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Overview of the United Nations Global Loss Data Collection Initiative

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ABSTRACT

The Year 2015 was marked by the emergence of three international agreements: The Sendai Framework for Disaster Risk Reduction, the 2030 Agenda for Sustainable Development, and in the Intergovernmental Panel on Climate Change (IPCC) Conference of the Parties (COP) 2015, a global legally binding agreement on Climate Change now known as the Paris Agreement.

All of these frameworks explicitly recognize the importance and usefulness of collecting and analyzing loss data in their corresponding implementations. The Sendai Framework, in particular, calls for the collection of data about disaster of all scales. It also calls for the collection of data about man-made, technological, environmental, and other hazards, with an emphasis on climate-related risks.

Most importantly, the Sendai Framework sets out seven targets, of which four relate to losses: mortality, people affected, economic loss, and damages to infrastructure. This implies that the coverage of national disaster loss data sets will have to be expanded to be global so that countries can report on these targets. This development represents a unique opportunity to build a bottom-up constructed global disaster loss database.

Many actors have collected national loss data for many years. For over a decade, the United Nations (UN) system has supported and promoted the construction of national disaster databases based on the Disaster Information Management System (DesInventar) methodology and software tools. Additionally, a number of countries have been collecting data with proprietary specifications and different levels of resolution. These include several countries that collect data at a localized level, for example, European countries where data are associated with compensation mechanisms.

DesInventar-based national data sets also cover small disasters, breaking down event data by municipality aggregates and using a rich set of indicators, which contain those that will be required to report against the Sendai Framework. The number of indicators implies bigger efforts may be required to build or retrofit and sustain these databases, which in addition can provide a clearer picture of damage trends and patterns at subnational scales and contribute to a better understanding of risk.

There are, however, methodological, conceptual, and practical challenges associated with a relatively localized data collection. These challenges may range from discrepancies in the perception of what an "event" is, to difficulties in the integration of multiple data sources, to the additional effort required to disaggregate information collected otherwise and the challenge of the economic valuation of the damage aggregates using a consistent and homogeneous methodology.

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Flood Damage Survey and Assessment: New Insights from Research and Practice, Geophysical Monograph 228, First Edition. Edited by Daniela Molinari, Scira Menoni, and Francesco Ballio.

Despite these challenges, the 2015 edition of the Global Assessment Report on Disaster Risk Reduction (GAR) by the UN features analyses using a consolidated, homogenized, and standardized data set covering 82 countries and several states in India, which includes a uniform economic valuation of damage. The United Nations Office for Disaster Risk Reduction (United Nations International Strategy for Disaster Reduction [UNISDR]) has been using this data set as a proof of concept of what a global database could look like. The UN Initiative, which started in 2005 when only 15 countries had these data sets, has continued to approach 100 countries in 2015. It will continue with renewed enthusiasm in the next few years, with the target of global coverage by 2020, as stated by the Sendai Framework.

1.1. DISASTER RISK REDUCTION: A FRAMEWORK FOR ACTION

The concept and practice of reducing disaster losses and risk through systematic efforts to analyze and reduce the causal factors of disasters and therefore reduce its impacts is known today as Disaster Risk Reduction (DRR). Reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness and early warning for adverse events are all examples of disaster risk reduction [*UNISDR,* 2009a].

Progress in reducing risk has been undeniable over the past decades. However, global models suggest that the risk of economic losses is rising as a result of a series of factors, including increases in exposure and vulnerability, exacerbation of hazards because of climate change, and the rapidly increasing value of the assets that are exposed to major hazards [*UNISDR,* 2015a]. In addition, a large proportion of losses continue to be associated with small and recurring disaster events that severely damage critical public infrastructure, housing, and production, which are key pillars of growth and development in low- and middle-income countries.

The long road of international agreements that started with the declaration of 1990–1999 as the International Decade for Natural Disaster Reduction (IDNDR) [*UNISDR,* 1999a], and which produced the Yokohama Strategy and Plan of Action, and the subsequent Hyogo Framework for Action, has shown the international continuous concern about the growing impacts of disasters.

1.2. THE SENDAI AND OTHER FRAMEWORKS OF 2015

On 18 March 2015, representatives from 187 United Nations Member States gathered in Sendai, Japan for the Third World Conference on Disaster Risk Reduction and adopted the Sendai Framework for Disaster Risk Reduction (SFDRR) (*UNISDR,* 2015). Later in the same year, the 2030 Agenda for Sustainable Development was also adopted, and to finalize a golden year in international agreements, countries participating in the Paris COP 21 reached for the first time a global legally binding agreement on climate change, now known as the Paris Agreement.

The international community made a big effort to align these three processes as much as possible. In its first page, the Paris Agreement welcomes "the adoption of United Nations General Assembly resolution A/RES/70/1, 'Transforming our world: the 2030 Agenda for Sustainable Development,' in particular its goal 13, the adoption of the Addis Ababa Action Agenda of the third International Conference on Financing for Development and the adoption of the Sendai Framework for Disaster Risk Reduction" [*United Nations Framework Convention on Climate Change (UNFCCC),* 2015].

The Sendai Framework, the first of these to be adopted, sets "the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries" as its main outcome. It also sets as its only goal to "prevent the creation of new risks and to reduce existing ones through different measures and thus strengthen resilience."

The 2030 Agenda for Sustainable Development embeds within its goals and targets all of the targets set by the Sendai Framework. Goal 11 Target 5 in particular comprises three of the seven targets of the Sendai Framework, all of them aiming at the reduction of human and economic losses [*UN,* 2015]. Targets in other goals, such as Goal 13 addressing climate change, also address similar challenges as those identified by SFDRR.

The Paris Agreement, in its Article 7 on adaptation, sets a global goal to increase adaptive capacity, strengthen resilience, and reduce vulnerability. This is the first time there is a formal agreement on a global adaptation goal. Article 8 on loss and damage (one of the problematic issues that delayed negotiations) includes reducing risk of losses and damages, early warning systems, emergency preparedness, and comprehensive risk assessment and management, all of which are aligned with the Sendai Framework Priorities for Action and Targets [*UNFCCC,* 2015].

1.3. THE SENDAI FRAMEWORK AND LOSS DATA COLLECTION

The Sendai Framework is structured around one main outcome and one goal, four priorities for action, seven targets and has a much wider scope than its predecessor, the Hyogo Framework for Action.

Priority 1. "Understanding disaster risk" states that disaster risk management should be based on a thorough understanding of disaster risk and losses in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics, and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness, and response.

Priority 2, "Strengthening disaster risk governance to manage disaster risk" recommends clear vision, plans, competence, guidance, and coordination within and across sectors, as well as participation of relevant stakeholders and fostering collaboration and partnership across mechanisms and institutions for the implementation of instruments relevant to disaster risk reduction and sustainable development.

Priority 3, "Investing in disaster risk reduction for resilience" suggests public and private investment in disaster risk prevention and reduction through structural and non-structural measures, which are essential to enhance the economic, social, health, and cultural resilience of persons, communities, countries, and their assets, as well as the environment.

Priority 4, "Enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation, and reconstruction" recognizes there is a need to strengthen disaster preparedness and ensure capacities are in place for effective response and recovery at all levels. The recovery, rehabilitation, and reconstruction phases are critical opportunities to build back better than before and opportunities to integrate disaster risk reduction into development.

Both the Sendai Framework for reducing disaster risk and its predecessor, the Hyogo Framework for Action, explicitly recognize the importance and usefulness of collecting loss data as one of the actions that will help countries to increase the knowledge about the risks they face. In particular, the Sendai Framework Priority 1, "Understanding disaster risk," suggests among other activities the following:

"(d) Systematically evaluate, record, share and publicly account for disaster losses and understand the economic, social, health, education, environmental and cultural heritage impacts, as appropriate, in the context of event-specific hazard-exposure and vulnerability information;

(e) Make non-sensitive hazard exposure, vulnerability, risk, disaster and loss-disaggregated information freely available and accessible, as appropriate";

The text of the Framework calls for its application to *disasters of all scales* and, as opposed to the Hyogo framework, it requests countries to address and therefore collect data about hazards that are not only considered of "natural" origin:

"15. This Framework will apply to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters caused by natural or man-made hazards, as well as related environmental, technological and biological hazards and risks".

To support the assessment of global progress in achieving the outcome and goal of the framework, seven global targets were agreed upon. Most importantly, out of these seven targets, four are related to losses and impacts.

These targets will be measured at the global level and will be complemented by work of the Open Ended Intergovernmental Working Group (OEIWG), tasked with the responsibility of developing appropriate indicators, with all the details and precise definitions that will be required, and defining the rules regarding how those indicators will be used to compute the targets [*UNISDR,* 2015]. The seven global targets, in summary form, follow:

(a) Substantially reduce relative (per capita) global disaster mortality.

(b) Substantially reduce the relative number of affected people globally.

(c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP).

(d) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities.

(e) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.

(f) Substantially enhance international cooperation to developing countries.

(g) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments.

There are several consequences to the wider scope of the framework, the explicit recommendations of Priority Action 1 on loss data collection and, in particular, to the fact that Targets (a) to (d) are based on loss indicators. One is that countries are strongly encouraged to systematically account for disaster losses and impacts for a wide spectrum of disaster scales and a large set of hazards. This accounting must take into account an expectedly large number of loss indicators defined by the OEIWG, including human, infrastructure, and economic indicators. This set of indicators will allow, on one hand, the monitoring of the outcomes of the framework, reduction of losses, and the progress in achieving the targets, and on the other hand, it will allow improvement of the understanding of risk and the impacts of disasters in member states.

The work of the OEIWG has defined a relatively manageable but still numerous and complex set of indicators to

Table 1.1 Set of Indicators Agreed Upon by the OEIWG in Geneva.

Target A: Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020 and 2030 compared to 2005 to 2015.	
A-1	Number of deaths and missing persons attributed to disasters per 100,000 population. (This indicator should be computed based on indicators A-2, A-3, and population figures.)
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.
Target B: Substantially reduce the number of affected people globally by 2030 with the aim of lowering the average global figure per 100,000 between 2020 and 2030 compared to 2005 to 2015.	
B-1	Number of directly affected people attributed to disasters per 100,000 population. (This indicator should be computed based on indicators B-2 to B-6 and population figures.)
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.
Target C: Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.	
C-1	Direct economic loss due to hazardous events in relation to global gross domestic product. (This indicator should be computed based on indicators C-2 to C-6 and GDP figures.)
C-2	Direct agricultural loss attributed to disasters. *Agriculture is understood to include the crops, livestock, fisheries, apiculture, aquaculture, and forest sectors as well as associated facilities and infrastructure.*
C-3	Direct economic loss to all other damaged or destroyed productive assets attributed to disasters. *Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies. This would be described in the associated metadata.*
C-4	Direct economic loss in the housing sector attributed to disasters. *Data would be disaggregated according to damaged and destroyed dwellings.*
C-5	Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters. *The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the member states and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.*
C-6	Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.
Target D: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including developing their resilience by 2030.	
D-1	Damage to critical infrastructure attributed to disasters. (This index should be computed based on indicators D-2 to D-5.)
D-2	Number of destroyed or damaged health facilities attributed to disasters.
D-3	Number of destroyed or damaged educational facilities attributed to disasters.
D-4	Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters. *The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the member states and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.*
D-5	Number of disruptions to basic services attributed to disasters. (This indicator should be computed based on indicators D-6 to D-8.)
D-6	Number of disruptions to educational services attributed to disasters.
D-7	Number of disruptions to health services attributed to disasters.
D-8	Number of disruptions to other basic services attributed to disasters. *The decision regarding those elements of basic services to be included in the calculation will be left to the member states and described in the accompanying metadata.*

measure these targets [*UNISDR,* 2015b]. Among the indicators considered, several are oriented to capture human losses, including those required to measure mortality and people affected, concepts that require very precise definitions and therefore precise indicators. A larger number of indicators will be required to measure direct economic losses and damages to critical infrastructure referred in Targets (c) and (d). At the time of writing this text, the OEIWG has put forward more than 20 indicators for consideration by the member states [*UNISDR,* 2015b], indicators that are deemed the minimum necessary for these measurements.

Systematically accounting for losses translates, in technological terms, to the creation of national disaster loss databases that are capable of recording the large number of loss indicators for disasters, at all scales, in a disaggregated manner, which is in agreement with the spirit of Priority Action 1 of the framework (see above). Priority 1 recommendations go even further, suggesting that these databases and information should be publicly accessible.

Table 1.1 compiles the set of indicators that have been agreed upon by the OEIWG in Geneva in the Third Session held in November 2016. This list of indicators is available in the United Nations General Assembly Resolution A/71/644.

1.4. WHERE WE ARE: BASIC PRINCIPLES OF THE UNITED NATIONS INITIATIVE

Although there are a few global disaster loss databases such as the Emergency Events Database (EM-DAT) [*Centre for Research on the Epidemiology of Disasters (CRED)*, 2011], NatCat from Munich Re, Sigma from SwissRe, and others, it is important to note that any reporting process to the Sendai Framework monitoring system has to be based on *officially endorsed data*, ideally collected and authenticated by national governments. These data should comply with the requirements of the framework, that is, it should address small- and large-scale disasters, slow and rapid onset events, it should cover a large number of hazards, including technological and man-made hazards, and most importantly, it should record a larger number of indicators not currently available in these global loss databases. Furthermore, if the recommendations of the framework are to be applied, databases should be built gathering disaggregated data that have to be usable at a subnational scale. Data should be disaggregated, at the minimum, by hazard, by event, and at a certain level of geography. For internal purposes, countries are encouraged to pursue even higher levels of disaggregation, for example, by recording human impacts in a gender-sensitive way or to collect data at asset level.

All of these minimum requirements imply that current national disaster databases will have to be expanded to reach global coverage once consolidated. Additionally, many existing databases and loss data collection systems will have to be retrofitted so that data sets contain all of the required indicators and comply with disaggregation requirements (see Chapter 3).

From the UN perspective, this situation represents a unique opportunity to build a bottom-up constructed global disaster loss database, allowing the process of global consolidation of data required to assess the progress in achieving the targets.

1.4.1. A Bottom-up Approach to Build a Global Database

The building of a global scale disaster loss database is not just the provision of a mechanism to measure Sendai Targets. Robust, official, systematic, and homogeneous measurements of losses will be a major contribution to the implementation of the Sendai Framework, and in general to disaster risk reduction, climate change adaptation, and sustainable development strategies.

National disaster loss databases will increase the capacity of countries to understand their risks and will provide a solid evidence base upon which to help countries to assess and address their disaster losses and impacts, particularly those associated with climate and weather-related hazards.

More specifically, loss databases will significantly improve the understanding of how disasters and risks affect the most vulnerable, and the databases could be used to better understand how climate variability impacts are trending and their true magnitude.

In those countries where no loss data are collected, or where information is kept only as paper archives, the UN has been proposing the use of a common simple but effective tool that implements the minimum requirements for the Sendai Framework. This effort, its challenges and achievements, and its future will be described in detail in the following sections.

In summary, this UN initiative has been implementing national disaster loss databases that comply with the following requirements:

- Data are collected for every hazardous event that has any type and level of damage registered, therefore, allowing the collection of information for disaster on all scales. Damage registered can be either quantitative (a number) or qualitative (a yes/no marker or a textual description of the damage).
- For each hazardous event, a set of indicators that is very similar, if not the same, as those discussed in the OEIWG for Sendai Targets are collected and recorded. Each indicator collected has precise definitions and even

recommendations on data collection issues and problems [*UNISDR,* 2011b].

• For each hazardous event, the main and triggering hazards (from a local perspective) are recorded. The list of hazards used in the initiative is also standardized as much as possible; the IRDR[1]-suggested definitions of perils [*IRDR,* 2014] have been adopted by the initiative.

• For each hazardous event, summary loss indicators are collected and recorded separately for each of the geographic units affected; geographic units are in general equivalent to a municipality. It is important to note that collecting loss data at asset level has not been encouraged (but neither discouraged) given its level of complexity and the repercussions on data privacy, legal, and financial liabilities and other factors.

The initiative has been using the "DesInventar" free open source software and methodology [*UNISDR,* 2011b]. In addition to implementing the above criteria for data collection and storage, the software tools provide basic analysis and reporting tools without which the data collection itself would not be as valuable.

It has to be recognized though that several other countries follow different approaches to collect data. The recent studies of the Joint Research Centre (JRC) Working Group [*JRC,* 2013; *JRC,* 2014; *JRC,* 2015] show that within the European continent there are disparities in the types of data indicators, thresholds, hazards, and resolution of the data collected (which may range from building or asset level to national aggregates), and in those mechanisms that trigger data collection. In particular, it has been found that a number of European countries collect data at building/asset level for purposes of compensation, be it from official funds [the case of Spain, for example, *Defensa Civil Española,* 2014] or from insurance policies [the case of France, for example, *Observatoire,* 2015].

In these cases, the United Nations, in collaboration with countries, intends to build automated interfaces to consolidate the information up to a level equivalent to municipality. Such data sets will be aligned and compatible with the products obtained in the rest of the world, in a common resolution. Most importantly, data aggregates will avoid privacy and data protection problems that could prevent the data from being made publicly available.

Active work is also happening in Europe to standardize and adopt similar hazard/peril classifications as the IRDR and to ensure the consolidation process will render the set of indicators proposed and defined by the OEIWG (see Chapter 2 in this book).

Despite the initial expectations that rich-information countries could easily comply with all of the requirements for Sendai Framework monitoring, it has been seen that not all databases in developed countries contain all of the indicators required. The Sheldus database, for example, in the United States (US) [*Cutter et al.,* 2005; Chapter 4 in this book] only contains a subset of the indicators proposed, and a similar situation has been found in some European countries. For instance, no indicators are collected around critical infrastructure or people affected in many of these databases. However, it is expected that the amount of digital data, the diversity of data sources, and the abundance of resources will result in a coherent integration of all the information required for monitoring the framework.

The final consolidated global data set will be, therefore, a feasible possibility within a few years from now, because it must be finished by 2020 in accordance with Sendai Framework requirements. See Box 1.1 for sample output of consolidated data for South American countries.

UNISDR already has been conducting consolidation exercises with data from a growing number of countries to build the data sets used for analysis posted in the Global Assessment Report (GAR). The data set started with 12 countries in the 2009 edition of GAR, then 21 in the 2011 edition of GAR, followed by 56 in the 2013 edition of GAR, and with the latest edition of GAR in 2015 featuring a consolidated data set containing data for 82 countries and 2 Indian states [*UNISDR,* 2015c].

This data set, of more than half a million records, was used for several research activities and as a proof of concept of the possibilities of consolidation of relatively homogeneous data sets. As documented in Annex II of the GAR 2015 Report, this consolidation was successful although it faced several challenges and some manual work.

Most of the problems faced were related to homologation of hazards, not only because of differences due to the particular context of the participating countries, but also because of linguistic and translation issues. Another area in which a careful examination of the data was required is quality control because some of the raw data still contained rogue or invalid values that had to be removed from the main body of data.

1.4.2. Economic Assessment of Direct Losses–United Nations Methodology

A major challenge faced while building the proof-of-concept data set was the lack of consistent, homogeneous, and documented evaluations of economic loss assessments of the impacts of disasters. As documented in several studies [*Dilley et al.,* 2013], all disaster loss databases register economic losses in a very poor manner.

[1]Integrated Research on Disaster Risk (IRDR) is a decade-long research programme co-sponsored by the International Council for Science (ICSU), the International Social Science Council (ISSC), and the United Nations International Strategy for Disaster Reduction (UNISDR).

Box 1.1 Sample output of consolidated data for 10 countries in South America.

Integration of data across boundaries is a feasible exercise if the data sources are compatible not only in format but also conceptually. This map shows the spatial distribution of the frequency of disasters associated with extreme precipitation at the second administrative level (municipality). Data from Brazil exists, and it is expected to become publicly available in the near future. Similar data sources exist for practically all countries in Central America and North America, meaning that for the first time, a continental view of the historical distribution, trends, and patterns of disasters can be readily obtained.

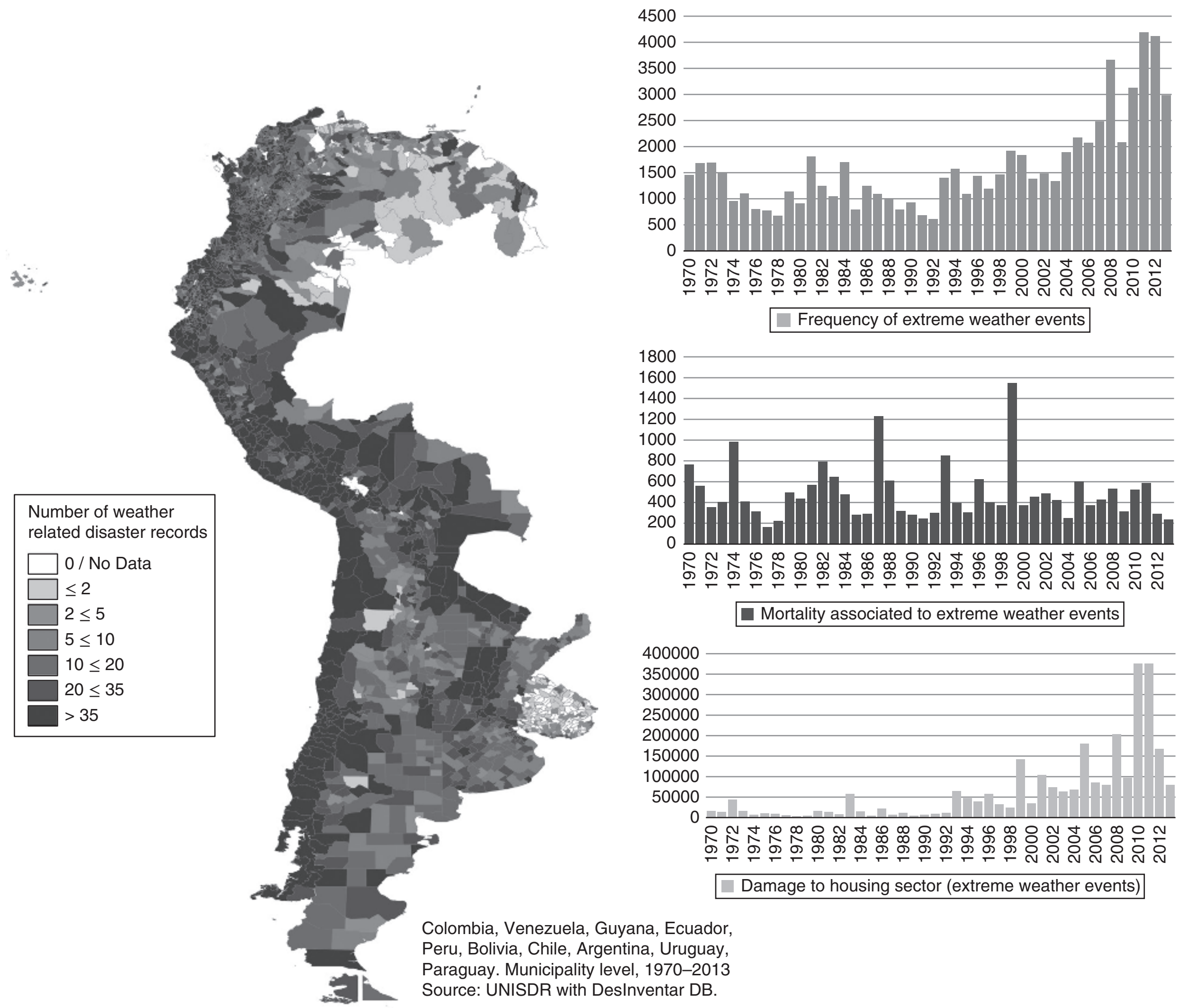

Figure 1.1 Consolidated extreme precipitation related disasters in South America (1970–2013).

A good manifestation of this issue is the extremely low coverage of data on economic losses, a problem that is common to most disaster loss databases, with the possible exception of insurance databases, where insured losses are operational assets and total losses are inferred using indexes such as market penetration. The well-known EM-DAT (see Chapter 3 in this book) only contains 25% of records with an economic assessment figure. Existing national databases contain 20% or even fewer records with dollar figures. Additionally, in all of these cases, national and global, methodologies and parameters used to estimate the economic loss are undocumented, if not unknown, and at the minimum, are not homogeneous or inconsistent given the disparity of the actors, contexts, and the circumstances in which the measurements were taken.

Target (c) of the Sendai Framework puts additional pressure on the requirements to collect loss data by requesting countries to assess "direct economic loss" defined as the value of the assets lost as consequence of disasters (loss of stock, in economic terms).

By applying a systematic and relatively simple approach to calculate direct economic loss, the GAR research team found it was possible to estimate a large portion of total direct losses recorded in the 82 countries for which data were available in the consolidated GAR data set of 2015.

Using a simple and consistent pricing methodology for indicators of losses in houses, roads, agriculture, schools, and health facilities, it was possible to estimate a significant part of total direct economic loss [*GAR,* 2011, 2013; *Velásquez et al.,* 2014]. However, this estimation still doesn't take into account damages to other sectors such as industrial and commercial, and costly infrastructure in cases of large disasters. However, the methodology proposed to the OEIWG will address many more of these missing sectors and will address known weaknesses of the GAR methodology.

In particular, the methodology addresses each sector separately, proposing methods to assess the economic value of direct damage using a replacement value methodology.

For all of the sectors that refer to built environment (i.e., housing, health, education, commercial, industrial facilities), the methodology is quite simple, estimating the price using the value of construction as a base. The Economic Commission for Latin America and the Caribbean (ECLAC) methodology suggests that the value of the physical damage to buildings can be calculated based on the following:

- the size of the building
- the price per square meter of construction
- the damage to furniture and equipment contained in the building (as a percent of the value of the building)
- the associated infrastructure (utility networks, access roads, landscaping, as a percent of the value of the building)

In turn, the values of the equipment and associated infrastructure are estimated as a percentage of the value of the construction, a percentage that varies on each sector. In the case of houses, for example, the equipment contained is suggested to be 25% of the value of the house; this percentage is much higher in health and industrial sectors.

For transportation infrastructures, the methodology uses rehabilitation costs per lineal meter, extracted from common projects in the sector.

Agricultural damage is estimated as a proxy value calculated based on the output of the crops. The underlying principle is that direct losses (seeds, fertilizers, pesticides, labor, and other costs that comprise what farmers invest in their crops) can be estimated as a percentage of the expected yield of crops.

It may be possible in the future to better estimate direct and total losses, based on conclusions from rigorous economic assessment of disasters conducted by the UN using the economic assessment methodology developed by ECLAC and the World Bank, which showed that direct losses represent statistically between 50 and 80% of total losses with this percentage higher in geological events [*ECLAC,* 2012]. In a subsequent phase, wider impact and macroeconomic losses could also be estimated if the quality of the data is high and adequate methods are developed.

Annex II of the GAR Report 2015 showed that direct losses calculated with this methodology are statistically well correlated and are usually close to the figures evaluated by UN-ECLAC, World Bank Damage and Loss Assessments (DaLA) and UN-PDNA (Post-Disaster and Needs Assessments). The report suggested that by extrapolating the figures found in these 82 countries, real economic losses could be significantly higher than losses reported by global data sources such as EM-DAT or NatCat from Munich Re, also taking into account losses in other sectors such as industrial and commercial sectors that were still to be accounted for.

To address some of the weaknesses of this methodology, the Secretariat of the OEIWG has proposed extending the loss indicators to cover industrial and commercial sectors and has developed a more detailed methodology that could take advantage of better local construction prices and asset average size data, to produce more accurate economic assessments [*UNISDR,* 2015e]. This methodology also opens the door to using very detailed data in countries where data collection is done at asset level or at intermediate levels of details that would greatly improve the accuracy of the assessment.

In all cases, the Secretariat is proposing, as a best practice, that all of the physical damage indicators are collected and kept by countries as important information asset. Physical damage indicators will allow the future connection of loss data with risk assessments or disaster forensics. It will make the Sendai Framework assessment of direct losses more transparent, and will allow, among other things, the incremental improvement of the assessment as countries develop better methodologies and as countries collect better and more comprehensive baseline data.

1.5. WHERE DO WE GO? EXPERIENCE FROM THE PAST INDICATES CHALLENGES FOR THE FUTURE

In 2008, when the first Global Assessment Report was being prepared to be launched in one year, approximately 15 countries were found to be using the DesInventar methodology. Most of the countries were in Latin America and, more incipiently, in several of the countries that were affected by the tsunami of December 2004. A first consolidated data set was assembled, aiming to look deeper into the real extent and importance of small and medium disasters. A sample of data from 12 countries was used to define, for the first time in numerical terms, the concepts of "Extensive" and "Intensive" risk. It was estimated that the number of countries with national disaster loss databases by 2008 was less than 30 [Global Risk Identification Program (*GRIP*), 2008], from which 90% were using the DesInventar methodology.

Since then, the number of countries covered by a DesInventar standardized electronic system for loss data collection has increased to over 90, under concerted efforts of the UN mainly represented by United Nations Development Programme (UNDP) and UNISDR, and other organizations including the European community and the World Bank. As stated before in this chapter, the GAR edition for 2015 contained a consolidated data set for 82 countries and 2 Indian states, and another set of countries joined the initiative during 2015, which is now approaching 100 countries in total.

Building more than 60 new data sets in a period of seven years has resulted in a wealth of experience and an important data asset.

1.5.1. Challenges and Achievements of National Databases

The next few sections of this chapter summarize the achievements, but especially the challenges, that countries and the UN system have faced while building a large number of disaster loss databases in the past decade.

Is important to underscore that the majority of this work has been done in developing countries, some of which are even classified as Least Developed Countries (LDC), and in many Small Island Developing States (SIDS), which are, of course, the focus of the development and humanitarian work of the UN. Only recently, the initiative has welcomed countries from the developed world, where a very different set of challenges occur.

Achievements of the initiative can be seen at national and global levels. The contribution of the group of Latin American countries that started the initiative under the umbrella of LA RED (LA RED de Estudios Sociales en Prevención de Desastres en America Latina[2]) has to be recognized as a pioneer work that brought to Sendai and other frameworks important ideas and hypothesis about the nature and significance of small and medium disasters, among other things.

It would be difficult to condense all of the achievements and products outcome of the initiative within countries in a few paragraphs. A few examples of loss accounting systems that are truly institutionalized and embedded into the national risk reduction mechanisms are the cases of Sri Lanka,[3] Indonesia,[4] Turkey,[5] Ethiopia, Cambodia, and Panama, among many other countries.

The Secretariat of the Pacific, a regional intergovernmental body, has developed and maintains Pacific Damage and Loss (PDALO), a data set covering 22 SIDS, many of which have very little capacity to maintain the system by themselves. Analysis of their data has been issued as documents in the Pacific Disaster Network, and loss data analysis is used as one of the inputs for the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) system [South Pacific A*SPC/SOPAC,* 2014].

There are many examples of disaster loss data usage for policy analysis. Good examples are the applications in Latin American countries, where governments have adopted policy recommendations based on the impacts of the El Niño phenomenon [*LA RED/ENSO,* 2007]. In Tunisia, Niger, Mali, and several other African countries, disaster loss databases are providing, for the first time, evidence-based results of risks historically faced by these countries, which in some cases challenges the current perception of risks of governments. For example, in Mali, the impact of insect infestations was confirmed to have similar or greater impacts than floods.

More and more, loss data are used as input, calibration, validation, and complement of risk assessments and as linking data with climate change processes. Lebanon has recently produced a flood risk assessment that contains historical mapping and measures of impact of past flood disasters.

Data from the initiative have been crucial in shaping the current discourse of UNISDR in risk reduction. Four consecutive editions of the Global Assessment Report have strong basis, reflected in entire chapters and annexes devoted to the topic, on the findings arisen from the analysis of individual and consolidated data sets.

The ongoing work of JRC aimed at producing a recommendation for loss data collection to Member States [*JRC,* 2013, 2014, 2015] has gathered, perfected, and adopted many of the ideas, best practices, and lessons

[2] *The Network for Social Studies on Disaster Prevention in Latin America. See http://www.la-red.org*

[3] *See www.desinventar.lk. System includes subnational profiles for districts, public awareness, and education sections and publications.*

[4] *See http://dibi.bnbp.gov.in. Data Informasi Bencana Indonesia (DIBI) system is decentralized, with provincial subsystems. The data are linked, and the open source software has been reused for a poverty eradication project system and other applications.*

[5] *See https://tuaatest.afad.gov.tr/map.jsp. The Turkish system is coupled with a DRR knowledge base system.*

learned by the UN system and UNISDR over the years (see Chapter 2 in this book). UNISDR and UNDP contributions were provided by the Secretariat during the entire process of development of the recommendations.

Nevertheless, the most important reflection of the global impact of the initiative is its influence on the targets of the Sendai Framework and its indicators and their presence in other international agreements. The current set of indicators being discussed by OEIWG are an almost perfect match with the indicators and definitions collected for more than a decade with DesInventar. UNISDR intends to continue with the initiative, now with the renewed goal of turning it into the formal reporting mechanism for Targets (a) to (d) of Sendai, which are replicated in several of the indicators of the Sustainable Development Goals (SDG), to continue its use as prescribed by the Paris Agreement and, as usual, as a crucial step for countries to better understand their risks.

1.5.2. Challenges in Developing Countries: Scarcity of Data, Quality Control, and Sustainability

When starting the work of the UN system in developing countries, the first activity conducted is usually a capacity-building exercise where the basic concepts associated with risk reduction in general and those related to disaster loss databases in particular are explained. The software tools are introduced to a usually large number of stakeholders. These stakeholders range from emergency management bodies, which are usually the "hosting agency" of the initiatives, to data providers such as line ministries and to end users in planning and finance sectors.

The ease of use of the software tools used for data collection and analysis gives, at first, a false sense of the task being simple, but when actual research and data collection starts, the list of challenges is enormous. UN-supported databases are built in two clear phases: a first stage in which historical research is conducted during which loss data is obtained for a certain number of preceding years, normally 20 to 30 years, and a second stage during which the resulting data set is kept up to date by means of near real-time data collection.

Both stages face the following common challenges and difficulties:

Unavailability of information: The first common challenge that researchers face is simply the unavailability of data. No information is systematically collected or, if eventually collected, it is not properly stored. Many institutions that deal with this type of information only keep paper files, which after some time are discarded or destroyed, because there is no awareness of their importance.

Disaggregation: National data sets must cover disasters at all scales. There is a tendency in the humanitarian world to aggregate the total impact of a disaster in order to provide consolidated figures that are required for planning the emergency response. For small or medium disasters, which do not cross the borders of the target geographical unit (similar to a municipality) this is not a problem. For events that cover multiple areas, breaking down event data by geographic unit implies greater efforts in building national databases, which then can provide a clearer picture of damage trends and patterns at subnational scales.

Conceptual issues: There are methodological, conceptual, and practical challenges associated with a relatively localized data collection, ranging from discrepancies in the *local perception* of what an "event" is, the associated hazards, to the *local perception* of its date, duration, and other problems that jeopardize the integration of information from different sources. A meteorological event that causes landslides in one municipality and in another municipality causes flash floods over certain periods of time that could span over weeks are not easy to connect as being part of the same hazardous phenomena.

Integration of information: In most cases, the backbone of the disaster loss data collection in each country is the agency in charge of emergency management (the 'hosting agency'), which has access, coordinates operations, and produces many of the loss indicators that are typically related to human losses and those related to shelter, food security, and health. In theory, information from other agencies should feed and complement this initial picture, for example, with sectoral data coming from utilities management agencies (roads, water, sanitation, communications, etc.). Integrating these data tends to be a rather difficult task for reasons already stated above, but it is difficult also because of data sharing problems between agencies, which in many cases work as functional isolated silos.

Capacity of institutions: Especially in very low income countries, there is a lack of, or low, capacity among those engaged in data production. This is unfortunately the case for many emergency services where personnel deployed to the field have basic search and rescue training but in many cases lack the knowledge and technology required to properly assess physical damage to structures and other tasks required to obtain highest quality loss indicators.

Vision of disasters as catastrophes: Despite clear indications in both the Hyogo Framework and the Sendai Framework, there is still a tendency to disregard the data or even consider disasters as many damaging small hazardous events. Reflecting on a process that has also happened internationally and making extensive risk information available are the best triggers and justifications of specific risk reduction and risk management for extensive risk.

Disparities among countries: Several aspects make data collection on each country specific for its context. Legal regulations can impose restrictions and change definitions of loss indicators. For example, the concept of a 'missing person' can be legally established in different ways depending on each country's law, and the same can happen for the definition of hazards. Another important consideration is the concept of what a 'municipality' can be. Sizes and definitions of administrative divisions vary dramatically in each country making the choice of a type of administrative unit a sensitive issue.

Disaggregation by gender/age/other: There is a lot of pressure and work from different groups in the international community (including specific mentions in all of the three frameworks mentioned: Sendai, SDGs, and Paris) to introduce gender-specific approaches to disaster management, and this is also reflected in requirements for data collection. The experience in building disaster loss databases tells that collecting (and later analysing and using) this information requires a huge effort in changing the mindset of those deployed in the field to attend the emergencies. It is important to realize that most of the information on affectation to human lives is collected for humanitarian purposes (for example, per family or household), and only in a few cases is the information actually required in disaggregated form for operational reasons. Specialized agencies in sectors like education and health may be the key to produce and record this information.

Public access: Unfortunately, loss data are seen in many contexts as a legal or a financial liability, not to mention a political liability. Access to mortality and health information can be extremely regulated, especially in developed countries where there is strict data privacy legislation. For example, in the US, it is almost impossible to publish a record of a hazardous event with only one victim, because then the victim could be identified and associated with the disaster [*Cutter,* 2005]. The existence of compensation mechanisms is one of the reasons access to emergency loss data can be restricted, because it could give arguments to petitioners to request compensation. Political and national security liabilities are also noteworthy; good examples of this are the several countries in the Middle East that joined the initiative but have chosen not to share their information based on national security considerations.

The young institutionalism of African countries: One of the main targets of the UN initiative is the African continent. A big challenge here is the incipient status of institutions, particularly in countries that only became independent in the past half century. Many of these young institutions do not have the accumulated knowledge (and archives) that are required to conduct historical research, and their capacities are still to be highly reinforced.

Economic valuation: The economic valuation of the damage using a consistent and homogeneous methodology is a common problem for a high number of countries. Although today there are sophisticated methodologies for assessing the economic value of losses, there is no simplified methodology that can be applied in the myriad small-scale disasters that do not justify the deployment of specialized engineering valuation teams. The proposed UNISDR simplified methodology and its implementation in the software tool DesInventar aims at filling this gap.

Sustainability: Probably one of the main challenges in the past for disaster loss data sets is an issue with many faces that have been addressed by the UN using different but systematic approaches [*UNDP,* 2009]. Ownership from part of the government, resources needed for the operation of the system, continuity of political priorities and operational procedures, staff turnaround, continuous need for capacity building, unawareness of the results and applications, among others, are some of the challenges that are to be overcome when ensuring the sustainability of national disaster loss databases.

1.5.3. Developed Countries: Challenges in Information-Rich Environments

Several developed countries have mature and publicly available disaster loss databases, among them the US, Canada, Australia, Spain, and Slovenia. Looking closely at some of these data sets, it is immediately apparent that not all of them will be sufficient to respond to the demands of the Sendai monitoring system. Others, like the Spanish data set, are fully ready to be used and even have an interface with DesInventar, which allowed the data set to be integrated into the GAR 2015 consolidated loss database.

During 2014 and 2015, JRC conducted a series of workshops and produced three documents on the topic of loss data for European countries [*De Groeve et al.,* 2014, 2015]. Progress in the European continent is evident, but paradoxically the richness in data may play against the goals of an integrated system to collect loss data.

During the development of these workshops, a number of countries also provided sample data trying to test the comprehensiveness of the data sets and, from the UNISDR point of view, to look at the possible compliance of the data sets vis-à-vis the minimum requirements for the Sendai Framework targets (see Chapter 2 in this book).

Data from the European continent will be critical to assemble the puzzle of a global data set. Given the progress and actual practices found in member states, it is foreseen that European governments and those countries that have advanced loss databases, will have to build automated interfaces in collaboration with UNISDR to produce the desired output as requested by OEIWG.

However, the process is not without difficulties and challenges, although these will be very different from those faced by developing economies.

The apparent excess of data may play against the goals of sharing and integrating information. The more data sources that are available, the more chances there are to find discrepancies in aspects such as conceptualization, definition, electronic formats, and glossaries, among other things. Excess of information will not necessarily be an advantage, because it will come with different problems associated with integration. One of them will be the old and well-known problem of data sharing, which may be less patent in developed systems but which will be surely found.

Privacy and data protection issues have to be carefully managed so that no citizen rights are violated but at the same time, the aggregated figures required for the monitoring must be obtained. Compensation systems may also be seen as potentially introducing not only biases in the inventories of the impacts but in its economic valuation, and could also possibly contain political, national security, legal, and financial liabilities that may limit the collection of data and its dissemination and use.

1.6. CONCLUSIONS

The UN Global Loss Data Collection initiative has already achieved what is probably its most important goal that was set when it was conceived more than a decade ago. It has permeated the awareness of practitioners, researchers, and academics. Most importantly, it has made the public and governments more aware of the importance of considering the impacts of disasters at all scales in the process of national disaster risk management.

The Sendai Framework, explicitly stating it applies to "the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters caused by natural or man-made hazards, as well as related environmental, technological and biological hazards" is a recognition, to a large extent, of the work and conclusions that have been conceived and produced based on the evidence collected by the initiative, and published insistently in the GARs.

Building loss databases has been so far considered an optional element of the battery of tools and instruments that governments at all levels can use in their path to better understanding risks. Having three international frameworks (i.e., the Sendai Framework, the Agenda for Sustainable Development, and the Paris Agreement) consistently encouraging the construction of these artifacts as part of their implementation and the monitoring mechanisms is a game changer. Now loss data collection is becoming an almost mandatory instrument to be implemented globally by all member states.

The road ahead, however, is still partially unclear and rough. Much capacity building, provision of implementation means, and good institutional mechanisms have to be put in place for the monitoring systems to attain global coverage and to become sustainable during the next 15 years, the minimum period specified in the frameworks. Improved methodologies to collect, measure, and assess the economic impact of disasters will enhance the accuracy and usability of these systems.

It is a historical responsibility for national governments to start, revamp, or continue the systematic collection of loss data as part of the process of contributing to a better understanding of our risks, the impact of climate change, and in general, the process of sustainable development. As citizens of the world, all of us who contribute to the topic will be, at the end of the day, contributing to make this a better planet for us and for generations to come.

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