C-alpha for the scale, it can be inferred that, by excluding the indicator of interest, the reliability decreases; if the value is higher than the initial estimate, the composite construct will be improved by excluding that indicator.

Health conditions: in the present INFORM GRI framework, the health conditions are assessed using three indicators (H1, H2 and H3). The C-alpha value (0.795) is above the acceptable threshold, indicating that the indicators are internally consistent. However, in the case of H3, the Cronbach's Alpha if Indicator Deleted value (0.799) is larger than the initial estimates of the component (0.795), which shows inconsistency in incorporating this indicator in the health conditions component. In the upgraded INFORM GRI, the H3 indicator has been replaced by H3r, and an H4 indicator has been added to provide better insights and empower the composite construct for this component. The C-alpha estimate has been improved (0.834), which validates the use of the replacement and new indicators. The correlation values are in the acceptable range as well.

Economic dependency: in the present INFORM GRI framework, this scale has been presented with only two indicators, with an acceptable C-alpha value equal to 0.773. In the upgraded INFORM GRI, we added indicator E3 to the component items to enlarge the set. However, it was observed that the internal scale consistency is decreased by adding this indicator to the analysis (0.733). The Cronbach's Alpha if Indicator Deleted value for E3 is larger than the initial estimate, which shows that the composite construct will deteriorate if this indicator is included, but still be acceptable.

Immunisation coverage: the present INFORM GRI considered only one indicator for this component (I4). In the upgraded methodology, to avoid a single-indicator component, it has been enriched by adding four new indicators (I1n, I2n and I3n). The C-alpha value for this component in the upgraded framework is in the acceptable range

([9]) https://www.spss.it/

(0.832). However, the results suggest excluding I4 because of the moderate Corrected Indicator-Total Correlation value (0.518) and the Cronbach's Alpha if Indicator Deleted value higher than the initial estimate of the component.

Table 18. Inter-indicator Cronbach's Alpha within component

Dimension	Component	INFORM version	Number of ind. in the component	Cronbach's Alpha	Indicators	Description	Corrected Ind.-Total Correlation	Cronbach's Alpha if Ind. Deleted
Vulnerability	Health conditions	INFORM 2019	3	0.795	H1	Estimated number of people living with HIV - Adult (>15) rate	0.697	0.654
					H2	Tuberculosis prevalence	0.661	0.699
					H3	Malaria mortality rate	0.562	0.799
		Upgraded INFORM 2019	4	0.834	H1	Estimated number of people living with HIV - Adult (>15) rate	0.687	0.78
					H2	Tuberculosis prevalence	0.639	0.802
					*H3r	Malaria incidence per 1,000 population at risk	0.657	0.794
					*H4n	People requiring interventions against neglected tropical diseases	0.692	0.783
	Economic dependency	INFORM 2019	2	0.773	E1	Public Aid per capita (US$)	0.631	**Not defined
					E2	Net ODA received (% of GNI)	0.631	**Not defined
		Upgraded INFORM 2019	3	0.733	E1	Public Aid per capita (US$)	0.587	0.612
					E2	Net ODA received (% of GNI)	0.648	0.531
					E3n	Volume of remittances	0.446	0.773
Lack of Coping Capacity	Immunization coverage	INFORM 2019	1	***Not defined	I4	Measles immunization coverage	***Not defined	***Not defined
		Upgraded INFORM 2019	4	0.832	I1n	Proportion of the target population with access to 3 doses of diphtheria-tetanus-pertussis (DTP3) (%)	0.757	0.767
					I2n	Proportion of the target population with access to measles-containing-vaccine second-dose (MCV2) (%)	0.756	0.743
					I3n	Proportion of the target population with access to pneumococcal conjugate 3rd dose (PCV3) (%)	0.705	0.77
					I4	Measles immunization coverage	0.518	0.874

* n, new item; r, replacement item.
** In the case of two items, if we delete one of them, the remaining item will represent the composite score.
*** In the case of only one item, the composite score represents the same item. Hence, Cronbach's alpha cannot be measured.

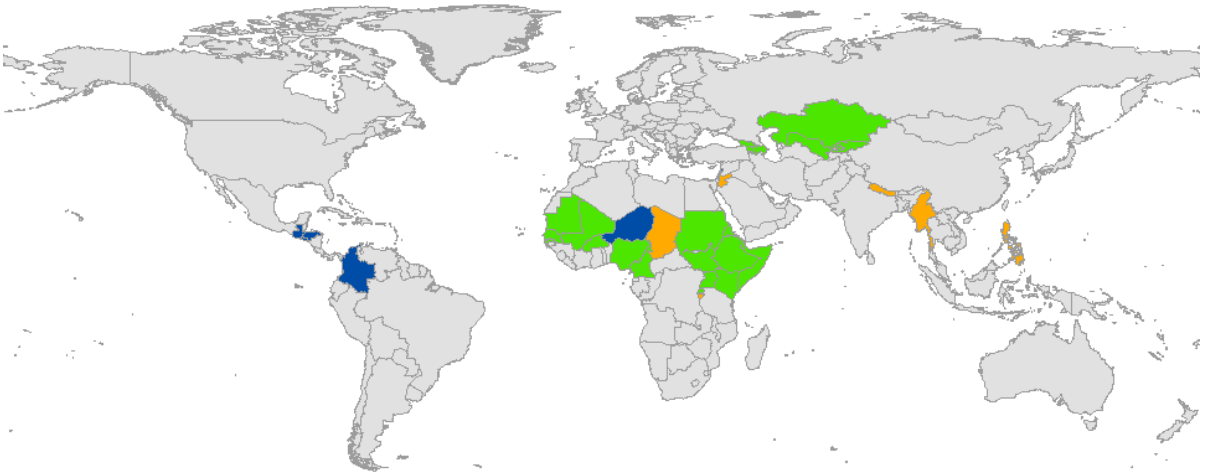
5. How the INFORM GRI could contribute to the SFDRR

5.1. SFDRR targets

The INFORM GRI is a global multi-hazard tool for assessing risk of disasters. It simplifies a lot of information about crisis and disaster risk, providing a detailed picture of the risk drivers across the three dimensions of risk.

The INFORM SRI model uses the same risk assessment methodology and development process as the INFORM GRI, but is adapted to a region or country level. An INFORM SRI captures a detailed picture of risk and its components at the provincial, municipal or village level that is comparable across a region or country. Subnational models profile regional and national risk by developing indicators that reflect hazards and conditions from these areas. The process of developing an INFORM SRI model is locally owned and managed. This approach ensures that each model has local buy-in, is used in local analysis and decision-making processes, and is adapted to local risks. **Figure 12** shows the current level of implementation of the INFORM SRI initiatives.

Figure 12. Status of the INFORM Subnational models



The map shows the regional and national models in different colours according to their status: green (regional, completed); blue (national, completed); orange (national, under development).

Source: INFORM, 2019

The implementation of an INFORM SRI allows countries to report against SFDRR targets E and G:

- Global target E, 'Substantially increase the number of countries with national and local disaster risk reduction strategies by 2030';
- Global 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'.

Furthermore, the INFORM SRI model (and also the INFORM GRI) can help Member States to compile some of the SFM indicators, e.g. providing the denominator for indicators G-3 and G-6 (exposed population to hazards), or the weights for G-1, G-2 and G-5 ('Hazard & Exposure' dimension scores) (UNISDR, 2018).

5.2. The upgraded INFORM GRI as monitoring system for the SFDRR

The methodology of composite indicators can be useful to give an interpretation of a complex phenomenon. The INFORM GRI presents a lot of information about crisis and disaster risk in a simple manner.

In the INFORM Annual Report 2018, an analysis (Garschagen and Hagenlocher, 2017) was presented of how indices can be used for assessing and monitoring the progress of the global frameworks towards disaster risk reduction.

Indices might prove useful for two reasons:

- First, the current number of indicators to track progress in the implementation of the SDGs (238 indicators) and SFDRR (38 indicators) is quite high. In order to get a comprehensive overview that allows easy comparison and communication, some sort of aggregation will be not only helpful but necessary. Aggregate index products have a lot to offer in this respect.
- Second, indices such as the INFORM GRI offer, through their modular approach, an important measure of the major driving factors of risk. They therefore provide a key supplement to the current focus, which is on either past disaster losses or the adoption of risk reduction plans at the policy level.

Many examples exist of the use of indices for monitoring global frameworks. In particular, for monitoring progress towards the SDGs, different initiatives have adopted a composite indicators approach for sectorial (WHO, 2017), regional (Eurostat, 2018; Alleanza Italiana per lo Sviluppo Sostenibile, 2018) and global (Sustainable Development Solutions Network and Bertelsmann Stiftung ([10])) monitoring analysis.

All these indices are based on simple average scores of the indicators selected for each SDGs. Some of them (e.g. the SDG Index) calculate a final score as the arithmetic average of the 17 goals. The structure of the SDGs defines the conceptual framework for all the abovementioned indices.

In the context of disaster risk reduction, the conceptual framework is well defined. The INFORM GRI, as an open, well-established, widely recognised index for disaster risk assessment, can be used as a system for monitoring SFDRR achievements towards risk reduction. As we have described in this report, the INFORM GRI will incorporate many SFM and SDG indicators related to disaster risk. That way, SFM and SDG indicators are put in the context of disaster risk reduction. Any progress in indicators' performance will be reflected in the light of disaster risk.

Furthermore, SFDRR targets A to D provide information on loss data to accompany the effort in disaster risk reduction activities. The disaster risk and disaster losses, which are the materialisation of the disaster risk, depend on hazards, exposure, vulnerability and coping capacity. The INFORM GRI could be therefore a more accurate tool to interpret the loss data: losses can increase as a result of hazardous events (recent extreme events, climate changes) and exposure (population growth (Pesaresi et al., 2017), informal settlements, bad urban planning). The effort put into vulnerability reduction (SDGs) and increase of coping capacity (SFDRR) could still not be enough to compensate for them. In order to assess progress in DRR indicators (SFDRR targets E-G), it is necessary to consider them in a disaster risk framework as provided by the INFORM GRI. The higher the level of risk, the more effort is needed in vulnerability reduction and coping capacity improvement to reduce the risk.

The INFORM GRI would help to inform discussions on risk drivers in different countries, as well as trends in risk reduction. The index could foster trans-disciplinary dialogue to compare risk across hazards and (iteratively and over time) define compound risk. It should allow thematic communities to contribute their knowledge (by hazard, by sector).

([10]) http://www.sdgindex.org/

5.3. The INFORM GRI's contribution to early warning systems and rapid risk assessment

The SFDRR identified EWSs and disaster risk assessment (DRA) as key elements of DRR. Global target G calls to 'substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030'.

EWSs detect, monitor, analyse and forecast hazards and their possible consequences. Continuous monitoring of hazard parameters and their precursors (when available for a particular hazard), as well as accessing contextual information on hazard exposure, vulnerability and capacity, is essential to generate accurate warnings in a timely fashion that allows sufficient time for the affected community or communities to enact their disaster management plans appropriate to that hazard.

The Global Disaster Alert and Coordination System (GDACS) is a framework for cooperation between the United Nations and the European Commission. GDACS provides alerts based on the estimation of the overall impact of natural hazards on affected countries. The JRC provides the automatic estimates and risk analysis, the basis of the alerts. GDACS alert levels aim to draw attention to an event that might turn out to be serious enough to merit international intervention, or that could overwhelm national authorities' response capacity. GDACS alert levels aim to classify disasters according to the likelihood that the societies affected can no longer cope at national level and will require humanitarian intervention.

As of September 2017, the GDACS alert score for earthquake consider the level of coping capacity of the affected country or countries, provided by the INFORM GRI ([11]). The 'Lack of coping capacity' dimension measures the ability of a country to cope with disasters in terms of formal, organised activities and the effort of the country's government as well as the existing infrastructure, which contribute to the reduction of the disaster risk.

In public health, the RRA of an acute public health event consists in an overall process of identification, analysis and evaluation of a risk for a defined human population in relation to an acute public health event. When a significant acute public health event occurs, health organisations performing RRA activities need to be able to promptly and appropriately describe key aspects related to (1) the possible cause and the specific health condition implicated; (2) the population affected; and (3) the overall context of the occurrence of the event (Mantero and Doherty, 2017).

The JRC is developing the Epidemic Intelligence from Open Sources (EIOS) platform, which combines into a single technical implementation the Hazard Detection and Risk Assessment System (HDRAS) of the WHO and the Early Alerting and Response (EAR) (Barboza et al., 2013) system of the Global Health Security Initiative (GHSI) ([12]). EIOS creates the pre-eminent global early warning system for health threats and helps bring the health perspective into the SFDRR.

The INFORM GRI, and in particular the epidemic hazard-dependent version (Poljanšek et al., 2018), provides a library of contextual information integrated into EIOS, covering exposure and vulnerability to hazards (e.g. population density, suitability maps), and the coping capacity of the affected areas.

In addition, the INFORM GRI could also provide the contextual information on vulnerability and coping capacity required for more EWSs developed by JRC (e.g. Global Wildfire Information System (GWIS ([13])), Global Flood Awareness System (GLOFAS ([14])) or others (e.g. World Meteorological Organization systems).

([11]) http://www.gdacs.org/Knowledge/models_eq.aspx
([12]) http://www.ghsi.ca/
([13]) http://gwis.jrc.ec.europa.eu/

6. Conclusion

The SFM and the SDGs provide a unique set of reliable, consistent and comparable indicators required to understand disaster risk drivers and underlying risk factors. The two monitoring frameworks collect a massive amount of data on disaster risk dimensions, vulnerability and coping capacity, introducing important indicators covering weak areas. This creates a unique opportunity to enhance the quality and the coverage of the underlying indicators used in the INFORM GRI.

We identified a large set of indicators that can be potentially included in the next releases of the INFORM GRI model, helping to fill the existing data gaps. Some of them will be included in the next release; others will be included once the availability of the data meets the minimum requirements for the inclusion. Not all the identified indicators will necessarily be finally included in the model. The final decision will be taken year by year depending on the indicator's data quality and its relevance to the INFORM GRI model.

Most of the identified and included indicators are health related, in line with the intention of the INFORM partners of 'making adjustments to indicators in the vulnerability and lack of coping capacity dimensions to improve the overall coverage of health by the INFORM GRI' ([15]). However, we observed that the influence of the included indicators in the INFORM GRI results is minimal (section 4.9).

Many challenges remain in the data availability. Data behind SFM and SDG indicators are largely incomplete, often having weak geographical coverage, lacking time series and not having been recently updated. This is especially true of the SFM indicators, for which the country reporting is still at the embryonic stage.

Once most of the new indicators are available, many gaps identified in the current INFORM GRI model due to data unavailability will be filled. Particularly the SFM indicators will provide an essential contribution to assessing the capacity of countries for risk reduction.

Finally, the INFORM GRI can provide many contributions to the post-2015 global frameworks. Among others, the adaptation of the INFORM GRI at a national scale (INFORM SRI) is contributing to defining national and local disaster risk reduction strategies (SFDRR global target E) and to increasing the availability of and access to disaster risk information (SFDRR global target G). The INFORM GRI can be also used as a tool for assessing and monitoring progress towards risk reduction against the SFDRR and SDGs. Likewise, the INFORM GRI can provide the contextual information on exposure, vulnerability and coping capacity needed for early warning systems and rapid risk assessment for public health.

([14]) http://www.globalfloods.eu/

([15]) INFORM Annual Partners' Meeting, 22-23 June 2017, FAO, Rome; INFORM Annual Partners' Meeting, 28-29 June 2018, UNDP, Geneva

References

Afonso, H., LaFleur, M., and Alarcón, D., 2015, 'Inequality measurement', Development Issues No 2, Development Strategy and Policy Analysis Unit in the Development Policy and Analysis Division of UN/DESA (http://www.un.org/en/development/desa/policy/wess/wess_dev_issues/dsp_policy_02.pdf).

Alleanza Italiana per lo Sviluppo Sostenibile, 2018, *Monitoring SDGs at EU level with composite indicators* (http://asvis.it/public/asvis/files/ASVIS-REPORT-EU-COMPOSITES-REV_FINAL-EG.pdf).

Barboza, P., Vaillant, L., Mawudeku, A., Nelson, N. P., Hartley, D. M., Madoff, L. C., Linge, J. P., Collier, N., Brownstein, J. S., Yangarber, R., and Astagneau, P., 2013, 'Evaluation of epidemic intelligence systems integrated in the early alerting and reporting project for the detection of A/H5N1 influenza events', *PLOS ONE* (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0057252).

Bellù, L. G., and Liberati, P., 2006, *Inequality analysis: The Gini index*, Food and Agriculture Organisation, United Nations.

Chitiga, M., Sekyere, E., and Tsoanamatsie, N., n.d., 'Income inequality and limitations of the Gini index: the case of South Africa' (http://www.hsrc.ac.za/en/review/hsrc-review-november-2014/limitations-of-gini-index).

Corporate Finance Institute, n.d., 'What is the Gini coefficient?' (https://corporatefinanceinstitute.com/resources/knowledge/economics/gini-coefficient/).

Cronbach, L. J., 1951, 'Coefficient alpha and the internal structure of tests', *Psychometrika*, Vol. 16, No 3, pp. 297-334 (https://doi.org/10.1007/BF02310555).

Dadfar, M., and Lester, D., 2017, 'Cronbach's α reliability, concurrent validity, and factorial structure of the Death Depression Scale in an Iranian hospital staff sample', *International Journal of Nursing Sciences*, Vol. 4, No 2, pp. 135-141 (https://doi.org/10.1016/J.IJNSS.2017.02.007).

De Groeve, T., Poljanšek, K., and Vernaccini, L., 2015, *Index for Risk Management — Inform: Concept and methodology — version 2016*, Publications Office of the European Union, Luxembourg (doi:10.2788/636388).

De Groeve, T., Poljanšek, K., and Vernaccini, L., 2014, *Index for Risk Management — Inform: Concept and methodology report*, Publications Office of the European Union, Luxembourg (doi:10.2788/78658).

de Vet, H. C. W., Mokkink, L. B., Mosmuller, D. G., and Terwee, C. B., 2017, 'Spearman-Brown prophecy formula and Cronbach's alpha: different faces of reliability and opportunities for new applications', *Journal of Clinical Epidemiology*, Vol. 85, pp. 45-49 (https://doi.org/10.1016/J.JCLINEPI.2017.01.013).

Dočekalová, M. P., and Kocmanová, A., 2016, 'Composite indicator for measuring corporate sustainability', *Ecological Indicators*, Vol. 61, No 2, pp. 612-623 (https://doi.org/10.1016/J.ECOLIND.2015.10.012).

Eurostat, 2018, *Sustainable development in the European Union: Monitoring report on progress towards the SDGs in a EU context* (doi:10.2785/401485).

FAO, n.d.a, 'The Food Insecurity Experience Scale' (http://www.fao.org/in-action/voices-of-the-hungry/fies/en/).

FAO, n.d.b, 'SDG monitoring' (http://www.fao.org/in-action/voices-of-the-hungry/sdgs/en/).

Fuller, P., 2018, 'Social protection reduces disaster risk for poor' (https://www.unisdr.org/archive/59134).

Garschagen, M., and Hagenlocher, M., 2017, 'Assessing and monitoring progress towards risk reduction: a case for indices?', in Inform, *Inform Global Risk Index: Results 2018*, pp. 18-19.

INFORM, 2017a, INFORM Annual Meeting 2017, Rome.

INFORM, 2017b, *INFORM Annual Report 2018* (www.inform-index.org).

INFORM, 2018, *INFORM Annual Report 2019* (www.inform-index.org).

JRC, 2019, '10 step guide' (https://composite-indicators.jrc.ec.europa.eu/?q=10-step-guide).

Lafortune, G., Fuller, G., Moreno, J., Schmidt-Traub, G., and Kroll, C., 2018, *SDGs index and dashboards: Detailed methodological paper*, New York.

Le Quesne, F., Scott, Z., Shannon-Little, L., Solórzano, A., and Tarazona, M., 2016, *Evaluation of the Global Assessment Report on Disaster Risk Reduction*, Oxford Policy Management, Oxford (https://www.unisdr.org/2016/docs/evaluation/OPM%20GAR%20evaluation%20report.pdf).

Maini, R., Clarke, L., Blanchard, K., and Murray, V., 2017, 'The Sendai Framework for Disaster Risk Reduction and its indicators: where does health fit in?', *International Journal of Disaster Risk Science*, Vol. 8, No 2, pp. 150-155 (https://doi.org/10.1007/s13753-017-0120-2).

Mantero, J., and Doherty, B., 2017, *Identification of informative content needs supporting rapid risk assessment of acute public health events (ICN-RRA)*, Publications Office of the European Union, Luxembourg (doi:10.2760/53486).

Marin Ferrer, M., Do Ó, A., Poljanšek, K., and Casajus Valles, A., 2018, *Disaster damages and loss data for policy*, Publications Office of the European Union, Luxembourg (doi:10.2760/840421).

Marin-Ferrer, M., Doherty, B., Bejar Garcia, J., Luoni, S., and Vernaccini, L., 2017a, *Inform: Scientific and technical improvements in 2017: Missing values imputation and IT developments*, Publications Office of the European Union, Luxembourg (doi:10.2760/076136).

Marin-Ferrer, M., Vernaccini, L., and Poljanšek, K., 2017b. *Inform Index for Risk Management: Concept and methodology version 2017*, Publications Office of the European Union, Luxembourg (doi:10.2760/094023).

Mellor, J. W., 1989, 'Dramatic poverty reduction in the Third World: Prospects and needed action', International Food Policy Research Institute, Washington, USA, pp. 18-20.

Messina, L., Poljanšek, K., and Vernaccini, L., 2019, *Usage of Inform GRI in humanitarian aid and development assistance initiatives: Results of the Inform GRI's impact survey*, in preceding, Publications Office of the European Union, Luxembourg, *Advance online publication*.

Nardo, M., Saisanai, M., Saltelli, A., Tarantola, S., Hoffman, A., and Giovannini, E., 2005, *Handbook on constructing composite indicators: Methodology and user guide*, OECD Statistics Working Papers No 2005/03, OECD Publishing, Paris (doi:10.1787/533411815016).

OECD, 2008, *Handbook on constructing composite indicators*, OECD Publishing, Paris.

Paruolo, P., Saisana, M., and Saltelli A., 2013, 'Ratings and rankings: voodoo or science?', *Journal of the Royal Statistical Society A*, Vol. 176, No 3, pp. 609-634.

Pesaresi, M., Ehrlich, D., Kemper, T., Siragusa, A., Florczyk, A., Freire, S., Corban, C., 2017, *Atlas of the human planet 2017: Global exposure to natural hazards*, Publications Office of the European Union, Luxembourg (doi:10.2760/19837).

Poljanšek, K., Marin-Ferrer, M., Vernaccini, L., and Messina, L., 2018, *Incorporating epidemics risk in the Inform Global Risk Index*, Publications Office of the European Union, Luxembourg (doi:10.2760/990429).

UN, 2014, *A world that counts: Mobilizing the data revolution for sustainable development*, United Nations, New York.

UN, 2015, Resolution A/RES/70/1, adopted by the General Assembly on 25 September 2015.

UN Development Group, 2017, *Guidelines to support country reporting on Sustainable Development Goals*, UN SDG, New York.

UNISDR, n.d.a, 'Hyogo Framework for Action (HFA)' (https://www.unisdr.org/we/coordinate/hfa).

UNISDR, n.d.b, 'Integrated monitoring of the global targets of the Sendai Framework and the Sustainable Development Goals' (https://www.preventionweb.net/sendai-framework/sendai-framework-monitor/common-indicators).

UNISDR, 2018, *Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction*, UNISDR (https://www.preventionweb.net/publications/view/54970).

UNISDR, 2015, *Sendai Framework for Disaster Risk Reduction 2015-2030*, United Nations Office for Disaster Risk Reduction, Geneva.

UN Statistics Division, 2018, 'Indicator 3.8.1 metadata sheet' (https://unstats.un.org/sdgs/metadata/files/Metadata-03-08-01.pdf).

UN Statistics Division, n.d.a, 'A data revolution in motion' (https://unstats.un.org/sdgs/report/2018/data_revolution).

UN Statistics Division, n.d.b, 'Note to the reader' (https://unstats.un.org/sdgs/report/2018/note-to-reader/).

World Health Organization, 2017, *World health statistics 2017: monitoring health for the SDGs, Sustainable Development Goals*, Geneva, Licence: CC BY-NC-SA 3.0 IGO (https://www.who.int/gho/publications/world_health_statistics/2017/en/).

World Bank and International Monetary Fund, 2016, *Development goals in an era of demographic change* (http://www.worldbank.org/en/publication/global-monitoring-report).

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Annex 1: Upgraded INFORM 2019 results — countries in ranking order

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Somalia	SOM	7.0	10.0	9.0	9.5	8.8	9.2	9.3	8.6	9.0	9.1	1
South Sudan	SSD	3.3	10.0	8.2	7.9	9.0	8.5	9.2	9.3	9.3	8.7	2
Central African Republic	CAF	1.7	10.0	7.9	8.7	8.9	8.8	8.1	9.0	8.6	8.4	3
Yemen	YEM	2.9	10.0	8.1	7.1	8.0	7.6	8.5	7.1	7.9	7.9	4
Afghanistan	AFG	6.1	10.0	8.8	7.1	7.2	7.2	7.2	7.7	7.5	7.8	5
Congo DR	COD	3.3	9.0	7.1	6.6	8.3	7.6	7.8	8.1	8.0	7.6	6
Chad	TCD	3.4	7.0	5.5	7.2	7.8	7.5	8.0	9.5	8.9	7.2	7
Iraq	IRQ	5.3	10.0	8.6	4.6	7.3	6.1	8.2	4.9	6.9	7.1	8
Sudan	SDN	4.1	9.0	7.3	5.8	7.9	7.0	6.5	7.5	7.0	7.1	8
Syria	SYR	5.3	10.0	8.6	6.7	8.0	7.4	6.6	4.6	5.7	7.1	8
Nigeria	NGA	2.6	10.0	8.0	5.9	6.6	6.3	5.1	7.5	6.5	6.9	11
Ethiopia	ETH	3.8	9.0	7.2	6.5	6.8	6.7	4.7	7.7	6.4	6.8	12
Niger	NER	3.7	8.0	6.3	6.6	6.3	6.5	5.9	8.8	7.6	6.8	12
Myanmar	MMR	8.1	9.0	8.6	5.0	6.0	5.5	7.1	5.7	6.5	6.7	14
Haiti	HTI	5.6	4.9	5.3	7.9	6.6	7.3	7.6	7.1	7.4	6.6	15
Mali	MLI	3.1	8.0	6.1	7.2	5.5	6.4	6.0	7.7	6.9	6.5	16
Uganda	UGA	3.3	6.6	5.2	6.8	7.3	7.1	6.8	7.1	7.0	6.4	17
Pakistan	PAK	7.2	8.0	7.6	5.7	6.2	6.0	5.3	5.7	5.5	6.3	18
Mauritania	MRT	5.6	5.0	5.3	6.1	6.5	6.3	5.9	7.8	7.0	6.2	19
Bangladesh	BGD	8.2	6.6	7.5	5.5	6.2	5.9	4.9	5.5	5.2	6.1	20
Kenya	KEN	4.9	6.5	5.8	6.2	6.5	6.4	5.2	7.0	6.2	6.1	20
Libya	LBY	4.5	10.0	8.4	2.5	5.1	3.9	8.6	4.2	6.9	6.1	20
Mozambique	MOZ	5.8	4.4	5.1	7.4	5.3	6.5	4.6	8.3	6.8	6.1	20
Burundi	BDI	2.8	6.4	4.9	7.1	6.2	6.7	6.2	6.9	6.6	6.0	24
Cameroon	CMR	2.3	6.8	4.9	6.2	6.7	6.5	4.8	6.8	5.9	5.7	25
Guatemala	GTM	6.8	4.3	5.7	4.8	6.6	5.8	6.1	4.8	5.5	5.7	25
Philippines	PHL	8.5	9.0	8.8	4.5	5.2	4.9	4.7	3.9	4.3	5.7	25
Tanzania	TZA	4.7	4.7	4.7	6.2	5.8	6.0	4.9	7.6	6.4	5.7	25
Colombia	COL	6.5	7.0	6.8	4.4	7.8	6.4	4.4	3.6	4.0	5.6	29
Côte d'Ivoire	CIV	2.6	6.4	4.8	6.4	4.0	5.3	7.1	6.8	7.0	5.6	29

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Papua New Guinea	PNG	5.8	3.5	4.8	5.3	4.4	4.9	6.8	8.3	7.6	5.6	29
Congo	COG	3.2	4.3	3.8	5.6	6.2	5.9	7.6	7.0	7.3	5.5	32
India	IND	7.6	6.4	7.0	5.5	5.3	5.4	3.6	5.2	4.4	5.5	32
Djibouti	DJI	6.0	2.5	4.5	6.4	4.6	5.6	6.2	6.5	6.4	5.4	34
Guinea-Bissau	GNB	1.5	4.5	3.1	7.9	4.8	6.6	8.1	7.7	7.9	5.4	34
Burkina Faso	BFA	2.6	4.8	3.8	7.2	4.6	6.1	4.6	7.5	6.3	5.3	36
Lebanon	LBN	4.1	7.0	5.7	4.5	7.7	6.4	5.7	2.1	4.1	5.3	36
Nepal	NPL	5.6	4.8	5.2	5.7	3.7	4.8	6.1	5.7	5.9	5.3	36
Sierra Leone	SLE	2.7	4.6	3.7	7.4	3.5	5.8	5.4	8.3	7.1	5.3	36
Zimbabwe	ZWE	4.6	4.8	4.7	6.5	4.3	5.5	5.1	6.6	5.9	5.3	36
Eritrea	ERI	3.7	4.0	3.9	5.5	3.4	4.5	8.2	7.7	8.0	5.2	41
Guinea	GIN	2.6	5.0	3.9	5.9	3.6	4.9	6.1	8.1	7.2	5.2	41
Liberia	LBR	3.0	2.6	2.8	8.0	4.6	6.6	7.3	7.9	7.6	5.2	41
Mexico	MEX	7.0	9.0	8.2	3.8	4.1	4.0	5.5	3.2	4.4	5.2	41
Ukraine	UKR	3.1	9.0	7.0	2.3	5.6	4.1	6.6	2.8	5.0	5.2	41
Honduras	HND	5.6	3.5	4.6	5.7	5.2	5.5	6.0	4.3	5.2	5.1	46
Madagascar	MDG	6.0	0.9	3.9	6.2	2.7	4.7	6.1	8.3	7.4	5.1	46
Rwanda	RWA	3.0	4.7	3.9	7.0	6.0	6.5	3.9	6.2	5.2	5.1	46
Iran	IRN	7.0	5.5	6.3	2.9	5.5	4.3	5.3	3.7	4.5	5.0	49
Turkey	TUR	5.9	8.0	7.1	2.8	6.9	5.2	3.8	2.7	3.3	5.0	49
Cambodia	KHM	5.7	3.0	4.5	5.4	2.2	4.0	7.0	6.0	6.5	4.9	51
Egypt	EGY	5.5	7.0	6.3	3.9	4.2	4.1	5.4	3.4	4.5	4.9	51
Solomon Islands	SLB	5.8	0.8	3.7	6.8	1.7	4.7	6.6	6.7	6.7	4.9	51
Angola	AGO	2.1	4.9	3.6	4.4	4.4	4.4	6.5	7.7	7.1	4.8	54
Azerbaijan	AZE	4.5	5.8	5.2	2.9	5.8	4.5	6.1	2.6	4.6	4.8	54
Indonesia	IDN	7.8	6.2	7.1	3.8	3.0	3.4	4.5	4.7	4.6	4.8	54
Senegal	SEN	4.4	2.7	3.6	6.6	3.8	5.4	5.2	6.4	5.8	4.8	54
Korea DPR	PRK	4.9	2.7	3.9	5.0	3.0	4.1	8.3	3.8	6.6	4.7	58
Tajikistan	TJK	6.0	5.0	5.5	4.5	2.8	3.7	6.1	4.1	5.2	4.7	58
Lesotho	LSO	2.0	2.7	2.4	6.9	4.7	5.9	7.3	6.2	6.8	4.6	60
Malawi	MWI	3.6	1.5	2.6	7.2	4.1	5.9	5.4	7.3	6.4	4.6	60
Marshall Islands	MHL	3.6	2.1	2.9	6.3	4.3	5.4	7.7	4.6	6.4	4.6	60
Nicaragua	NIC	6.6	2.5	4.9	5.5	1.3	3.7	5.8	4.7	5.3	4.6	60
South Africa	ZAF	4.7	5.3	5.0	4.9	4.1	4.5	4.5	4.0	4.3	4.6	60

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Timor-Leste	TLS	4.0	2.4	3.2	5.8	3.5	4.8	6.5	6.5	6.5	4.6	60
Russian Federation	RUS	6.3	6.9	6.6	2.6	3.3	3.0	6.3	2.5	4.7	4.5	66
Togo	TGO	1.6	2.8	2.2	6.6	3.8	5.4	8.1	7.4	7.8	4.5	66
Venezuela	VEN	6.0	5.7	5.9	2.9	4.0	3.5	5.2	3.8	4.5	4.5	66
Algeria	DZA	4.1	6.7	5.5	3.3	3.4	3.4	5.0	4.4	4.7	4.4	69
Bolivia	BOL	3.7	4.8	4.3	5.1	1.9	3.7	6.0	4.8	5.4	4.4	69
China	CHN	8.0	5.7	7.0	3.2	3.6	3.4	3.8	3.4	3.6	4.4	69
Gabon	GAB	1.8	5.8	4.1	4.4	2.4	3.5	6.7	5.5	6.1	4.4	69
Morocco	MAR	4.8	4.4	4.6	5.1	2.0	3.7	5.6	4.1	4.9	4.4	69
Peru	PER	7.0	1.7	4.9	4.1	3.6	3.9	4.7	4.3	4.5	4.4	69
Ecuador	ECU	6.9	1.0	4.6	3.8	4.0	3.9	4.7	3.8	4.3	4.3	75
El Salvador	SLV	6.1	7.0	6.6	4.1	0.8	2.6	5.7	3.4	4.7	4.3	75
Gambia	GMB	2.2	2.5	2.4	7.8	3.3	6.0	5.0	6.0	5.5	4.3	75
Lao PDR	LAO	4.8	1.5	3.3	5.5	2.0	4.0	6.3	5.8	6.1	4.3	75
Micronesia	FSM	4.6	0.2	2.7	6.2	4.2	5.3	5.9	5.3	5.6	4.3	75
Thailand	THA	6.4	4.1	5.4	2.9	4.1	3.5	5.0	3.0	4.1	4.3	75
Benin	BEN	1.4	2.7	2.1	6.8	2.6	5.1	5.8	7.5	6.7	4.2	81
Dominican Republic	DOM	5.9	3.0	4.6	4.4	1.9	3.2	5.5	3.8	4.7	4.1	82
Jordan	JOR	3.8	1.3	2.6	4.4	7.7	6.3	5.6	2.5	4.2	4.1	82
Zambia	ZMB	2.3	1.7	2.0	6.3	5.4	5.9	4.9	6.8	5.9	4.1	82
Ghana	GHA	2.6	2.7	2.7	5.9	3.2	4.7	4.6	5.8	5.2	4.0	85
Kyrgyzstan	KGZ	5.8	4.3	5.1	4.1	1.0	2.7	5.4	3.4	4.5	4.0	85
Palestine	PSE	2.9	1.5	2.2	4.7	7.8	6.5	6.0	2.6	4.5	4.0	85
Vanuatu	VUT	4.6	0.1	2.6	6.2	1.4	4.2	5.9	5.8	5.9	4.0	85
Viet Nam	VNM	7.3	3.2	5.6	3.9	1.3	2.7	5.0	3.5	4.3	4.0	85
Equatorial Guinea	GNQ	1.8	3.9	2.9	3.7	1.8	2.8	8.1	6.4	7.3	3.9	90
Georgia	GEO	4.4	2.5	3.5	3.6	6.3	5.1	4.5	2.1	3.4	3.9	90
Kiribati	KIR	3.7	0.1	2.1	6.0	3.3	4.8	5.9	5.6	5.8	3.9	90
Namibia	NAM	4.3	0.3	2.5	6.1	3.2	4.8	4.6	5.5	5.1	3.9	90
Bosnia and Herzegovina	BIH	4.4	1.3	3.0	3.1	4.7	3.9	6.1	2.6	4.6	3.8	94
Brazil	BRA	3.8	7.0	5.6	3.4	1.3	2.4	5.1	3.2	4.2	3.8	94
Comoros	COM	2.2	0.8	1.5	7.2	2.3	5.2	7.8	5.8	6.9	3.8	94
Sri Lanka	LKA	5.1	1.0	3.3	3.2	4.0	3.6	4.7	3.5	4.1	3.7	97
Armenia	ARM	4.2	2.0	3.2	2.9	3.2	3.1	6.7	2.2	4.8	3.6	98

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Belize	BLZ	5.5	0.2	3.3	4.1	0.8	2.6	6.4	4.1	5.4	3.6	98
Serbia	SRB	4.8	3.9	4.4	2.3	3.2	2.8	5.2	2.2	3.9	3.6	98
Tonga	TON	3.9	0.1	2.2	5.7	3.6	4.7	5.7	3.1	4.5	3.6	98
Dominica	DMA	4.7	0.1	2.7	4.4	3.4	3.9	4.6	3.2	3.9	3.5	102
Tuvalu	TUV	2.8	0.1	1.5	7.1	2.0	5.1	6.9	3.8	5.6	3.5	102
Uzbekistan	UZB	6.1	3.5	4.9	3.6	0.6	2.2	4.8	3.4	4.1	3.5	102
Mongolia	MNG	3.1	0.8	2.0	4.1	3.5	3.8	5.5	4.7	5.1	3.4	105
Nauru	NRU	2.6	0.1	1.4	5.7	3.6	4.7	7.3	3.7	5.8	3.4	105
Tunisia	TUN	4.6	3.2	3.9	3.2	0.7	2.0	6.0	3.5	4.9	3.4	105
Turkmenistan	TKM	4.9	1.6	3.4	2.7	0.9	1.8	7.7	4.4	6.3	3.4	105
United States of America	USA	7.0	6.6	6.8	1.2	4.2	2.8	2.7	1.4	2.1	3.4	105
Cuba	CUB	5.7	1.0	3.7	3.5	2.9	3.2	3.9	1.9	3.0	3.3	110
Eswatini	SWZ	2.3	0.1	1.3	6.2	4.2	5.3	5.3	5.2	5.3	3.3	110
Guyana	GUY	3.7	0.2	2.1	4.6	1.3	3.1	5.9	4.6	5.3	3.3	110
Malaysia	MYS	5.1	1.1	3.4	2.8	3.6	3.2	3.5	2.7	3.1	3.2	113
Panama	PAN	5.3	0.1	3.1	3.2	1.7	2.5	4.9	3.3	4.1	3.2	113
Bhutan	BTN	3.2	0.1	1.8	5.4	1.2	3.6	4.1	5.1	4.6	3.1	115
North Macedonia	MKD	3.2	3.9	3.6	3.2	1.2	2.3	4.8	2.4	3.7	3.1	115
Romania	ROU	4.5	3.7	4.1	2.6	1.4	2.0	4.6	2.4	3.6	3.1	115
Fiji	FJI	4.1	0.1	2.3	3.8	3.6	3.7	2.8	3.8	3.3	3.0	118
Suriname	SUR	3.6	0.1	2.0	3.9	1.3	2.7	5.8	4.1	5.0	3.0	118
Albania	ALB	5.6	0.1	3.3	2.9	0.6	1.8	5.6	2.8	4.3	2.9	120
Botswana	BWA	2.8	0.1	1.5	4.1	2.8	3.5	4.8	4.7	4.8	2.9	120
Chile	CHL	6.7	2.0	4.8	2.2	1.1	1.7	3.2	2.7	3.0	2.9	120
Costa Rica	CRI	6.3	0.1	3.8	3.1	1.9	2.5	2.9	2.5	2.7	2.9	120
Greece	GRC	4.9	3.4	4.2	1.8	3.0	2.4	3.6	1.0	2.4	2.9	120
Moldova Republic of	MDA	3.7	0.3	2.2	3.2	1.3	2.3	6.4	2.5	4.7	2.9	120
Cyprus	CYP	3.3	0.1	1.8	1.9	6.4	4.5	3.7	1.3	2.6	2.8	126
Jamaica	JAM	3.7	0.3	2.2	4.0	0.9	2.6	4.1	3.4	3.8	2.8	126
Oman	OMN	6.0	0.1	3.6	2.3	0.9	1.6	5.1	2.5	3.9	2.8	126
Palau	PLW	3.4	0.1	1.9	3.7	1.0	2.5	5.9	2.4	4.4	2.8	126
Paraguay	PRY	2.0	1.8	1.9	4.1	0.8	2.6	5.3	3.6	4.5	2.8	126
Samoa	WSM	2.9	0.0	1.6	5.3	0.6	3.3	4.3	3.9	4.1	2.8	126
Israel	ISR	4.5	4.1	4.3	1.6	2.7	2.2	3.1	1.0	2.1	2.7	132

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Italy	ITA	4.8	1.7	3.4	1.5	3.5	2.6	3.5	0.7	2.2	2.7	132
Argentina	ARG	3.4	1.2	2.4	2.9	1.2	2.1	4.6	2.3	3.5	2.6	134
Bulgaria	BGR	3.3	0.7	2.1	2.8	2.7	2.8	4.2	1.8	3.1	2.6	134
France	FRA	3.8	2.0	2.9	1.5	4.2	3.0	2.8	1.1	2.0	2.6	134
Canada	CAN	5.0	0.4	3.0	0.9	3.3	2.2	2.2	2.3	2.3	2.5	137
Croatia	HRV	5.2	0.6	3.2	2.3	0.8	1.6	4.5	1.5	3.1	2.5	137
Antigua and Barbuda	ATG	2.9	0.1	1.6	3.4	1.0	2.3	5.0	2.1	3.7	2.4	139
Australia	AUS	5.7	0.1	3.4	0.9	2.8	1.9	2.3	1.9	2.1	2.4	139
Belgium	BEL	1.6	5.5	3.8	1.4	2.9	2.2	2.4	0.8	1.6	2.4	139
Cabo Verde	CPV	1.9	0.1	1.0	5.4	1.1	3.5	4.1	3.9	4.0	2.4	139
Maldives	MDV	3.2	0.1	1.8	2.9	0.8	1.9	6.0	1.8	4.2	2.4	139
Montenegro	MNE	4.2	0.1	2.4	2.2	1.2	1.7	4.6	2.0	3.4	2.4	139
Belarus	BLR	2.3	2.9	2.6	1.6	1.4	1.5	4.3	1.4	3.0	2.3	145
Kazakhstan	KAZ	4.4	1.1	2.9	1.8	0.3	1.1	4.9	2.5	3.8	2.3	145
Saudi Arabia	SAU	2.3	4.1	3.3	1.8	0.3	1.1	4.8	2.0	3.5	2.3	145
Mauritius	MUS	3.8	0.1	2.1	2.4	0.7	1.6	3.7	2.2	3.0	2.2	148
Seychelles	SYC	2.9	0.0	1.6	2.9	0.8	1.9	4.3	2.7	3.5	2.2	148
Spain	ESP	4.6	2.0	3.4	1.3	2.1	1.7	2.9	0.7	1.9	2.2	148
Bahamas	BHS	3.4	0.3	2.0	2.4	0.8	1.6	3.6	2.5	3.1	2.1	151
Germany	DEU	2.2	1.3	1.8	1.0	5.3	3.4	2.2	0.8	1.5	2.1	151
Hungary	HUN	3.6	0.1	2.0	2.4	1.7	2.1	3.1	1.2	2.2	2.1	151
Japan	JPN	8.4	0.6	5.8	1.0	0.9	1.0	2.0	0.9	1.5	2.1	151
United Kingdom	GBR	2.4	2.9	2.7	1.1	3.3	2.3	2.0	0.9	1.5	2.1	151
Kuwait	KWT	2.3	0.2	1.3	2.3	0.8	1.6	5.8	1.4	3.9	2.0	156
Malta	MLT	2.4	0.0	1.3	2.2	2.9	2.6	3.8	0.9	2.5	2.0	156
Poland	POL	2.3	0.3	1.4	1.9	1.8	1.9	4.1	1.5	2.9	2.0	156
Trinidad and Tobago	TTO	1.9	0.2	1.1	2.9	1.2	2.1	4.9	1.8	3.5	2.0	156
United Arab Emirates	ARE	5.8	0.1	3.5	1.6	0.8	1.2	2.4	1.3	1.9	2.0	156
Barbados	BRB	2.6	0.0	1.4	3.2	0.5	1.9	2.9	1.9	2.4	1.9	161
Brunei Darussalam	BRN	2.2	2.4	2.3	0.9	0.5	0.7	4.7	4.1	4.4	1.9	161
Korea Republic of	KOR	5.2	2.2	3.9	1.1	0.6	0.9	2.7	1.0	1.9	1.9	161
New Zealand	NZL	5.3	0.1	3.1	1.2	1.1	1.2	1.9	1.9	1.9	1.9	161
Saint Lucia	LCA	2.0	0.0	1.0	2.6	0.9	1.8	5.0	2.9	4.0	1.9	161
Latvia	LVA	2.2	0.1	1.2	2.5	1.0	1.8	3.6	1.4	2.6	1.8	166

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Portugal	PRT	3.9	0.0	2.2	1.6	0.9	1.3	2.9	0.9	2.0	1.8	166
Saint Kitts and Nevis	KNA	2.0	0.0	1.0	2.9	0.5	1.8	4.4	2.3	3.4	1.8	166
Slovakia	SVK	3.3	0.1	1.8	1.9	0.9	1.4	3.8	1.0	2.5	1.8	166
Austria	AUT	2.3	0.0	1.2	1.3	4.0	2.8	2.2	0.7	1.5	1.7	170
Saint Vincent and the Grenadines	VCT	1.2	0.0	0.6	3.1	1.4	2.3	4.4	3.1	3.8	1.7	170
Sao Tome and Principe	STP	0.1	0.3	0.2	6.6	1.8	4.6	5.9	4.4	5.2	1.7	170
Slovenia	SVN	3.9	0.0	2.2	1.2	0.9	1.1	2.2	1.4	1.8	1.6	173
Czech Republic	CZE	2.0	0.1	1.1	1.5	1.4	1.5	3.1	1.0	2.1	1.5	174
Ireland	IRL	2.4	0.0	1.3	1.0	1.8	1.4	2.5	1.2	1.9	1.5	174
Lithuania	LTU	1.8	0.0	0.9	2.2	1.2	1.7	3.5	1.2	2.4	1.5	174
Qatar	QAT	1.2	0.1	0.7	2.9	0.7	1.9	4.2	0.6	2.6	1.5	174
Uruguay	URY	1.3	0.0	0.7	2.4	0.9	1.7	3.8	1.9	2.9	1.5	174
Grenada	GRD	0.6	0.1	0.4	2.6	1.0	1.8	4.9	2.5	3.8	1.4	179
Netherlands	NLD	1.9	0.0	1.0	0.7	3.7	2.3	1.7	0.8	1.3	1.4	179
Sweden	SWE	1.0	0.1	0.6	1.0	4.9	3.2	2.0	0.9	1.5	1.4	179
Switzerland	CHE	1.8	0.1	1.0	0.8	3.9	2.5	1.1	0.7	0.9	1.3	182
Iceland	ISL	1.6	0.0	0.8	1.0	1.1	1.1	2.3	1.6	2.0	1.2	183
Denmark	DNK	1.0	0.0	0.5	0.9	3.1	2.1	2.0	0.8	1.4	1.1	184
Estonia	EST	0.9	0.1	0.5	1.9	1.0	1.5	2.9	1.1	2.0	1.1	184
Bahrain	BHR	0.1	0.2	0.2	1.7	0.9	1.3	4.6	1.0	3.0	0.9	186
Liechtenstein	LIE	1.3	0.1	0.7	0.4	1.2	0.8	1.6	0.8	1.2	0.9	186
Luxembourg	LUX	0.5	0.0	0.3	1.7	1.6	1.7	1.7	0.7	1.2	0.8	188
Norway	NOR	0.2	0.0	0.1	0.4	3.6	2.1	1.9	1.2	1.6	0.7	189
Finland	FIN	0.1	0.0	0.1	1.0	2.6	1.8	1.8	1.0	1.4	0.6	190
Singapore	SGP	0.1	0.1	0.1	0.4	0.3	0.4	1.2	0.9	1.1	0.4	191

Annex 2: Upgraded INFORM 2019 results — countries in alphabetical order

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Afghanistan	AFG	6.1	10.0	8.8	7.1	7.2	7.2	7.2	7.7	7.5	7.8	5
Albania	ALB	5.6	0.1	3.3	2.9	0.6	1.8	5.6	2.8	4.3	2.9	120
Algeria	DZA	4.1	6.7	5.5	3.3	3.4	3.4	5.0	4.4	4.7	4.4	69
Angola	AGO	2.1	4.9	3.6	4.4	4.4	4.4	6.5	7.7	7.1	4.8	54
Antigua and Barbuda	ATG	2.9	0.1	1.6	3.4	1.0	2.3	5.0	2.1	3.7	2.4	139
Argentina	ARG	3.4	1.2	2.4	2.9	1.2	2.1	4.6	2.3	3.5	2.6	134
Armenia	ARM	4.2	2.0	3.2	2.9	3.2	3.1	6.7	2.2	4.8	3.6	98
Australia	AUS	5.7	0.1	3.4	0.9	2.8	1.9	2.3	1.9	2.1	2.4	139
Austria	AUT	2.3	0.0	1.2	1.3	4.0	2.8	2.2	0.7	1.5	1.7	170
Azerbaijan	AZE	4.5	5.8	5.2	2.9	5.8	4.5	6.1	2.6	4.6	4.8	54
Bahamas	BHS	3.4	0.3	2.0	2.4	0.8	1.6	3.6	2.5	3.1	2.1	151
Bahrain	BHR	0.1	0.2	0.2	1.7	0.9	1.3	4.6	1.0	3.0	0.9	186
Bangladesh	BGD	8.2	6.6	7.5	5.5	6.2	5.9	4.9	5.5	5.2	6.1	20
Barbados	BRB	2.6	0.0	1.4	3.2	0.5	1.9	2.9	1.9	2.4	1.9	161
Belarus	BLR	2.3	2.9	2.6	1.6	1.4	1.5	4.3	1.4	3.0	2.3	145
Belgium	BEL	1.6	5.5	3.8	1.4	2.9	2.2	2.4	0.8	1.6	2.4	139
Belize	BLZ	5.5	0.2	3.3	4.1	0.8	2.6	6.4	4.1	5.4	3.6	98
Benin	BEN	1.4	2.7	2.1	6.8	2.6	5.1	5.8	7.5	6.7	4.2	81
Bhutan	BTN	3.2	0.1	1.8	5.4	1.2	3.6	4.1	5.1	4.6	3.1	115
Bolivia	BOL	3.7	4.8	4.3	5.1	1.9	3.7	6.0	4.8	5.4	4.4	69
Bosnia and Herzegovina	BIH	4.4	1.3	3.0	3.1	4.7	3.9	6.1	2.6	4.6	3.8	94
Botswana	BWA	2.8	0.1	1.5	4.1	2.8	3.5	4.8	4.7	4.8	2.9	120
Brazil	BRA	3.8	7.0	5.6	3.4	1.3	2.4	5.1	3.2	4.2	3.8	94
Brunei Darussalam	BRN	2.2	2.4	2.3	0.9	0.5	0.7	4.7	4.1	4.4	1.9	161
Bulgaria	BGR	3.3	0.7	2.1	2.8	2.7	2.8	4.2	1.8	3.1	2.6	134
Burkina Faso	BFA	2.6	4.8	3.8	7.2	4.6	6.1	4.6	7.5	6.3	5.3	36
Burundi	BDI	2.8	6.4	4.9	7.1	6.2	6.7	6.2	6.9	6.6	6.0	24
Cabo Verde	CPV	1.9	0.1	1.0	5.4	1.1	3.5	4.1	3.9	4.0	2.4	139
Cambodia	KHM	5.7	3.0	4.5	5.4	2.2	4.0	7.0	6.0	6.5	4.9	51
Cameroon	CMR	2.3	6.8	4.9	6.2	6.7	6.5	4.8	6.8	5.9	5.7	25

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Canada	CAN	5.0	0.4	3.0	0.9	3.3	2.2	2.2	2.3	2.3	2.5	137
Central African Republic	CAF	1.7	10.0	7.9	8.7	8.9	8.8	8.1	9.0	8.6	8.4	3
Chad	TCD	3.4	7.0	5.5	7.2	7.8	7.5	8.0	9.5	8.9	7.2	7
Chile	CHL	6.7	2.0	4.8	2.2	1.1	1.7	3.2	2.7	3.0	2.9	120
China	CHN	8.0	5.7	7.0	3.2	3.6	3.4	3.8	3.4	3.6	4.4	69
Colombia	COL	6.5	7.0	6.8	4.4	7.8	6.4	4.4	3.6	4.0	5.6	29
Comoros	COM	2.2	0.8	1.5	7.2	2.3	5.2	7.8	5.8	6.9	3.8	94
Congo	COG	3.2	4.3	3.8	5.6	6.2	5.9	7.6	7.0	7.3	5.5	32
Congo DR	COD	3.3	9.0	7.1	6.6	8.3	7.6	7.8	8.1	8.0	7.6	6
Costa Rica	CRI	6.3	0.1	3.8	3.1	1.9	2.5	2.9	2.5	2.7	2.9	120
Côte d'Ivoire	CIV	2.6	6.4	4.8	6.4	4.0	5.3	7.1	6.8	7.0	5.6	29
Croatia	HRV	5.2	0.6	3.2	2.3	0.8	1.6	4.5	1.5	3.1	2.5	137
Cuba	CUB	5.7	1.0	3.7	3.5	2.9	3.2	3.9	1.9	3.0	3.3	110
Cyprus	CYP	3.3	0.1	1.8	1.9	6.4	4.5	3.7	1.3	2.6	2.8	126
Czech Republic	CZE	2.0	0.1	1.1	1.5	1.4	1.5	3.1	1.0	2.1	1.5	174
Denmark	DNK	1.0	0.0	0.5	0.9	3.1	2.1	2.0	0.8	1.4	1.1	184
Djibouti	DJI	6.0	2.5	4.5	6.4	4.6	5.6	6.2	6.5	6.4	5.4	34
Dominica	DMA	4.7	0.1	2.7	4.4	3.4	3.9	4.6	3.2	3.9	3.5	102
Dominican Republic	DOM	5.9	3.0	4.6	4.4	1.9	3.2	5.5	3.8	4.7	4.1	82
Ecuador	ECU	6.9	1.0	4.6	3.8	4.0	3.9	4.7	3.8	4.3	4.3	75
Egypt	EGY	5.5	7.0	6.3	3.9	4.2	4.1	5.4	3.4	4.5	4.9	51
El Salvador	SLV	6.1	7.0	6.6	4.1	0.8	2.6	5.7	3.4	4.7	4.3	75
Equatorial Guinea	GNQ	1.8	3.9	2.9	3.7	1.8	2.8	8.1	6.4	7.3	3.9	90
Eritrea	ERI	3.7	4.0	3.9	5.5	3.4	4.5	8.2	7.7	8.0	5.2	41
Estonia	EST	0.9	0.1	0.5	1.9	1.0	1.5	2.9	1.1	2.0	1.1	184
Eswatini	SWZ	2.3	0.1	1.3	6.2	4.2	5.3	5.3	5.2	5.3	3.3	110
Ethiopia	ETH	3.8	9.0	7.2	6.5	6.8	6.7	4.7	7.7	6.4	6.8	12
Fiji	FJI	4.1	0.1	2.3	3.8	3.6	3.7	2.8	3.8	3.3	3.0	118
Finland	FIN	0.1	0.0	0.1	1.0	2.6	1.8	1.8	1.0	1.4	0.6	190
France	FRA	3.8	2.0	2.9	1.5	4.2	3.0	2.8	1.1	2.0	2.6	134
Gabon	GAB	1.8	5.8	4.1	4.4	2.4	3.5	6.7	5.5	6.1	4.4	69
Gambia	GMB	2.2	2.5	2.4	7.8	3.3	6.0	5.0	6.0	5.5	4.3	75
Georgia	GEO	4.4	2.5	3.5	3.6	6.3	5.1	4.5	2.1	3.4	3.9	90
Germany	DEU	2.2	1.3	1.8	1.0	5.3	3.4	2.2	0.8	1.5	2.1	151

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Ghana	GHA	2.6	2.7	2.7	5.9	3.2	4.7	4.6	5.8	5.2	4.0	85
Greece	GRC	4.9	3.4	4.2	1.8	3.0	2.4	3.6	1.0	2.4	2.9	120
Grenada	GRD	0.6	0.1	0.4	2.6	1.0	1.8	4.9	2.5	3.8	1.4	179
Guatemala	GTM	6.8	4.3	5.7	4.8	6.6	5.8	6.1	4.8	5.5	5.7	25
Guinea	GIN	2.6	5.0	3.9	5.9	3.6	4.9	6.1	8.1	7.2	5.2	41
Guinea-Bissau	GNB	1.5	4.5	3.1	7.9	4.8	6.6	8.1	7.7	7.9	5.4	34
Guyana	GUY	3.7	0.2	2.1	4.6	1.3	3.1	5.9	4.6	5.3	3.3	110
Haiti	HTI	5.6	4.9	5.3	7.9	6.6	7.3	7.6	7.1	7.4	6.6	15
Honduras	HND	5.6	3.5	4.6	5.7	5.2	5.5	6.0	4.3	5.2	5.1	46
Hungary	HUN	3.6	0.1	2.0	2.4	1.7	2.1	3.1	1.2	2.2	2.1	151
Iceland	ISL	1.6	0.0	0.8	1.0	1.1	1.1	2.3	1.6	2.0	1.2	183
India	IND	7.6	6.4	7.0	5.5	5.3	5.4	3.6	5.2	4.4	5.5	32
Indonesia	IDN	7.8	6.2	7.1	3.8	3.0	3.4	4.5	4.7	4.6	4.8	54
Iran	IRN	7.0	5.5	6.3	2.9	5.5	4.3	5.3	3.7	4.5	5.0	49
Iraq	IRQ	5.3	10.0	8.6	4.6	7.3	6.1	8.2	4.9	6.9	7.1	8
Ireland	IRL	2.4	0.0	1.3	1.0	1.8	1.4	2.5	1.2	1.9	1.5	174
Israel	ISR	4.5	4.1	4.3	1.6	2.7	2.2	3.1	1.0	2.1	2.7	132
Italy	ITA	4.8	1.7	3.4	1.5	3.5	2.6	3.5	0.7	2.2	2.7	132
Jamaica	JAM	3.7	0.3	2.2	4.0	0.9	2.6	4.1	3.4	3.8	2.8	126
Japan	JPN	8.4	0.6	5.8	1.0	0.9	1.0	2.0	0.9	1.5	2.1	151
Jordan	JOR	3.8	1.3	2.6	4.4	7.7	6.3	5.6	2.5	4.2	4.1	82
Kazakhstan	KAZ	4.4	1.1	2.9	1.8	0.3	1.1	4.9	2.5	3.8	2.3	145
Kenya	KEN	4.9	6.5	5.8	6.2	6.5	6.4	5.2	7.0	6.2	6.1	20
Kiribati	KIR	3.7	0.1	2.1	6.0	3.3	4.8	5.9	5.6	5.8	3.9	90
Korea DPR	PRK	4.9	2.7	3.9	5.0	3.0	4.1	8.3	3.8	6.6	4.7	58
Korea Republic of	KOR	5.2	2.2	3.9	1.1	0.6	0.9	2.7	1.0	1.9	1.9	161
Kuwait	KWT	2.3	0.2	1.3	2.3	0.8	1.6	5.8	1.4	3.9	2.0	156
Kyrgyzstan	KGZ	5.8	4.3	5.1	4.1	1.0	2.7	5.4	3.4	4.5	4.0	85
Lao PDR	LAO	4.8	1.5	3.3	5.5	2.0	4.0	6.3	5.8	6.1	4.3	75
Latvia	LVA	2.2	0.1	1.2	2.5	1.0	1.8	3.6	1.4	2.6	1.8	166
Lebanon	LBN	4.1	7.0	5.7	4.5	7.7	6.4	5.7	2.1	4.1	5.3	36
Lesotho	LSO	2.0	2.7	2.4	6.9	4.7	5.9	7.3	6.2	6.8	4.6	60
Liberia	LBR	3.0	2.6	2.8	8.0	4.6	6.6	7.3	7.9	7.6	5.2	41
Libya	LBY	4.5	10.0	8.4	2.5	5.1	3.9	8.6	4.2	6.9	6.1	20

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Liechtenstein	LIE	1.3	0.1	0.7	0.4	1.2	0.8	1.6	0.8	1.2	0.9	186
Lithuania	LTU	1.8	0.0	0.9	2.2	1.2	1.7	3.5	1.2	2.4	1.5	174
Luxembourg	LUX	0.5	0.0	0.3	1.7	1.6	1.7	1.7	0.7	1.2	0.8	188
Madagascar	MDG	6.0	0.9	3.9	6.2	2.7	4.7	6.1	8.3	7.4	5.1	46
Malawi	MWI	3.6	1.5	2.6	7.2	4.1	5.9	5.4	7.3	6.4	4.6	60
Malaysia	MYS	5.1	1.1	3.4	2.8	3.6	3.2	3.5	2.7	3.1	3.2	113
Maldives	MDV	3.2	0.1	1.8	2.9	0.8	1.9	6.0	1.8	4.2	2.4	139
Mali	MLI	3.1	8.0	6.1	7.2	5.5	6.4	6.0	7.7	6.9	6.5	16
Malta	MLT	2.4	0.0	1.3	2.2	2.9	2.6	3.8	0.9	2.5	2.0	156
Marshall Islands	MHL	3.6	2.1	2.9	6.3	4.3	5.4	7.7	4.6	6.4	4.6	60
Mauritania	MRT	5.6	5.0	5.3	6.1	6.5	6.3	5.9	7.8	7.0	6.2	19
Mauritius	MUS	3.8	0.1	2.1	2.4	0.7	1.6	3.7	2.2	3.0	2.2	148
Mexico	MEX	7.0	9.0	8.2	3.8	4.1	4.0	5.5	3.2	4.4	5.2	41
Micronesia	FSM	4.6	0.2	2.7	6.2	4.2	5.3	5.9	5.3	5.6	4.3	75
Moldova Republic of	MDA	3.7	0.3	2.2	3.2	1.3	2.3	6.4	2.5	4.7	2.9	120
Mongolia	MNG	3.1	0.8	2.0	4.1	3.5	3.8	5.5	4.7	5.1	3.4	105
Montenegro	MNE	4.2	0.1	2.4	2.2	1.2	1.7	4.6	2.0	3.4	2.4	139
Morocco	MAR	4.8	4.4	4.6	5.1	2.0	3.7	5.6	4.1	4.9	4.4	69
Mozambique	MOZ	5.8	4.4	5.1	7.4	5.3	6.5	4.6	8.3	6.8	6.1	20
Myanmar	MMR	8.1	9.0	8.6	5.0	6.0	5.5	7.1	5.7	6.5	6.7	14
Namibia	NAM	4.3	0.3	2.5	6.1	3.2	4.8	4.6	5.5	5.1	3.9	90
Nauru	NRU	2.6	0.1	1.4	5.7	3.6	4.7	7.3	3.7	5.8	3.4	105
Nepal	NPL	5.6	4.8	5.2	5.7	3.7	4.8	6.1	5.7	5.9	5.3	36
Netherlands	NLD	1.9	0.0	1.0	0.7	3.7	2.3	1.7	0.8	1.3	1.4	179
New Zealand	NZL	5.3	0.1	3.1	1.2	1.1	1.2	1.9	1.9	1.9	1.9	161
Nicaragua	NIC	6.6	2.5	4.9	5.5	1.3	3.7	5.8	4.7	5.3	4.6	60
Niger	NER	3.7	8.0	6.3	6.6	6.3	6.5	5.9	8.8	7.6	6.8	12
Nigeria	NGA	2.6	10.0	8.0	5.9	6.6	6.3	5.1	7.5	6.5	6.9	11
North Macedonia	MKD	3.2	3.9	3.6	3.2	1.2	2.3	4.8	2.4	3.7	3.1	115
Norway	NOR	0.2	0.0	0.1	0.4	3.6	2.1	1.9	1.2	1.6	0.7	189
Oman	OMN	6.0	0.1	3.6	2.3	0.9	1.6	5.1	2.5	3.9	2.8	126
Pakistan	PAK	7.2	8.0	7.6	5.7	6.2	6.0	5.3	5.7	5.5	6.3	18
Palau	PLW	3.4	0.1	1.9	3.7	1.0	2.5	5.9	2.4	4.4	2.8	126
Palestine	PSE	2.9	1.5	2.2	4.7	7.8	6.5	6.0	2.6	4.5	4.0	85

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Panama	PAN	5.3	0.1	3.1	3.2	1.7	2.5	4.9	3.3	4.1	3.2	113
Papua New Guinea	PNG	5.8	3.5	4.8	5.3	4.4	4.9	6.8	8.3	7.6	5.6	29
Paraguay	PRY	2.0	1.8	1.9	4.1	0.8	2.6	5.3	3.6	4.5	2.8	126
Peru	PER	7.0	1.7	4.9	4.1	3.6	3.9	4.7	4.3	4.5	4.4	69
Philippines	PHL	8.5	9.0	8.8	4.5	5.2	4.9	4.7	3.9	4.3	5.7	25
Poland	POL	2.3	0.3	1.4	1.9	1.8	1.9	4.1	1.5	2.9	2.0	156
Portugal	PRT	3.9	0.0	2.2	1.6	0.9	1.3	2.9	0.9	2.0	1.8	166
Qatar	QAT	1.2	0.1	0.7	2.9	0.7	1.9	4.2	0.6	2.6	1.5	174
Romania	ROU	4.5	3.7	4.1	2.6	1.4	2.0	4.6	2.4	3.6	3.1	115
Russian Federation	RUS	6.3	6.9	6.6	2.6	3.3	3.0	6.3	2.5	4.7	4.5	66
Rwanda	RWA	3.0	4.7	3.9	7.0	6.0	6.5	3.9	6.2	5.2	5.1	46
Saint Kitts and Nevis	KNA	2.0	0.0	1.0	2.9	0.5	1.8	4.4	2.3	3.4	1.8	166
Saint Lucia	LCA	2.0	0.0	1.0	2.6	0.9	1.8	5.0	2.9	4.0	1.9	161
Saint Vincent and the Grenadines	VCT	1.2	0.0	0.6	3.1	1.4	2.3	4.4	3.1	3.8	1.7	170
Samoa	WSM	2.9	0.0	1.6	5.3	0.6	3.3	4.3	3.9	4.1	2.8	126
Sao Tome and Principe	STP	0.1	0.3	0.2	6.6	1.8	4.6	5.9	4.4	5.2	1.7	170
Saudi Arabia	SAU	2.3	4.1	3.3	1.8	0.3	1.1	4.8	2.0	3.5	2.3	145
Senegal	SEN	4.4	2.7	3.6	6.6	3.8	5.4	5.2	6.4	5.8	4.8	54
Serbia	SRB	4.8	3.9	4.4	2.3	3.2	2.8	5.2	2.2	3.9	3.6	98
Seychelles	SYC	2.9	0.0	1.6	2.9	0.8	1.9	4.3	2.7	3.5	2.2	148
Sierra Leone	SLE	2.7	4.6	3.7	7.4	3.5	5.8	5.4	8.3	7.1	5.3	36
Singapore	SGP	0.1	0.1	0.1	0.4	0.3	0.4	1.2	0.9	1.1	0.4	191
Slovakia	SVK	3.3	0.1	1.8	1.9	0.9	1.4	3.8	1.0	2.5	1.8	166
Slovenia	SVN	3.9	0.0	2.2	1.2	0.9	1.1	2.2	1.4	1.8	1.6	173
Solomon Islands	SLB	5.8	0.8	3.7	6.8	1.7	4.7	6.6	6.7	6.7	4.9	51
Somalia	SOM	7.0	10.0	9.0	9.5	8.8	9.2	9.3	8.6	9.0	9.1	1
South Africa	ZAF	4.7	5.3	5.0	4.9	4.1	4.5	4.5	4.0	4.3	4.6	60
South Sudan	SSD	3.3	10.0	8.2	7.9	9.0	8.5	9.2	9.3	9.3	8.7	2
Spain	ESP	4.6	2.0	3.4	1.3	2.1	1.7	2.9	0.7	1.9	2.2	148
Sri Lanka	LKA	5.1	1.0	3.3	3.2	4.0	3.6	4.7	3.5	4.1	3.7	97
Sudan	SDN	4.1	9.0	7.3	5.8	7.9	7.0	6.5	7.5	7.0	7.1	8
Suriname	SUR	3.6	0.1	2.0	3.9	1.3	2.7	5.8	4.1	5.0	3.0	118
Sweden	SWE	1.0	0.1	0.6	1.0	4.9	3.2	2.0	0.9	1.5	1.4	179
Switzerland	CHE	1.8	0.1	1.0	0.8	3.9	2.5	1.1	0.7	0.9	1.3	182

COUNTRY	ISO3	Natural	Human	Hazard & Exposure	Socio-economic vulnerability	Vulnerable groups	Vulnerability	Institutional	Infrastructure	Lack of coping capacity	Upgraded INFORM 2019	RANK
Syria	SYR	5.3	10.0	8.6	6.7	8.0	7.4	6.6	4.6	5.7	7.1	8
Tajikistan	TJK	6.0	5.0	5.5	4.5	2.8	3.7	6.1	4.1	5.2	4.7	58
Tanzania	TZA	4.7	4.7	4.7	6.2	5.8	6.0	4.9	7.6	6.4	5.7	25
Thailand	THA	6.4	4.1	5.4	2.9	4.1	3.5	5.0	3.0	4.1	4.3	75
Timor-Leste	TLS	4.0	2.4	3.2	5.8	3.5	4.8	6.5	6.5	6.5	4.6	60
Togo	TGO	1.6	2.8	2.2	6.6	3.8	5.4	8.1	7.4	7.8	4.5	66
Tonga	TON	3.9	0.1	2.2	5.7	3.6	4.7	5.7	3.1	4.5	3.6	98
Trinidad and Tobago	TTO	1.9	0.2	1.1	2.9	1.2	2.1	4.9	1.8	3.5	2.0	156
Tunisia	TUN	4.6	3.2	3.9	3.2	0.7	2.0	6.0	3.5	4.9	3.4	105
Turkey	TUR	5.9	8.0	7.1	2.8	6.9	5.2	3.8	2.7	3.3	5.0	49
Turkmenistan	TKM	4.9	1.6	3.4	2.7	0.9	1.8	7.7	4.4	6.3	3.4	105
Tuvalu	TUV	2.8	0.1	1.5	7.1	2.0	5.1	6.9	3.8	5.6	3.5	102
Uganda	UGA	3.3	6.6	5.2	6.8	7.3	7.1	6.8	7.1	7.0	6.4	17
Ukraine	UKR	3.1	9.0	7.0	2.3	5.6	4.1	6.6	2.8	5.0	5.2	41
United Arab Emirates	ARE	5.8	0.1	3.5	1.6	0.8	1.2	2.4	1.3	1.9	2.0	156
United Kingdom	GBR	2.4	2.9	2.7	1.1	3.3	2.3	2.0	0.9	1.5	2.1	151
United States of America	USA	7.0	6.6	6.8	1.2	4.2	2.8	2.7	1.4	2.1	3.4	105
Uruguay	URY	1.3	0.0	0.7	2.4	0.9	1.7	3.8	1.9	2.9	1.5	174
Uzbekistan	UZB	6.1	3.5	4.9	3.6	0.6	2.2	4.8	3.4	4.1	3.5	102
Vanuatu	VUT	4.6	0.1	2.6	6.2	1.4	4.2	5.9	5.8	5.9	4.0	85
Venezuela	VEN	6.0	5.7	5.9	2.9	4.0	3.5	5.2	3.8	4.5	4.5	66
Viet Nam	VNM	7.3	3.2	5.6	3.9	1.3	2.7	5.0	3.5	4.3	4.0	85
Yemen	YEM	2.9	10.0	8.1	7.1	8.0	7.6	8.5	7.1	7.9	7.9	4
Zambia	ZMB	2.3	1.7	2.0	6.3	5.4	5.9	4.9	6.8	5.9	4.1	82
Zimbabwe	ZWE	4.6	4.8	4.7	6.5	4.3	5.5	5.1	6.6	5.9	5.3	36

Annex 3: Indicators fact sheets

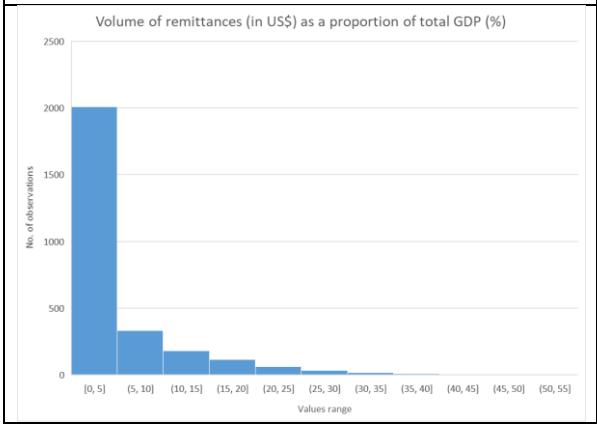
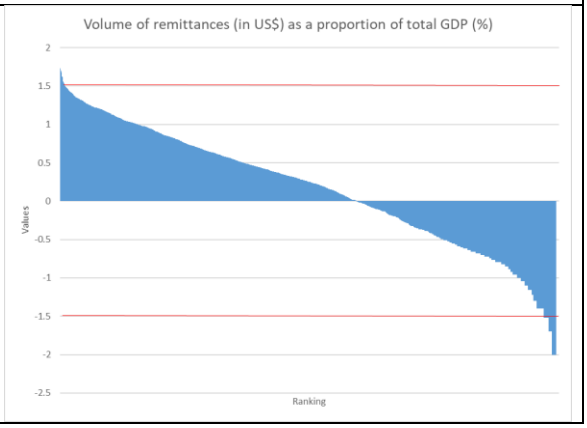
	Dimension:	Vulnerability
	Category:	Socio-economic vulnerability
	Component:	Economic dependency

INDICATOR	Indicator:	Volume of remittances as a proportion of total GDP (%)
	Global framework:	SDG target 17.3
	SDG/Sendai Code:	BX_TRF_PWKR
	Long Name:	17.3.2 Volume of remittances (in United States dollars) as a proportion of total GDP (%)
	Definition:	Personal remittances received as proportion of GDP is the inflow of personal remittances expressed as a percentage of Gross Domestic Product (GDP).
	Rationale:	
	Concept:	Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. Personal transfers thus include all current transfers between resident and non-resident individuals. Compensation of employees refers to the income of border, seasonal and other short-term workers who are employed in an economy where they are not resident, and of residents employed by non-resident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees.
	Relevance:	
	Validity/Limitation of indicator:	

METHODOLOGY	Unit of Measure:	United States dollars as a proportion of total GDP (%)			
	Indicator Creation Method:	Personal remittances are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees. World Bank staff estimates on the volume of personal remittances data are used for gap-filling purposes. GDP data, sourced from the World Bank's World Development Indicators (WDI) database, are then used to express the indicator as a percentage of GDP.			
	Treatment of missing values:	World Bank staff estimates for personal remittances data are based on data from the IMF's Balance of Payments Statistics database and data releases from central banks, national statistical agencies and World Bank country desks.			
	Additional notes:	Volume of personal remittances data are sourced from IMF's Balance of Payments Statistics database and then gap-filled with World Bank staff estimates.			
	Pre-processing:	Transformation:	LOG	Min:	-1.5
		Normalisation:	MIN-MAX	Max:	1.5

DATA AVAILABILITY	Country coverage:	92 % (176/191)
	Reference time:	2016
	Periodicity:	Annual
	Time series:	2000-2016
	Date of publication:	
	URL:	
	Provider:	World Bank
	Metadata:	https://unstats.un.org/sdgs/metadata/files/Metadata-17-03-02.pdf

FIGURES		
	Distribution:	Histogram of the raw indicator dataset
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

	Dimension:	Vulnerability
	Category:	Other vulnerable groups
	Component:	Health conditions

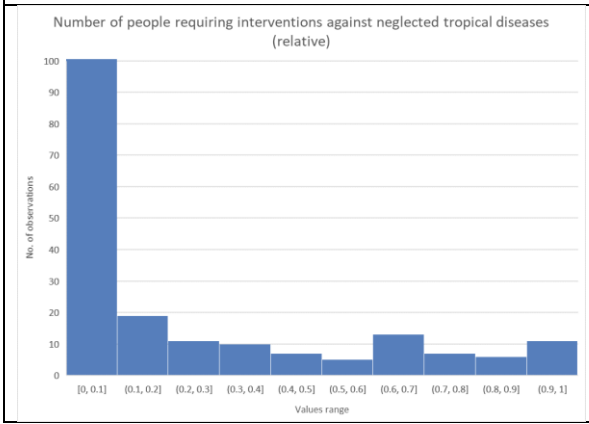
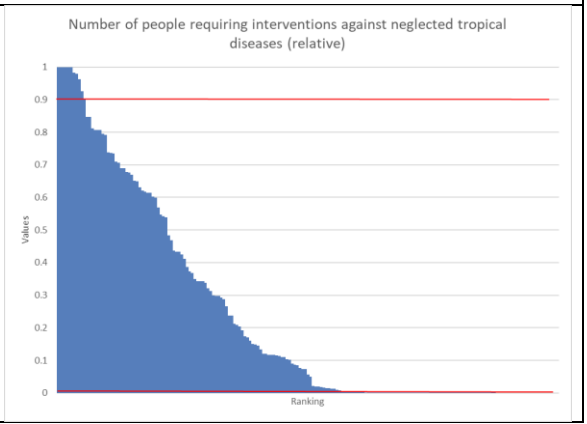
INDICATOR	Indicator:	Number of people requiring interventions against neglected tropical diseases (relative)
	Global framework:	SDG target 3.3
	SDG/Sendai Code:	SH_TRP_INTVN
	Long Name:	3.3.5 Number of people requiring interventions against neglected tropical diseases (number) as percentage of the total population
	Definition:	Number of people requiring treatment and care for any one of the neglected tropical diseases (NTDs) targeted by the WHO NTD Roadmap and World Health Assembly resolutions and reported to WHO.
	Rationale:	This number should not be interpreted as the number of people at risk of NTDs. It is in fact a subset of the larger number of people at risk. Mass treatment is limited to those living in districts above a threshold level of prevalence; it does not include all people living in districts with any risk of infection. Individual treatment and care is for those who are or have already been infected; it does not include all contacts and others at risk of infection. This number can better be interpreted as the number of people at a level of risk requiring medical intervention — that is, treatment and care for NTDs.
	Concept:	Treatment and care is broadly defined to allow for preventative, curative, surgical or rehabilitative treatment and care. In particular, it includes both (1) average annual number of people requiring mass treatment known as preventative chemotherapy (PC) for at least one PC-NTD; and (2) number of new cases requiring individual treatment and care for other NTDs. Other key interventions against NTDs (e.g. vector management, veterinary public health, water, sanitation and hygiene) are to be addressed in the context of other targets and indicators, namely UHC and universal access to water and sanitation.
	Relevance:	
	Validity/Limitation of indicator:	Country reports may not be perfectly comparable over time. Improved surveillance and case-finding may lead to an apparent increase in the number of people known to require treatment and care. Some further estimation may be required to adjust for changes in surveillance and case-finding. Missing country reports may need to be imputed for some diseases in some years.

METHODOLOGY	Unit of Measure:	Number			
	Indicator Creation Method:	Some estimation is required to aggregate data across interventions and diseases. There is an established methodology that has been tested and an agreed international standard (http://www.who.int/wer/2012/wer8702.pdf?ua=1).			
	Treatment of missing values:	Missing values are not imputed for countries that have never reported data for any NTD. For countries that have reported data in the past, missing values are imputed only for those NTDs that have been reported in the past but that have not been reported in the current year.			
	Additional notes:	This indicator is based on national-level data reported to WHO by its Member States.			
	Pre-processing:	Transformation:	Divided by the total population	Min:	0 %
		Normalisation:	MIN-MAX	Max:	90 %

AVAIL ABILIT	Country coverage:	99 % (189/191)
	Reference time:	2016
	Periodicity:	Annual

	Time series:	2010-2016
	Date of publication:	Q1
	URL:	https://www.who.int/neglected_diseases/en/
	Provider:	National NTD programmes within ministries of health, compiled by WHO
	Metadata:	https://unstats.un.org/sdgs/metadata/files/Metadata-03-03-05.pdf

FIGURES		
	Distribution:	Histogram of the raw indicator dataset
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

	Dimension:	Vulnerability
	Category:	Other vulnerable groups
	Component:	Health conditions

INDICATOR	Indicator:	Malaria incidence per 1 000 population at risk
	Global framework:	SDG target 3.3
	SDG/Sendai Code:	SH_STA_MALR
	Long Name:	3.3.3 Malaria incidence per 1 000 population at risk (per 1 000 population)
	Definition:	Incidence of malaria is defined as the number of new cases of malaria per 1 000 people at risk each year.
	Rationale:	To measure trends in malaria morbidity and to identify locations where the risk of disease is highest. With this information, programmes can respond to unusual trends, such as epidemics, and direct resources to the populations most in need. This data also serves to inform global resource allocation for malaria such as when defining eligibility criteria for Global Fund finance.
	Concept:	A case of malaria is defined as the occurrence of malaria infection in a person in whom the presence of malaria parasites in the blood has been confirmed by a diagnostic test. The population considered is the population at risk of the disease.
	Relevance:	
	Validity/Limitation of indicator:	The estimated incidence can differ from the incidence reported by a ministry of health.

METHODOLOGY	Unit of Measure:	Number of new cases per 100 000 population per year			
	Indicator Creation Method:	The country estimates what is the proportion at high risk (H) and what is the proportion at low risk (L), and the population at risk is estimated as UN population * H + UN population * L/2.			
	Treatment of missing values:	For missing values of the parameters (test positivity rate and reporting completeness), a distribution based on a mixture of the distribution of the available values is used, if any value exists for the country or otherwise from the region. Values for health-seeking behaviour parameters are imputed by linear interpolation of the values when the surveys were made or extrapolation from the first or last survey. When no reported data are available, the number of cases is interpolated taking into account the population growth.			
	Additional notes:	https://unstats.un.org/sdgs/metadata/files/Metadata-03-03-03.pdf			
	Pre-processing:	Transformation:		Min:	0
		Normalisation:	MIN-MAX	Max:	400

DATA AVAILABILITY	Country coverage:	52 % (99/191)
	Reference time:	2017
	Periodicity:	Annual
	Time series:	2000, 2005, 2010, 2015, 2016, 2017
	Date of publication:	December
	URL:	http://www.who.int/malaria/publications/world-malaria-report-2018/en/
	Provider:	World Health Organisation (WHO)
	Comments:	https://unstats.un.org/sdgs/metadata/files/Metadata-03-03-03.pdf

FIGURES		
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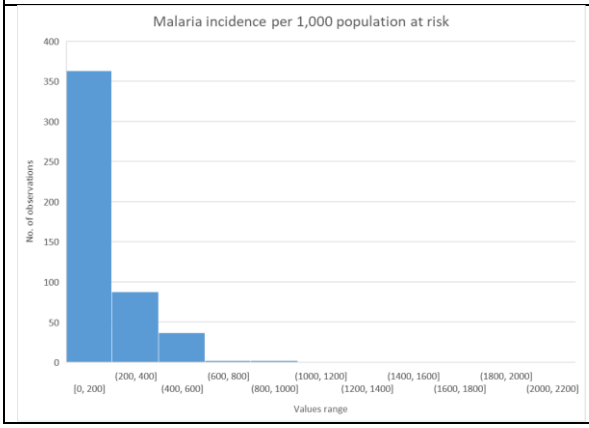
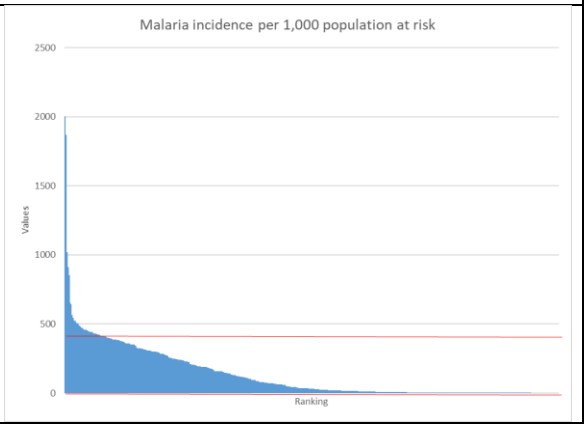
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

	Dimension:	Lack of coping capacity
	Category:	Infrastructure
	Component:	Access to health system

INDICATOR	Indicator:	Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%)
	Global framework:	SDG target 3.b
	SDG/Sendai Code:	SH_ACS_DTP3
	Long Name:	3.b.1 Proportion of the target population with access to three doses of diphtheria-tetanus-pertussis (DTP3) (%)
	Definition:	Percentage of surviving infants who received the three doses of diphtheria and tetanus toxoid with pertussis containing vaccine in a given year.
	Rationale:	This indicator aims to measure access to vaccines, including newly available or underutilised vaccines, at the national level. For monitoring disease control and impact of vaccines, it is important to measure coverage from each vaccine in the national immunisation schedule. National immunisation schedules and number of recommended vaccines vary between countries, with only DTP-, polio- and measles-containing vaccines being used in all countries.
	Concept:	Coverage of DTP-containing vaccine measures the overall system strength to deliver infant vaccination.
	Relevance:	
	Validity/Limitation of indicator:	

METHODOLOGY	Unit of Measure:	%			
	Indicator Creation Method:	The methodology uses data reported by national authorities from countries' administrative systems as well as data from immunisation or multi-indicator household surveys.			
	Treatment of missing values:	The first data point is the first reporting year after vaccine introduction. When country data are not available, interpolation is used between two data points and extrapolation from the latest available data point.			
	Additional notes:				
	Pre-processing:	Transformation:	—	Min:	40 %
		Normalisation:	MIN-MAX	Max:	90 %

DATA AVAILABILITY	Country coverage:	100 % (191/191)
	Reference time:	2016
	Periodicity:	Annual
	Time series:	2000-2016
	Date of publication:	15 July
	URL:	https://www.who.int/immunization/monitoring_surveillance/routine/coverage/en/index4.html; https://www.unicef.org/immunization/
	Provider:	Ministries of health, immunisation programmes; compiled by WHO and Unicef
	Metadata:	https://unstats.un.org/sdgs/metadata/files/Metadata-03-0b-01.pdf

FIGURES		
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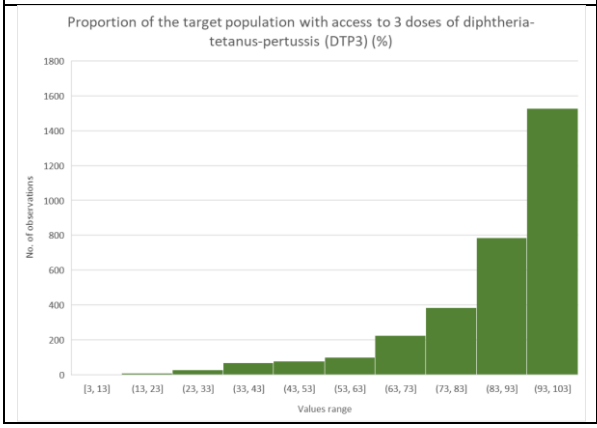
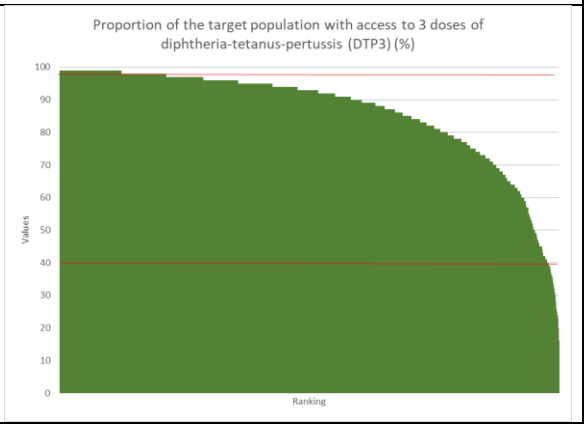
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

	Dimension:	Lack of coping capacity
	Category:	Infrastructure
	Component:	Access to health system

INDICATOR	Indicator:	Coverage of measles-containing vaccine
	Global framework:	SDG target 3.b
	SDG/Sendai Code:	SH_ACS_DTP3
	Long Name:	3.b.1 Proportion of the target population with access to measles-containing-vaccine second dose (MCV2) (%)
	Definition:	Percentage of children who received two dose of measles-containing vaccine in accordance with nationally recommended schedule through routine immunisation services.
	Rationale:	This indicator aims to measure access to vaccines, including newly available or underutilised vaccines, at the national level. For monitoring disease control and impact of vaccines, it is important to measure coverage from each vaccine in the national immunisation schedule. National immunisation schedules and number of recommended vaccines vary between countries, with only DTP-, polio- and measles-containing vaccines being used in all countries.
	Concept:	Coverage of measles-containing vaccine measures ability to deliver vaccines beyond the first year of life through routine immunisation services.
	Relevance:	
	Validity/Limitation of indicator:	

METHODOLOGY	Unit of Measure:	%			
	Indicator Creation Method:	The methodology uses data reported by national authorities from countries' administrative systems as well as data from immunisation or multi-indicator household surveys.			
	Treatment of missing values:	The first data point is the first reporting year after vaccine introduction. When country data are not available, interpolation is used between two data points and extrapolation from the latest available data point.			
	Additional notes:				
	Pre-processing:	Transformation:		Min:	40 %
		Normalisation:	MIN-MAX	Max:	90 %

DATA AVAILABILITY	Country coverage:	83 % (158/191)
	Reference time:	2016
	Periodicity:	Annual
	Time series:	2000-2016
	Date of publication:	15 July
	URL:	https://www.who.int/immunization/monitoring_surveillance/routine/coverage/en/index4.html; https://www.unicef.org/immunization/
	Provider:	Ministries of health, immunisation programmes; compiled by WHO and Unicef
	Metadata:	https://unstats.un.org/sdgs/metadata/files/Metadata-03-0b-01.pdf

FIGURES		
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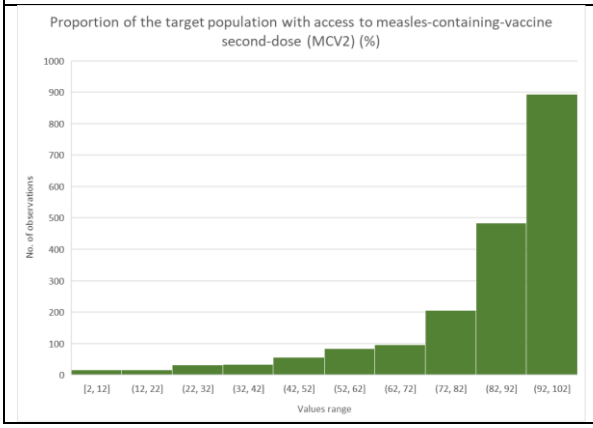
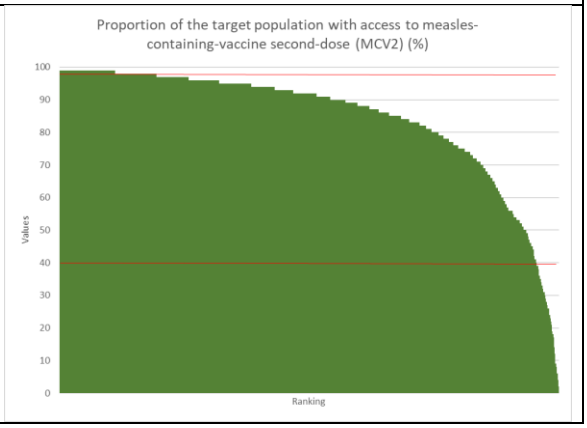
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

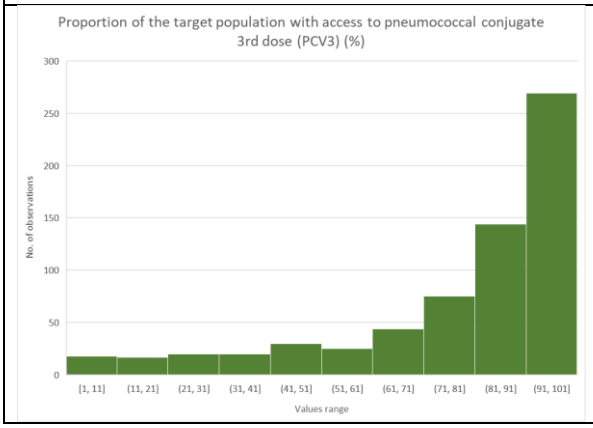
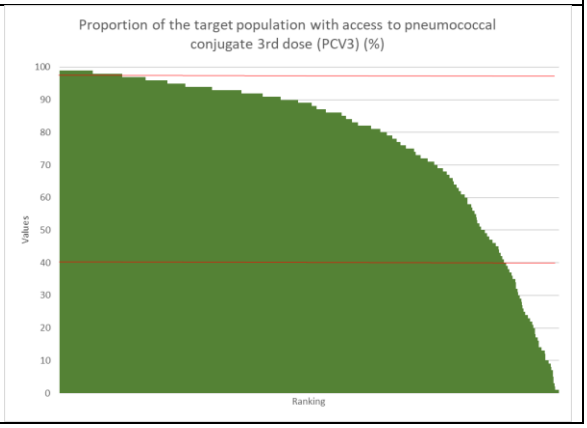
	Dimension:	Lack of coping capacity
	Category:	Infrastructure
	Component:	Access to health system

INDICATOR	Indicator:	Coverage of pneumococcal conjugate vaccine
	Global framework:	SDG target 3.b
	SDG/Sendai Code:	SH_ACS_PCV3
	Long Name:	3.b.1 Proportion of the target population with access to pneumococcal conjugate third dose (PCV3) (%)
	Definition:	Percentage of surviving infants who received the recommended doses of pneumococcal conjugate vaccine.
	Rationale:	This indicator aims to measure access to vaccines, including newly available or underutilised vaccines, at the national level. For monitoring disease control and impact of vaccines, it is important to measure coverage from each vaccine in the national immunisation schedule. National immunisation schedules and number of recommended vaccines vary between countries, with only DTP-, polio- and measles-containing vaccines being used in all countries.
	Concept:	Coverage of pneumococcal conjugate vaccine: adaptation of new vaccines for children.
	Relevance:	
	Validity/Limitation of indicator:	

METHODOLOGY	Unit of Measure:	%			
	Indicator Creation Method:	The methodology uses data reported by national authorities from countries' administrative systems as well as data from immunisation or multi-indicator household surveys.			
	Treatment of missing values:	The first data point is the first reporting year after vaccine introduction. When country data are not available, interpolation is used between two data points and extrapolation from the latest available data point.			
	Additional notes:				
	Pre-processing:	Transformation:		Min:	40 %
		Normalisation:	MIN-MAX	Max:	90 %

DATA AVAILABILITY	Country coverage:	68 % (130/191)
	Reference time:	2016
	Periodicity:	Annual
	Time series:	2008-2016
	Date of publication:	15 July
	URL:	https://www.who.int/immunization/monitoring_surveillance/routine/coverage/en/index4.html; https://www.unicef.org/immunization/
	Provider:	Ministries of health, immunisation programmes; compiled by WHO and Unicef
	Metadata:	https://unstats.un.org/sdgs/metadata/files/Metadata-03-0b-01.pdf

FIGURES		
	Distribution:	Histogram of the raw indicator dataset
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

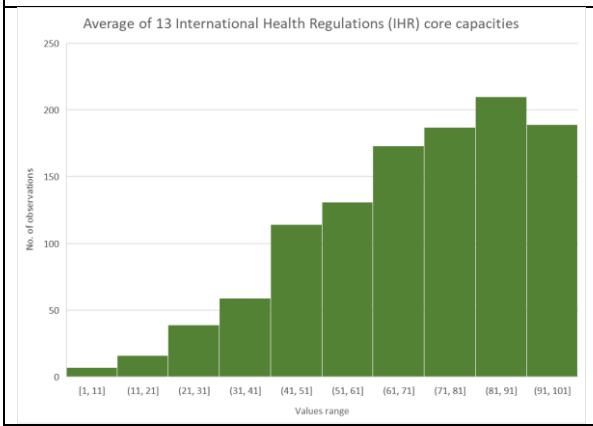
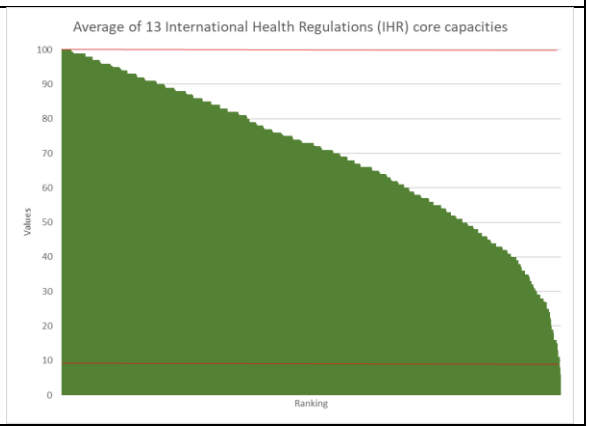
	Dimension:	Lack of coping capacity
	Category:	Infrastructure
	Component:	Access to health system

INDICATOR	Indicator:	International Health Regulations (IHR) core capacities
	Global framework:	SDG target 3.d
	SDG/Sendai Code:	SH_IHR_CAPPRD
	Long Name:	3.d.1 Average of 13 International Health Regulations (IHR) core capacities
	Definition:	Percentage of attributes of 13 core capacities that have been attained at a specific point in time. The 13 core capacities are (1) national legislation, policy and financing; (2) coordination and National Focal Point communications; (3) surveillance; (4) response; (5) preparedness; (6) risk communication; (7) human resources; (8) laboratory; (9) points of entry; (10) zoonotic events; (11) food safety; (12) chemical events; (13) radionuclear emergencies.
	Rationale:	Annex 1 of International Health Regulations (2005) (IHR (2005)): http://apps.who.int/iris/bitstream/10665/43883/1/9789241580410_eng.pdf
	Concept:	Core capacity: the essential public health capacity that States Parties are required to have in place throughout their territories by the year 2012 pursuant to Articles 5 and 12, and Annex 1A of the IHR (2005) requirements. Eight core capacities are defined in this document. Indicator: a variable that can be measured repeatedly (directly or indirectly) over time to reveal change in a system. It can be qualitative or quantitative, allowing the objective measurement of the progress of a programme or event. The quantitative measurements need to be interpreted in the broader context, taking other sources of information (e.g. supervisory reports and special studies) into consideration, and they should be supplemented with qualitative information. The capability levels: each attribute has been assigned a level of maturity, or a 'capability level'. Attainment of a given capability level requires that all attributes at lower levels are in place. In the checklist, the status of core capacity development is measured at four capability levels: Level < 1, prerequisites (foundational level); Level 1, inputs and processes; Level 2, outputs and outcomes; Level 3, additional.
	Relevance:	
	Validity/Limitation of indicator:	It is based on self-reporting by the State Party.

METHODOLOGY	Unit of Measure:				
	Indicator Creation Method:	(Number of 'yes' to Level 1 and Level 2 questions)/(Total number of Level 1 and Level 2 questions) per core capacity			
	Treatment of missing values:	No estimate is made.			
	Additional notes:				
	Pre-processing:	Transformation:		Min:	10
		Normalisation:	MIN-MAX	Max:	100

DATA AVAILABILITY	Country coverage:	99 % (190/191)
	Reference time:	2017
	Periodicity:	Annual
	Time series:	2010-2017
	Date of publication:	
	URL:	https://www.who.int/ihr/procedures/monitoring/en/
	Provider:	National IHR Focal Points; compiled by WHO
	Metadata:	

FIGURES		
	Distribution:	Histogram of the raw indicator dataset
	Ranked data:	Ranking of the raw indicator dataset

Distribution	Ranked data
	

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