PART II

TOOLS AND GUIDANCE FOR IMPLEMENTATION

CHAPTER 6: BASIC STEPS FOR IMPLEMENTATION

1. The Fundamental Principles of Official Statistics were adopted by the UN General Assembly at its 68th Session in 2014. (A/RES/68/261).[35] Guidelines for Implementation for the Fundamental Principles of Official Statistics were developed and finalized by the UN Statistics Commission in 2015.[36] The Fundamental Principles describes the core responsibilities and quality criteria for work on official statistics. Understanding these principles helps identify opportunities and challenges for agencies involved with disaster-related statistics. (see also ECE TF-MEED).

2. UNDP (2009) summarizes a basic checklist of steps for establishing an institutional environment for official disaster-related statistics:

Step 1– Create an enabling environment for disaster risk reduction

Step 2 – Find an appropriate 'home' for the database

Step 3 – Integrate use of official statistics for design and monitoring of national strategies disaster risk reduction

Step 4 – Collect, enter and validate data

Step 5 – Conduct analysis, manage data and ensure sustainability

Institutional arrangements for disaster-related statistics

3. NSOs are typically empowered by national law to promote national statistical quality aligned with the commitment to the Fundamental Principles of Official Statistics. One of the ways that NSOs respond to these responsibilities is by establishing and enforcing methodological standards. This supports the development of transparent and consistent time series.

4. NSOs have a responsibility for continuous review of new tools for improving the availability and quality of statistics, including the use of big data and geospatial information. This can be done in collaboration, where applicable, with other producers of statistics. In reviewing new tools and new opportunities, NSOs also need to identify and address as an integrated part of the broader official statistical systems, emerging areas of demand for statistics, such as disaster-related statistics.

5. For institutions at an early stage of creating a nationally centralized database or system for compilation of disaster-related statistics, one of the vital steps is to design a database and system of information flows for accessing coherent and well-documented data for organization into standardized tables.

6. Ultimately, the roles or potential contributions of NDMAs, NSOs and others for production and compilation of relevant official data should be reflected in the governing policies, such as the national statistical law, national statistical policy, and work programmes. This would allow the facilitation and access to necessary resources to build and sustain capacities for developing and managing national databases.

---

[35] (A/RES/68/261), https://unstats.un.org/unsd/dnss/gp/FP-New-E.pdf

[36] https://unstats.un.org/unsd/dnss/gp/impguide.aspx

7. Many guidelines on institutional arrangements already exist, especially for the development of systems for compiling statistics on disaster impacts (also known as loss and damage databases), particularly from the European Union and UNDP. In addition, the UNECE Task Force for Measuring Extreme Events and Disaster (TF-MEED) developed a complementary report on the role of national statistics offices for disaster-related statistics.

8. UNDP Guidelines and lessons for establishing disaster loss databases (UNDP, 2009) emphasized the importance of engagement of partners from the initial stages of database development, to promote a clear and common understanding of the expected scope for the data collection and its importance for tracking and reducing disaster risk.

9. The goal of partnerships is "to create a database initiative in conjunction with other disaster-related capacity building activities and within government structures to ensure local ownership and management of the data." It is important to ensure that data collection and validation are conducted in alignment with nationally-adopted framework and standards for data sources and methodologies.

10. A centralized database does not require that all related basic data are stored physically in the same place or on the same server. Rather, the objective should be institutional and technological solutions (e.g. via a centralized online portal) for accessing the basic range of disaster-related statistics with a seamless system of database queries. These queries can be used for calculating indicators, conducting risk and post-disaster assessments, and other statistical purposes that arise during the phases of disaster risk management.

11. When data is organised in a geospatial interface (with codes and format compatible with use in geographic information systems), the databases will have inherent flexibility in terms of geographic scale and level of detail of analysis, so that the same basic data inputs can be (re)utilized for complementary analyses at virtually any geographic scale.

Statistical coordination

12. Once a suitable institutional environment has been established for producing a basic range of disaster-related statistics, TF-MEED identified some core functions for the national statistical system, as follows:

- Produce primary data;
- Produce baseline official statistics;
- Provide geospatial information;
- Coordinate information flows;
- Provide data sharing platforms;
- Maintain disaster database; and
- Produce official statistics and indicators on climate change and disasters

13. Statistical coordination is a particularly important factor for the DRSF because most of the compilations of statistics involve close collaboration between disaster management agencies, and several other producers of official data. The current situation for disaster-related statistics in countries is that data collections are scattered and dispersed among a variety of governing agencies, in varying formats and according to different frameworks.

14. The relevant institutions typically involved in producing official data at the national or subnational scale are: disaster management agencies (or equivalent coordinating in organizations), national statistics offices, geographic or mapping agencies, ministries with responsibilities for critical infrastructure and/or emergency response, and potentially also including non-governmental organizations involved with research or with support for disaster risk reduction and response.

15. Statistical coordination usually involves both conceptual harmonization and institutional management. The conceptual harmonization requires that, for all institutions involved, the variables have the same definitions, which are known and shared and are encoded in the same way. Also, documentation of methodologies is shared during the phases of statistical production and after the final data have been processed. (UN Statistics Division, 2015).

16. An important coordination mechanism, particularly during early stages of development (or expansion or redevelopment) phases for a database, is to establish a multi-agency technical working group. The technical working group should involve all key data providers across government and be empowered to adopt decisions on terminologies and key methodological issues. The purpose is to create coherence across basic data collections, data processing, compilation, aggregation, dissemination and analysis for a basic range of disaster-related statistics.

17. The expected core analytical uses for the basic range of statistics should be made explicit and included in the terms of reference for relevant databases as the reference for defining and assessing qualities of the input data. The goal for statistical coordination and related activities of the technical working group should be to make official statistics accessible for use in disaster risk reduction policy and related research.

Roles and responsibilities

18. A crucial first step for implementation of DRSF by national agencies is a detailed mapping of existing sources of data accessible at the national level for calculating variables in the basic range of disaster-related statistics tables. To assist with this national mapping or assessment exercise, specific demands for statistics and common sources for relevant data are outlined for the basic range for disaster-related statistics in chapters 8 and 9. Further discussions on roles of national statistics offices for these statistics can also be found in the outcomes of the ECE TF-MEED.[37]

19. Government agencies perform their monitoring and statistical analyses functions by law. Government institutions have obligations to collect statistical and geospatial data for assessing risks and the impacts that disasters have on people. Statistics may come from the census, relevant surveys and other sources of official data. So, coordinating agencies must develop standard models for applications of these data if greater resilience to disasters is to be achieved.

20. Practices vary from country to country according to legislated mandates of governing institutions. It is common that a national disaster management agency (NDMA), or equivalent

[37]https://www.unece.org/statistics/networks-of-experts/task-force-on-measuring-extreme-events-and-disasters.html

national institution, has the primary responsibility for the collection of initial observations of impacts immediately after a disaster for coordinating emergency response, recovery, and for official reporting to the government and to the media. Some of these initial functions related to data collection are governed by national laws or policies. For example, identification and coding of a disaster occurrence and for collection and management of data on missing persons. All related methodological practices and procedures of disaster management for collecting and managing data should also be shared for coordination with agencies involved in the technical working group.

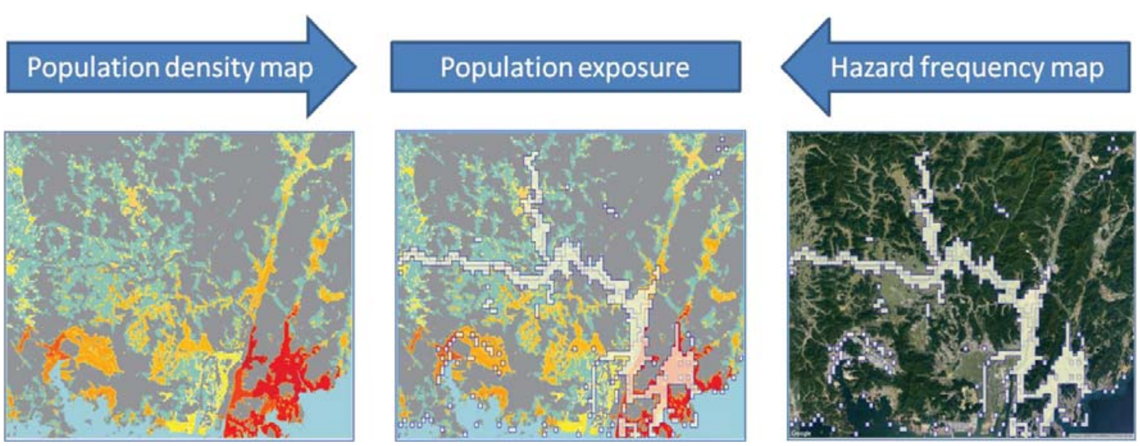
21. Through implementation of DRSF it will be possible to: (i) improve production of statistics from existing databases and (ii) bridge the representations of the realm of disasters and risk reduction on the one hand, with the socio-economic statistics on the other. The bridge between the two domains of statistical information is essential for producing indicators. This bridge requires strong partnership between disaster management agencies, national statistical offices, and other official sources of relevant data. It also requires a mutual understanding of core concepts and the methods for applying the concepts to the practice of producing coherent statistics.

Geographic Information Systems (GIS)

22. There are growing challenges to predicting disaster risk due to climate change and other factors of the modern globalized world. However, from a technical perspective, there are many enhanced opportunities, such as the free availability of software and methodologies for making use of new data sources, like remote sensing, mobile phone datasets, and especially the use of geographic information systems (GIS) for assimilation of data. For example, Figure 6.1 shows an example for calculation of exposure of population to a hazard, by using GIS to create multiple layers of statistic derived from geospatial data. Statistics, e.g. numbers or proportions of exposed people by administrative areas, can be calculated directly from the maps.

Figure 5.1

Population exposed to hazards measurement



Sources: Right Map: UN Environment-GRID'S frequency of flood hazard map. Left map: Population census 2015 from KOSTAT, resampled by UNESCAP to the DLR's Global Urban Footprint

23. GIS is an indispensable tool for producing and analysing disaster-related statistics for their use in disaster risk reduction policy. While emphasizing the tremendous opportunity for

evidence-based policy from these new tools, the World Bank's Global Facility for Disaster Risk Reduction (GFDRR) alerted that "these advances and innovations create a need for better standards and transparency, which would enable replicating risk results by other actors, reporting on modelling assumptions and uncertainty, and so forth."

24. Increasingly, traditional data sources of the national statistical system like household and business registers, household and business surveys, and population and housing censuses are conducted with use of detailed geographic referencing. The geographic referencing may be confidential at the level of individual records, but summary statistics can be disseminated for defined areas, e.g. hazard areas. The broad trend has been a rapid expansion in the possibilities, using affordable tools and the existing data, towards increased flexibility and level of detail for geographic disaggregation of statistics on risk. For example, utilizing tablets for surveys and census interviews and preparing datasets in GIS-accessible formats have become common practices across the globe, whereas such advancements hardly existed within national statistics offices a mere decade ago.

25. Nearly all components of the basic range of disaster-related statistic depend on GIS for compilation, integration, or analysis and therefore establishing a database infrastructure in GIS, or a spatial data infrastructure (SDI) is a critical early step in the development of disaster-related statistics.

26. One of the advantages of working with data in GIS software is flexibility to present statistics at different scales, and combining multiple layers of variables. Agencies responsible for the underlying statistics should develop a common set of policies and standards for geographic reference and for managing GIS files, which can be used to maintain a minimum standard of reliability, accuracy, and relevant protections of confidentiality so that the statistics can be used at different scales for disaster risk reduction.

27. Geo-referencing is the coding of data, statistics and indicators according to geographic location, either point location (coordinates) or area (a standard reference shape or polygon). Adopting and implementing common intra-governmental norms and standards, including standards for place names and georeferenced coding is crucial for using GIS to seamlessly share, integrate and use geospatial information for improved decision making. (UNGGIM, 2015)

28. In addition, advancement of accessibility to geospatial data, like remote sensing, is a major opportunity for managers of disaster-related statistics to study factors of risk, for visual assessments of impacts, and as a resource for integrating and capturing new added values from existing and more traditional sources of data, such as sample surveys.

29. With the increased use of geo-referencing and emergence of analytical tools in GIS, geospatial information and services now "contribute vastly to the overarching effort of preventing or reducing the social, economic, and environmental impacts of disasters." UNGGIM (2017)

30. A standard spatial data infrastructure (SDI) allows for the integration of geospatial datasets, such as satellite imagery, e.g., visual spectral imagery in a disaster area immediately after the occurrence, which are often crucially important data sources for producing or validating statistics before and after a disaster.

31. At a minimum, variables identified for vulnerability to disasters should be compiled to the lowest available sub-national administrative regions. In DRSF background statistical tables, all variables are organized according to pre-defined geographic regions within countries. In reporting tables, geographic disaggregation is predetermined by existing practices and requirements of users. GIS provides the opportunity to modify geographic regions for specific analysis.

32. Often it is useful to define homogenous regions – e.g. urban and rural, residential and non-residential, and agricultural land. The European Joint-Research Council Guidance (De Groeve et al.,2013) describes three common layers of organization and use of disaster impacts data:

- Local civil protection;
- National/Regional assessment centres; and
- Hazard specific national authorities

33. Some specific requirements, e.g., level of geographic detail and timeliness will vary across different applications of the data, but, in principle, the same sources of data can be utilized for multiple purposes and for multiple scale of analyses and decision-making. The adoption of a harmonized framework and common standards, e.g. for geo-referencing and for geographic aggregation, will help ensure that reliable data can be accessed and used more efficiently, and reused for analyses at multiple phases of disaster risk management.

Metadata and quality assurance

34. Collection of data is usually resource intensive. Comprehensive documentation of the outputs from a data source is a vital protection for the value of that data for future use in statistical analyses. Metadata is the cornerstone for creating coherence across datasets. The issues discussed in this handbook, such as units of measurement, scope of measurement, definitions for key technical terms, and methods used for monetary valuation, are all key examples of methodological choices, for which multiple options are always possible. Sometimes the best choice is not the most obvious one and sometimes choices involve a practical compromise between the different qualitative dimensions of data (accuracy, reliability, relevance, simplicity). Documentation of these choices, in a comprehensive manual, glossary, and/ or technical annex attached to statistical releases should be standard practice.

35. The main role of metadata is descriptions explaining fundamental information about data, which are used for interpreting the data in analyses. Metadata also serves an additional purpose in facilitating a query system and developing an efficient structure in databases so that the same basic input data can be reused for multiple purposes.

36. A centralized database on disaster-related statistics must include a system of unique identifiers and coding for individual disaster occurrences and their main characteristics. Identifier codes within the datasets are an efficient method for linking data with metadata and for establishing links between related variables. Three characteristics of each disaster occurrence are recorded (see Chapter 2). A complete nationally-adopted **official glossary of**

hazard types[38] is an example, particular to disaster-related statistics, of important data for users for interpreting the statistics. As noted in Chapter 2, this glossary might simply replicate a list and legally adopted definitions for hazards, if available, as legislated for DRM purposes.

37. Currently, disaster occurrences and impacts information is typically stored as a set of records (see, for example, Desinventar.net). Given a standardized use of reference to time ("Start date") and location ("geographic name"), basic statistics on disaster occurrences and impacts could be queried from these underlying records for multiple disaster occurrences over a specified period, e.g. 2015-2030. However, accounting for the requirements of storing metadata and microdata from multiple separate collections requires a functional database structure. that integrates the impact statistics according to a model of relationships between components of the basic range of disaster-related statistics (see figure 4.1 in Chapter 4 and figure 7.2 in Chapter 7).

38. Each disaster occurrence may have many sources of data that are compiled and utilized to describe the relevant variables attached to that disaster. Usually, each data collection, when integrated, needs to be accompanied by a package of metadata explanations plus notes on revisions or other relevant details.

39. A standard practice for estimations or use of proxies for measurement is to include a confidence interval and related information to explain the expected accuracy of the figures and to correctly interpret the statistics and apply the values to their analysis appropriately. For example, indicators on economic impacts of disasters (both direct and indirect) are typically dependent on estimation or the use of average values (see UNISDR, 2017).

40. Another purpose for metadata is to inform continuous improvements to the scope, coverage, and accuracy of statistics and their use in analyses. "A first step in handling of uncertainty is to be aware of it at different levels of data collection and recording and communication: fitness for use (i.e., how well data model fits to application field), measurement errors while collecting data, processing errors while recording data and interpretation errors while communicating it. A second step is to be transparent when showing/visualizing the uncertainty at different levels. Only then, the overall quality of data can be assessed, and users can use the data in their work." (EU-JRC, 2015).

41. The European Joint Research Centre (EU-JRC, 2015) introduced a concept of the "data curator" for the different elements of data production, including (but not limited to) the:

- Calculation of codified values of database fields accompanied with method used;
- Identification of unclear or missing values that should be investigated;
- Conversion into the unit defined by methodology;
- Utilization of external references for the validation and verification process; and
- Applying an event identifier to provide relations to background information which is not (primarily/necessarily) part of disaster loss database, e.g., hazard event characteristics.

[38] The IRDR Hazard Glossary and Peril Classification (IRDR,2014) and Sendai Framework Indicator Technical Guidelines (UNISDR, 2017) should be utilized, as relevant, as references for harmonizing with international definitions

42. For most components of the basic range of disaster-related statistics, particularly the disaster impacts and many of the variables used for risk assessment, the data curator is typically the disaster management agency, or equivalent national institution. However, national statistics offices and other ministries or agencies will often retain the primary responsibility for many of the background statistics that are used in the impacts and risk assessments, such as baseline statistics on the population and economy.

Prioritization

43. One of the purposes of developing a basic range of disaster-related statistics is to help national statistical systems to identify and adopt priorities for statistical development for disaster risk management. For statistical systems at an early stage of the development of nationally harmonized disasters statistics, a limited core, first-tier compilation of statistics should be established as a basis for gradually expanding into a broader collection of data in the future.

44. The Sendai Framework and SDG targets provide broad macro-scale priorities for policy and a common international approach to monitoring progress. Within the basic range tables (see Annex) the input variables used (as numerators or denominators) in the internationally adopted indicators (SDGs and Sendai Framework) have been highlighted.

45. Some data inputs are utilized for multiple analytical purposes and appear as basic building blocks in multiple components of the basic range of disaster-related statistics, thus they are systemically important priorities for establishing a basic range of statistics. For example, the primary characteristics of a disaster occurrence (see Figure 3 in Chapter 2): timing, location, hazard type and magnitude, are minimum requirements to identify disasters and describe their basic characteristics. These are core data elements for developing databases and time series statistics on disaster impacts.

46. Another example of systemically important data are the inputs used for exposure statistics, (population, land and infrastructure) in hazard areas. These statistics are used for risk assessment, emergency response and as baseline statistics for measuring impacts after a disaster.

47. Another factor for prioritization is the current priority policy questions for decision-makers in the country. These priorities will vary but some common priorities can be identified for each of the main types or phases of disaster risk reduction decision-making (see Chapter 6).

48. The prioritization of qualitative aspects of the statistics, e.g., relevance, precision, timeliness) is a function of the expected uses. For example, if the statistics will be utilized in time series analysis (e.g. indicator reporting and monitoring over time, then consistency, metadata transparency and international comparability are priorities for making the data accessible for their intended uses. In contrast, during an emergency, urgent accessibility to data at flexible scales (including detailed geographic reference with the best available accuracy) are the first priorities.

49. Case studies developed Expert Group on Disaster-related Statistics in Asia and the Pacific show examples of how official statistics can be used or presented in a variety of way, in maps and tables, to meeting multiple purposes, potentially expanding upon the basic range of disaster-related statistics.

50. Statistics for relatively large disasters benefit from greater attention from post-disaster assessments and specially targeted data collections after the occurrences. Smaller and more frequent disaster occurrences will also have data on impacts collected and compiled into national databases, but they will rely more heavily on the regular and continuous sources of official statistics, such as including questions in household surveys or extracting information from monitoring systems operating in areas of the country exposed to hazards. Therefore, an additional consideration for prioritization is addressing challenges with coverage of extensive disaster risks, or the small and medium-scale disasters, that may not be as well captured by the existing compilations of impacts data and analysis.

Development of Technical Standards

51. After a suitable institutional environment has been established, with development of priorities, responsible agencies are ready to establish standards for developing the databases for harmonization and consistency in the variables over time. Key steps towards achieving technical standardization or harmonization for the content of national databases are:

a. Identify a basic range of statistics and mapping of existing data sources (see Chapters 8 and 9);

b. Adopt common definitions, an official glossary of hazard types (for statistical purposes), classification systems (where relevant), and standards for measurement units for each variable across the involved institutions producing official data. (Reference tools for this step are provided in Chapters 7 and 8); and

c. Develop database structure and establish sustainable and regular compilations of data using SDI.

CHAPTER 7: BASIC RANGE OF DISASTER-RELATED STATISTICS

1. A collection of summary statistics tables was developed for the DRSF as the basic templates for extracting statistics from the underlying databases in line with the recommendations in this handbook and comprehensively for the basic range of disaster-related statistics. The DRSF Basic Range of Disaster-related Statistics tables are presented in the Annex and also are available in spreadsheet (.xls) format on the expert group's website.[39] The Basic Range of Disaster-related Statistics tables was developed based on pilot studies and extensive discussions by the expert group. Each variable is a potential output from querying the national disaster-related statistics databases. The tables are comprehensive of the basic range according to multiple purposes by national agencies according to their own needs, such as for gap assessments.[40]

2. Most of the statistics in the basic range are compatible with GIS, meaning that the variables are associated with a standardized system of geo-referenced coding.

3. One of the advantages of working with data in geographic information system (GIS) is that statistics can be produced and calculated and reported flexibly at different geographic levels according to administrative and/or functional classifications of geographic areas (e.g. provinces, municipalities, river basins, buffer areas, hazard areas). The sample DRSF basic range tables provide a generic presentation ("Geo Region 1", "…"), adaptable to the different needs or availability of geographically disaggregated data.

4. A general minimum recommendation for the disaster impacts statistics is to attribute human and material impacts according to the district or municipality level of administrative region.

5. The basic range of disaster related statistics is organized according to generic tables or categories of tables, as follows:

- **A:** Summary tables of disaster occurrences;
- **B:** Selected background statistics and exposure to hazards;
- **C:** Summary tables of human impacts;
- **D:** Summary tables of direct material impacts in physical terms;
- **E:** Summary tables of direct material impacts in monetary terms;
- **F:** Summary of material impacts to Agriculture;
- **G:** Summary table of direct environmental impacts; and
- **DRRE:** Disaster risk reduction expenditure accounting

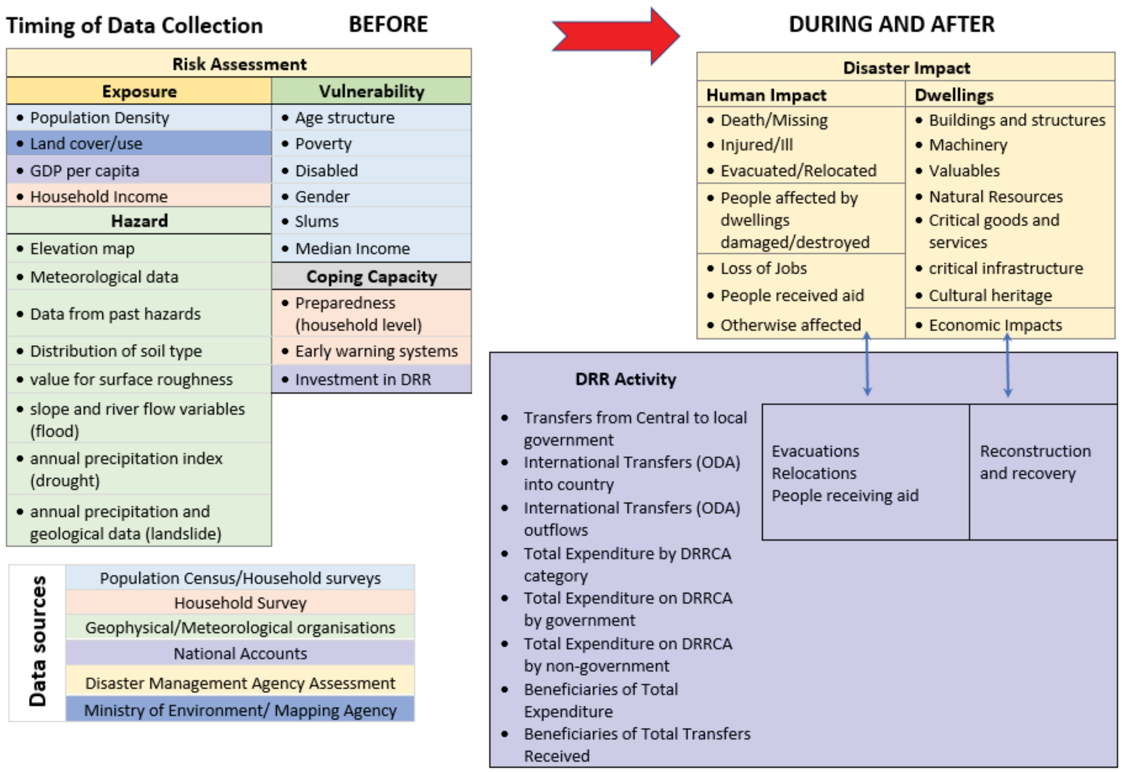
[39] https://stat-confluence.escap.un.org/x/1oL2

[40] Note: these tables are not designed for international collection of or monitoring of statistics using. The tables are presented as a tool for use by agencies responsible for developing relevant official statistics. The only relevant internationally agreed monitoring systems are the Sendai Framework Monitor and the SDG Indicators.

6. The scope for the basic range of disaster-related statistics (Figure 2.2) can be summarized in terms of a basic timeline, in relation to the cycle of disaster management. This relates to before, during and after the disaster occurrence.

Figure 6.1

Basic range of disaster-related statistics before, during and after a disaster



Summary tables of disaster occurrences (A tables)

7. Identifying a disaster occurrence is an essential element for centralized compilations of impacts statistics because of the need to attribute impacts specifically to disasters (Chapter 2). Additionally, long-term series of data on disaster occurrences and their basic characteristics (geography, timing, hazard type) are useful for many different types of trend analyses, such as the dynamics of risk and for measuring the relative intensity of impacts from individual occurrences over time.

8. A register or listing of disaster occurrences with data on their basic characteristics is the basic structure that has been used in DesInventar as in the sample below, drawing from the example seen previously, in Chapter 2.

Sample of registry of disaster occurrences

Code	Geo 1	Geo 2	Geo 3	Geo 4	Em. beginning	Em. End (d-m-y)
Fl2018-01-THA	Central Region	Chao Phraya River Basin	Samut Prakan	Central District	01-05-18	04-05-18

Dr2019-01-THA	Northeast	Mekong	Roi Et		01-06-18	01-06-18
……	……	……	……	……	……	……

9. Table A1 (see annex) is an organized extraction (or database query) from these types of basic records on disaster occurrences as initially recorded and archived by disaster management agencies. Logical groups for organizing statistics on disasters and their impacts are by geographic regions and by types of hazard, over time.

Selected background statistics and exposure to hazards (B tables)

10. A basic range of background statistics used in risk assessments are summarized in tables B1, B2, and B3.

11. Exposure to hazards is generally calculated by disaster management agencies, utilizing statistics from various sources for mapping hazards and mapping exposure of population, land and infrastructure derived from the existing official sources.

12. Measures of vulnerability are potentially vital background statistics, but difficult to define *a priori* and may involve complex relations with multiple factors. To develop an empirical approach to measuring vulnerability prior to a disaster, there is a need to develop a basic minimum selection of categories for disaggregated statistics describing the population and infrastructure, especially for hazard areas, as was developed as an example in Table B1b: Population Exposure by social groups, as:

- Age groups;
- Sex;
- Urban vs. rural populations;
- Persons with disabilities; and
- Economic poor (income below national or international poverty)

13. By agreement in the Sendai Framework, governments report on number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms. These and other underlying statistics for describing coping capacity, or resilience, to disasters could be extracted from official databases to produce a summary resembling table B3: Coping Capacity Background Statistics.

14. There are also background statistics compiled on a regular basis primarily for other purposes that may need to be investigated for estimating magnitudes of impacts in disaster areas. An example (not included in tables in the Annex) is collection of data on crop values, on average by growing areas, which are used for estimation of economic impacts to agriculture.

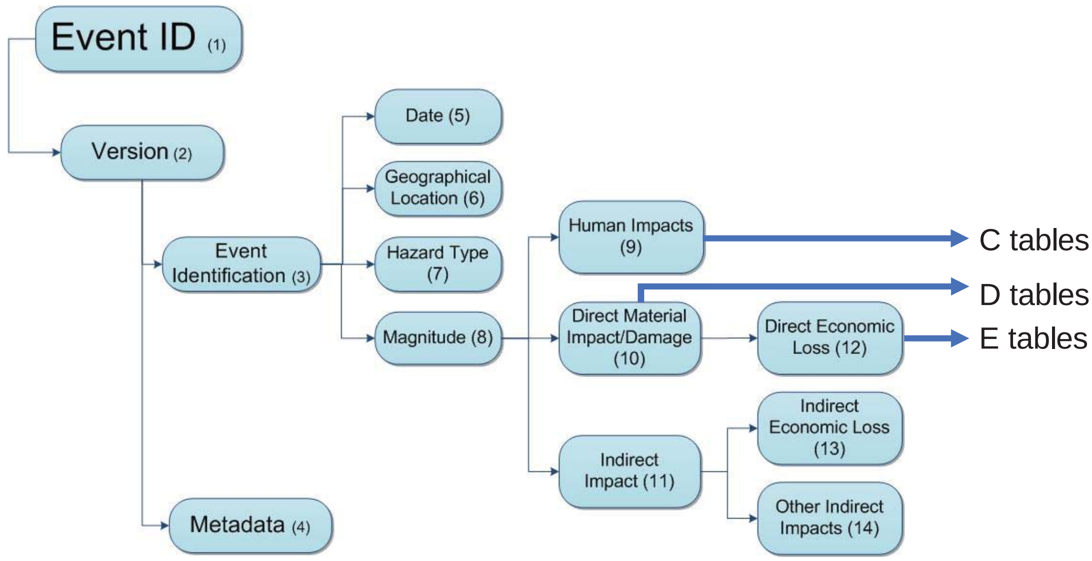
Summary tables of human impacts (C tables)

15. Impacts statistics (C, D, and E tables) are collected and coded in association with each individual disaster occurrence, following the basic model in Figure 4.1 and could be summarized as annual or multi-year statistics according to hazard types, geographic region, and according to demographic and social categories (where applicable).

16. These records can be summarized in statistics for each variable according to hazard types or geographic regions for annual monitoring by utilizing the references to the characteristics of the disaster occurrences.

Figure 6.2

From Data Model to Summary Tables



17. As mentioned in Chapter 4, a simple aggregation across human impacts creates multiple possibilities for double-counting of the same individuals. This issue is potentially managed by estimation of numbers of multiple impacts to the same individuals for an adjustment at the bottom of the table. If it is possible to adjust for double-counting in the totals, there will be two related but conceptually distinct aggregated counts across human impacts categories (see bottom of C tables)[41]: the total number of impacts, including individuals impacted in multiple ways (which is the Sendai Framework "affected population" indicator) or the number of people experiencing one or more impacts.

18. For disaggregation by social groups, references to national definitions should be applied, and documented clearly in metadata for: urban and rural, poor (i.e. national poverty line if it exists), and persons with disabilities. Sex and age disaggregation can have a variety of uses in analysis and should always be included in compilations of human impacts wherever possible. It is recognised that practices may differ across countries (e.g. for defining age group categories). The Sendai Framework Monitor compiles statistics from reporting agencies on impacts by three categories: 0-15, 16-64 and 65+. However, as discussed in Chapter 4, other groupings, e.g. a category for infants (e.g. 0-5 years old) may be important for assessing vulnerability.

[41] For example, if as direct consequence of a disaster, two people are injured, and one person is both injured and had her house destroyed, the total number of persons impacted is 2 and the total number of human impacts (Sendai Framework indicator B1) is 3. Neither figure is wrong, they are simply measurements of slightly different things.

Summary tables of direct material impacts (D tables)

19. Direct material impact (D) tables are for recording direct material impacts in "physical" terms, such as area (sq. m.) of damages or number of buildings, by categories. Recommendations for physical measurement units are presented later in this Chapter.

20. Direct impacts to cultural heritage and to the environment are identified separately due to special characteristics regarding measurement units and monetary valuation. Cultural heritage is unowned (or part of public owned infrastructure) with special value to the population and often they are irreplaceable.

21. Disruptions of basic services from a Disaster (D2 tables) are presented as an optional extension of direct material impacts tables, especially impacts to critical infrastructure. In the Sendai Framework, disruptions to services are consequence of damaged or destroyed infrastructure and the global indicator refers to statistics on numbers of units of critical infrastructure damaged or destroyed. However, some national agencies are also collecting data number of people affected and length of time by the types of disruptions.

Summary tables of direct material impacts in monetary terms (E tables)

22. Material impacts are estimated at first in physical terms (D tables) and then, compilations of the costs for reconstruction or replacement are applied to produce international indicators on Direct Economic Loss according to the Sendai Framework indicators (E tables). Also, the FAO developed a table, consistent with the DRSF format (Table F), which specifies the scope of basic range material impacts statistics relevant to agriculture, forestry, and fisheries.

23. The direct material impacts in monetary terms are broadly the same as direct material impacts (D tables), the difference being that the measurement units is amount of money. Monetary valuations of material impacts needed for calculating direct economic loss (SDG 1.5.2 and Sendai Framework Target C indicators) are based, in most cases, according to the costs of reconstruction or replacement of damaged or destroyed assets.

24. As discussed in Chapter 4, the monetary values compilations for material impacts normally requires a combination of data sources, including insurance claims assessments or assessments for cost of reconstruction, the recorded values of assets prior to a disaster (where available), records of actual transactions for recovery of damages (expenditure on post-disaster reconstruction) and average costs of crops or other exposed assets for estimating costs of damages based on average per unit values.

Summary material impacts to Agriculture (F table)

25. The FAO developed a table, consistent with the DRSF format (Table F), which specifies the scope of basic range material impacts statistics relevant to agriculture, forestry, and fisheries, by hazard types.

26. Impacts to agriculture presents some special considerations regarding measurement units, and particularly for monetary valuation of the impacts (see discussion in Chapter 4).

Summary tables of direct environmental impacts (G tables)

27. Environmental impacts variables (G tables) are built upon a nationally standardized classification of land cover types (such as the 14-class example presented in the G tables in the Annex). There are also functional categories of land cover that could be of special interest for assessing direct impacts such as designated biological reserves and World Heritage sites.

28. Monitoring impacts to water resources, ideally, should be an extension of data collection and monitoring programmes of national and regional water authorities.

29. Emissions of sulphur associated with volcanic eruptions and carbon emissions from wildfires are typically estimated by institutions responsible for official scientific monitoring of atmospheric conditions. Some national space agencies or other international scientific organizations are monitoring these emissions globally.

Disaster Risk Reduction Expenditure and Transfers (DRRE Tables)

30. The DRRE tables are sample accounting tables, to be developed as special functional accounts or “satellite accounts” of the national accounts, following, as much as possible, the standard practices of the System of National Accounts (SNA).

31. While disasters, and their impacts, are occurring randomly, disaster risk reduction is a continuous activity. Certain activities such as post disaster reconstruction are boosted in the recovery period after a major disaster and are related to disaster response and informed by the gradual improvements in knowledge on disaster risks and strategies to minimize them.

32. The disaster risk reduction activity accounting tables have been developed in alignment with the standards and formats of the System of National Accounts (SNA) because the information in these tables are extractions from the broader aggregated accounting framework for the whole economy. In principle, DRRE tables could be derived from the same data sources that are used in national accounts. This is dependent on the possibility of separately identifying the portions of activities with a primary disaster risk reduction purpose.

Measurement units for material impacts statistics

33. Recommendations for measurement units for the objects of material impacts as classified in Chapter 6 and in the D tables are specified below. Measurement units are a basic and vital consideration for the design of basic data collections on impacts and their compilation into nationally centralized databases.

34. There are multiple possibilities for measurement units and for material impacts statistics and national compilations should aim to converge toward consistency across disaster occurrences for improved quality of disaster impacts time series statistics. The options are not mutually exclusive, and for some cases, e.g., dwellings it is necessary to collect the same information in multiple units of measurement, e.g., number of people and number of units.

35. Thus, presented below is a ‘menu’ of recommendations for measurement units by category of material impacts, focussing on critical infrastructure and noting that for some cases multiple options from the menu might be selected for data collection.

36. Infrastructure is heterogeneous by nature. It includes buildings, equipment, land, and inventories. There is no possibility to produce an aggregated count of total damages to critical infrastructure without a common unit of measurement across all the relevant types of assets (i.e. monetary valuation).

37. Initially impacts to critical infrastructure are observed in physical terms, individually for each type of infrastructure or type of damages. For many types of critical infrastructure, a simple option is to count number of units, e.g., buildings, and where possible these counts are made more meaningful by utilizing categories already used in statistics or in their management by governments. For example, many countries use a tiered system to classify the different types of health facilities (from large hospitals down to small clinics). Thus, databases could keep records of numbers of tier 1, tier 2 and tier 3 facilities damaged or destroyed over time.

38. Defining the measurement units applies both to statistics on impacts and statistics on exposure of critical infrastructure, prior to the disaster. These compilations need to be coordinated closely with the relevant ministries, e.g., Ministry of Education, Ministry of Health, and Ministry of Transport who are typically responsible for official categorizations of facilities (if available) and the general monitoring and management of the infrastructure.

Menu of physical measurement units for material impacts

	Measurement units		
Dwellings	No. of units (households)	No. of people	Area in sq. m.
Critical infrastructures			
Hospitals, health facilities	No. of buildings by official category (tier 1, tier 2,)	capacity (no. of beds)	sq. m.
Education facilities	No. of buildings by official category (tier 1, tier 2,)	capacity (no. of students)	sq. m.
Other critical public administration buildings	no. of units		
Public monuments	no. of units		
Religious buildings	no. of buildings by official category		
Roads	km	capacity (avg. daily traffic affected)	no. of roads by official category
Bridges	km	capacity (avg. daily traffic affected)	no. of bridges by official category
Railways	km	Capacity (avg. daily passenger and/or tonnes of shipping)	
Airports	no. of buildings by official category	capacity (avg. daily traffic affected)	
Ports	no. of units by official category	capacity (avg. daily traffic affected)	
Transport equipment	no. of units		

Electricity generation facilities	no. of units	capacity (no. of people affected)	
Electricity grids	no. of units	capacity (no. of people affected)	
ICT Equipment	capacity (no. of people affected)	no. of units	
Dams	no. of units by official category	no. of units	capacity (no. of people affected)
Water supply infrastructure	no. of units	capacity (no. of people affected)	
Water sewage & treatment systems	no. of units	capacity (no. of people affected)	
Agriculture land, livestock, fish stocks, and managed forests	sq. km	capacity (food production affected)	

Dwellings

39. For the special case of dwellings, the number of units is mostly aligned with number of households impacted. Individual buildings may have multiple units, e.g., apartment buildings affected by a disaster and the number of units should be developed as a good approximation for the number of households affected by damaged or destroyed dwellings, i.e., counts of units, not counts of buildings.

40. If basic data on the number of individuals residing within each affected dwelling are not available for the impacts assessment, this can be estimated based on statistics on average household size within the affected area. However, compilers should take into account that household sizes vary geographically and by other factors, e.g., poverty that are also potentially correlated to disaster impacts.

41. It's also useful to compile data, where feasible, on estimated size or area of damages (in terms of square meters of damage) as an input for estimating expected costs of the damages. The severity of impacts is linked to the distinction a damaged or destroyed asset, an important distinction especially in the case of dwellings because a destroyed dwelling results in temporary or permanent displacement of the household and damages need to be repaired (either with or without temporary displacement).

Dwellings	**No. of units (households)**	**No. of people**	**Area in sq. m**	**Cost of impacts in local currency**
Damaged				
Destroyed				

42. If data are available for identifying shares of cases of insured or uninsured losses, an additional disaggregation could be introduced, such as:

Dwellings	**No. of units (households)**	**No. of people**	**Area in sq. m**	**Cost of impacts in local currency**
Of which costs insured				

Of which costs uninsured				
Of which insurance status unknown				

CHAPTER 8: DEFINITIONS AND CLASSIFICATIONS

1. Standard definitions and classifications for statistics are developed and adopted by national and international agencies to ensure a reasonable comparability in use of terminologies and in aggregated scope of measurement between countries and over time. Statistical classifications group and organise information meaningfully and systematically, usually in discrete, exhaustive and mutually exclusive sets of categories that are defined according to a set of criteria for similarity. (Hancock, 2013)

2. Statistical classifications are exhaustive listings of the contents of defined categories, even if not all elements are commonly measured currently as part of official statistical systems. Exhaustiveness in the classifications is an important factor for the classification's function as a description for the groups of concepts, ideas, events, or objects that constitute the topic. Classifications are tools for explanation and elaboration of coverage of the available data, statistics, or indicators, including cases where not all elements are relevant or could be measured. In other words, classifications do not define what should be measured in every instance, rather they are tools for clarifying scope of measurement in each instance.

3. The United Nations Statistics Commission has developed a set of principles and essential components for statistical classifications (Hoffman and Chamie, 1999). For development of new classifications or categories for statistics, it is important to build on sound and established concepts and practices but also incorporate emerging conceptual or technological innovations to produce a system that will remain robust and applicable for the harmonization of statistics across countries for producing time series statistics in the long-run.

4. During the development of DRSF, the Expert Group, identified three gaps in terms of classifications systems or complete definitions for disaster-related statistics: (i) hazard types (ii) the objects of direct material impacts, and (iii) disaster risk reduction activities (DRRCA).

5. In response to these gaps, the Expert Group developed a set of provisional recommendations, including two proposed provisional classifications. This chapter elaborates recommendations for development of these classifications, as a contribution to further consultation, at the global level, towards increased international harmonization of related statistics.

6. Further study is recommended, including pilot testing implementation by official national agencies, for the following proposed provisional classifications and definitions, followed by further consultations towards standardization at the global level, for all three of the topics covered in this chapter.

Hazards types

7. As mentioned in Chapter 2, lists of relevant hazards are developed at the national scale, in some cases according to official policy legislated by government. Disaster risk is also extremely variable across country and regions within countries and not all hazard types are relevant in each country. Thus, countries have different lists of relevant hazard types at the detailed level. However, at the broad aggregated level, this diverse range of hazards can be

summarized, for statistical purposes, in comparable aggregates that are useful for analysis of trends and for informed risk reduction.[42]

8. Methodological guidance for monitoring the Sendai Framework indicators recommended utilizing the IRDR Peril and Hazard Glossary (IRDR 2014). In IRDR (2014), the most aggregated level in the classification is called the hazard "family":

a. Geophysical;
b. Hydrological;
c. Meteorological and Climatological;
d. Biological; and
e. Other (e.g., technological and environmental hazards)

9. There are two additional categories of hazard types identified for monitoring the Sendai Framework monitoring: "**technological hazards**"[43] and "**environmental hazards**".[44.]

10. Other types of hazards excluded from the scope of IRDR (2014) are violent conflicts, including civil war and the associated human crises, e.g. refugee crises. The OECD estimates that approximately 80 per cent of international transfers of humanitarian aid goes to complex disasters and conflict-related settings.[45.] However, these circumstances are excluded from the scope of Sendai Framework monitoring, according to the Report of the OEIWG (UN, 2015), which excludes "the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation".

11. The IRDR glossary has a hierarchic structure, meaning it presents multiple levels of aggregation, called "Family" (see above), "Main Event", and "Peril". There are established lists of hazard types for data collection in many countries, usually approximately corresponding with the "Main Event" or "Peril" levels in IRDR (2013). However, for international comparisons the more aggregated family level is the most comparable and suitable for a wide range of purposes.

12. There are also other aggregations or grouping of hazard types that are of particular interest for trends analyses, such as **climate-related disasters**, which can be derived from a

[42] For example, if country 'A' records statistics for floods, flash floods and country 'B' records statistics only for a generic category called floods, the two countries' statistics could still be broadly coherent and comparable at the level of hydrological disasters.

[43]Technological hazards "originate from technological or industrial conditions, dangerous procedures, infrastructure failures or specific human activities. Examples include industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires and chemical spills. Technological hazards also may arise directly as a result of the impacts of a natural hazard event."- UNGA (2015)

[44] Environmental hazards "may include chemical, natural and biological hazards. They can be created by environmental degradation or physical or chemical pollution in the air, water and soil. However, many of the processes and phenomena that fall into this category may be termed drivers of hazard and risk rather than hazards in themselves, such as soil degradation, deforestation, loss of biodiversity, salinization and sea-level rise." - UNGA (2015),

[45] See statistics on humanitarian aid at stats.oecd.org

grouping of IRDR hazard types. These are hazards in the meteorological and hydrological hazard families as defined by IRDR (2014).[46]

13. **Climate** is "the synthesis of weather conditions in a given area, characterized by long-term statistics (mean values, variances, probabilities of extreme values, etc.) of the meteorological elements in that area." (WMO, 2017). The Intergovernmental Panel on Climate Change (IPCC) has indicated a strong likelihood that climate change will lead to increases in frequency and severity of related hazards, and reduce overall predictability of such hazards based on historical records (see, e.g., IPCC, 2012 and Birkman, 2013). Trends will be different and unevenly distributed across the globe. Statistics are needed for assessing how climate change may be impacting disaster risk for different countries or different regions over time.

14. A **cascading multiple-hazard disaster occurrence** is a disaster in which one type of hazard, such as a strong storm causes one or more additional hazards, e.g., flooding or landslides, creating combined impacts to the population, infrastructure and the environment. Cascading multiple-hazard are not two events with proximate timing or locations by coincidence. They are events that are causally linked to the same original trigger hazard, and thus are part of a single (multi-hazard) disaster occurrence. Cascading multi-hazard disasters can be reported as their own specialized category of hazard types, noting for categorization purposes the original trigger hazard, e.g. storm, as well as the connected hazards, e.g., floods, landslide.

15. Given enough available data and the right monitoring infrastructure, slowly evolving catastrophic risk or "**slow onset disasters**"[47], can potentially be identified as major risks early on in order to develop preventative and mitigation measures to reduce risks of impacts. A "**sudden-onset disaster"**[48] is characterized by having very little, if any, prior warning to a specific event. Sudden-onset disasters do not always end as quickly and definitively as they begin. Earthquakes, for example, often are followed with aftershocks. Volcanic eruptions can be either sudden or slow-evolving disasters. Thus, one of the unfortunate and common characteristics for both slow-onset and sudden-onset disasters is that they are difficult to determine, in concrete measurement terms, exactly when the hazards begin and when the impacts of disasters cease.

Classification for objects of material impacts

16. A classification for objective material impacts is needed to define, delineate and create comparability in scope of measurement for aggregated statistics on direct material impacts. The European Joint-Research Centre (JRC, 2005) called these objects the "affected elements".

[46] Alignment with meteorological and hydrological families of IRDR can be broadly applied for scope for measurement of climate-related disasters. However, some special distinctions may be needed in the details, for example to distinguish between fires that are accidents caused directly by human activities in urban area as compared to wildfires that are consequences of extreme climate conditions (dry heat). Further study of relationships between hazard types and analyses of climate change is suggested as an area for further study.

[47] "A **slow-onset disaster** emerges gradually over time. Slow-onset disasters could be associated with, e.g., drought, desertification, sea level rise, epidemic disease." (UNGA, 2015)

[48] **"A sudden-onset disaster** is one triggered by a hazardous event that emerges quickly or unexpectedly. Sudden-onset disasters could be associated with, e.g., earthquake, volcanic eruption, flash flood, chemical explosion, critical infrastructure failure, and transport accident." (UNGA, 2015).

17. The "affected elements" are a subset of all the exposed elements of the physical infrastructure from the risk assessment statistics. They define the scope of disaster impacts in terms of geographic areas, indicators, and (initially measured in physical terms) represent the scope for valuations of direct economic loss indicators.

18. Implementation of this objective material impact classification is used to:

a. create comparability in scope of measurement for aggregated statistics on disaster impacts, e.g., direct economic loss measurement;
b. improve coherence in categorization or cross-disaster compilations of material impacts statistics, noting that sometimes impacts assessments are conducted or indicators calculated based on incomplete information; and
c. help establish linkages, where relevant, between post-disaster collection of data on impacts by disaster management agencies with the existing systems of baseline economic statistics and to address the specialized functional requirement for an applied definition for critical infrastructure.

19. Recommendations on measurements units (size/length, area, etc.), for recording statistics in physical terms for each of the affected objects are provided in Chapter 5

20. Although one of the principle recommendations for developing statistical classifications (see Hancock, 2013) is, as much as feasible, to create statistical balance across the categories in a classification structure, there is an intentional imbalance in the presentation below, mainly because of the need for a detailed focus on critical infrastructure.

21. The classification below is designed as a comprehensive response to statistical demands for disaster-related statistics. However, further testing and development is recommended involving classifications experts and utilizing actual data collected on material impacts from a disaster.

22. Most of the groupings and definitions utilized in this section come from one of two sources:

a. The "Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction" (2015), which was further elaborated for the Sendai Framework Monitor in UNISDR (2017).
b. The 2008 edition of the System of National Accounts (UN, 2008), as well as some aligned or related sources of definitions such as the International Central Product Classification (CPC), Ver.2.1, the UN Central Product Classification (CPC ver. 2.1) and the System of Environmental-Economic Accounts –Central Framework (SEEA).

23. Each object can be either **damaged** or **destroyed.** Damages are the partial physical destruction to buildings or other objects. Destroyed assets are assets which are beyond repair. A destroyed asset is a total loss in terms of asset value and replacement would require a complete reconstruction.

24. The scope of this classification was developed in relation to the definition of assets from the SNA, because the Sendai Framework definition for direct economic loss (see Chapter 2) refers explicitly to impacts on assets. An exception is household consumer durables, which are not assets according to the SNA definition, but are potentially important objects of direct material impacts from disasters.

Draft provisional classification for objects of material impacts from disasters

1. Buildings and structures

Buildings and related structures, fixtures or land improvements.

1.1 Dwelling

Residences, including residential buildings or parts of building or other structures used as residences.

SNA defines dwellings as "buildings, or designated parts of buildings, that are used entirely or primarily as residences, including any associated structures, such as garages, and all permanent fixtures customarily installed in residences. Houseboats, barges, mobile homes and caravans used as principal residences of households are also included, as are public monuments identified primarily as dwellings. [SNA 10.68]; CPC Ver 2.1 class 5311.

1.2 Critical buildings and structures

Critical buildings and structures are defined as a specialized sub-category of buildings and structures for disaster statistics.

The physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society are critical buildings and structures. [UNGA, 2015]. Most critical infrastructures are assets involved in providing non-profit services, according to the SNA.

1.2.1 Healthcare facilities

Defined in CPC 5312 ("non-residential buildings") heath care facilities are: health centres, clinics, local, regional and tertiary hospitals, outpatient centres, health laboratories and in general facilities used by primary health providers.

1.2.2 Education facilities

Defined in CPC under 5312 "non-residential buildings" education facilities are: play schools, kindergartens, primary, secondary or middle schools, technical-vocational schools, colleges, universities, training centres, adult education, military schools and prison schools.

1.2.3 Public monuments

Public monuments are identifiable because of their historical, national, regional, local, religious or symbolic significance [SNA 10.78]. Public monuments include religious buildings or other facilities that often have additional functions for the community, including as refuge or assembly areas in the case of an emergency.

1.2.4 Other critical public administration buildings

Public buildings providing public services, other than those already mentioned are included in this category.

They include buildings used for refuge, assembly or as evacuation centres not otherwise classified (e.g. excluding public monuments), as well as buildings belonging to emergency response institutions, such as fire, police, army and emergency operation stations.

1.2.5 Roads

Defined in CPC under 532 "Civil engineering works", roads include highways, paved roads and unpaved roads.

1.2.6 Bridges

Defined in CPC under 532 "Civil engineering works", bridges include road bridges and railroad bridges.

1.2.7 Railways

Railways include surface railroads, underground railroads and railway stations.

1.2.8 Airports

Airports includes International airports, National airports; "Passenger Transport Services (CPC 64) and Freight Transport Services (CPC 65).

1.2.9 Piers

Piers include National and International ports, Fisheries ports, and other docks and piers; "Passenger Transport Services "(CPC 64) and "Freight Transport Services" (CPC 65)

1.2.10 Transport equipment

Transport equipment within SNA asset definition (excluding consumer durables) consists of equipment for moving people and objects. Examples include products other than parts included in CPC 2.0 division 49, transport equipment, such as motor vehicles, trailers and semi-trailers, ships, railway and tramway locomotives and rolling stock; aircraft and spacecraft; and motorcycles, bicycles, etc. [SNA 10.84]. It includes pipelines for transporting oil or gas.

1.2.11 Electricity generation facilities

Electricity generation facilities include, power stations and substations, refineries and CPC 532 "Civil engineering works".

1.2.12 Electricity grids

Electricity grids include power grids, transmission lines; CPC 532 "Civil engineering works".

1.2.13 ICT equipment

Information, computer and telecommunications (ICT) equipment consists of devices using electronic controls and the electronic components forming part of these devices. Examples are products within CPC 2.0 categories 452 and 472. In practice, this narrows the coverage of ICT equipment mostly to computer hardware and telecommunications equipment. [SNA 10.85]; ICT equipment includes telephone networks and other communication networks, related facilities for internet connectivity, radio and television stations.

1.2.14 Dams

Dams are artificial barriers presenting the flow of water for one or more purposes, including electricity production and water storage; CPC 532 "Civil engineering works".

1.2.15 Water supply infrastructure

Water supply infrastructure includes drinking water supply systems (water outlets, water treatment plants, aqueducts and canals which carry drinking water, storage tanks), wells, and reservoirs; CPC 532: "Civil engineering works".

1.2.16 Water sewage and treatment systems

Water sewage and treatment systems includes sanitation and sanitary sewage systems and collection and treatment of solid waste; CPC 532: "Civil engineering works".

1.2.17 Other critical infrastructures

Other critical infrastructures include buildings or structures with critical functions, particularly for disaster risk reduction or other protection functions, not elsewhere included, such as underground water infiltration trenches and storage systems, regional storm water reservoirs, flood protection walls and river defences, drainage systems and water storage systems. It also includes canals and other water management systems classified as critical but not included under water supply or treatment systems above. It may also include military installations and weapons systems.

1.3 Other buildings and structures

Other buildings and structures include all other buildings and structures, defined according to CPC and not designated as critical. These include commercial buildings or public government buildings, or facilities not included as critical. Also included are waste management plants and landfills and parks and green areas, or other permanent structures not otherwise classified.

2. Machinery and equipment

Machinery and equipment covers transport equipment, machinery for information, communication and telecommunications (ICT) equipment, and other machinery and equipment.

2.1 Critical machinery and equipment

Critical machinery and equipment are defined as a sub-category of assets for disaster statistics, particularly transportation, communication, and other equipment used for emergency response.

Critical machinery and equipment includes machinery and equipment used within critical buildings or other structures for providing basic services, such as equipment in health facilities, education facilities, and transportation equipment classified as critical.

2.2 Other machinery and equipment

Other machinery and equipment consists of machinery and equipment not classified as critical in 1.3. Examples include products included in the International Central Product Classification

(CPC), CPC Ver.2.1 divisions 43, general purpose machinery; 44, special purpose machinery; 45, office, accounting and computing equipment; 46, electrical machinery and apparatus; 47, radio, television and communication equipment and apparatus; and 48, medical appliances, precision and optical instruments, watches and clocks.

3 Environmental resources

3.1 Agricultural Land

Agricultural land consists of the ground, including the soil covering and any associated surface waters, over which ownership rights are enforced and from which economic benefits can be derived by their owners by holding or using them (SNA, 2018). Agricultural land includes the land and improvements to land used for production of agriculture.

3.2 Managed forests

Managed forests include areas that have a long-term documented management plan. They include planted forests, which are predominantly composed of trees established through planting and/or deliberate seeding.

3.3 Primary/Natural forest

Primary/natural forests are defined as forest areas other than managed or planted forests. They are naturally regenerated forests of native species, where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed. Key characteristics of primary forests are that: (a) they show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes; (b) the area is large enough to maintain its natural characteristics; and (c) there has been no known significant human intervention or the last significant human intervention occurred long enough in the past to have allowed the natural species composition and processes to have become re-established. [SEEA 5.286]

3.4 Cultivated biological resources

3.4.1 Livestock

Livestock are animal resources yielding repeat products and includes animals whose natural growth and regeneration are under the direct control, responsibility and management of institutional units. They include breeding stocks, dairy cattle, draft animals, sheep or other animals used for wool production and animals used for transportation, racing or entertainment. Animals raised for slaughter, including poultry, are not fixed assets but inventories. (SNA)

3.4.2 Fish stock and fisheries

Fish stock and fisheries includes aquatic resources yielding repeat products, consisting of aquatic resources maintained for controlled reproduction. These include aquatic plants (seaweeds), crustaceans, diadromous fishes, freshwater fishes, marine fishes and mollusks.

3.4.3 Work-in-progress Agricultural Crops – for all primary crops

"Work-in-progress consists of output produced by an enterprise that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units. Work-in-progress occurs in all industries, but is especially important in those in which some time is needed to produce a unit of finished output, for example, in agriculture, or in industries producing complex fixed assets such as ships, dwellings, software or films. Although work-in progress is output that has not reached the state in which it is normally supplied to others, its ownership is nevertheless transferable, if necessary. For example, it may be sold under exceptional circumstances such as the liquidation of the enterprise." [SNA 10.134]

See FAO Indicative Crop Classification (ICC)

3.4.4 Annual crops

Annual crops are those that are both sown and harvested during the same agricultural year, sometimes more than once;

3.4.5 Perennial crops

Perennial crops are sown or planted once and are not replanted after each annual harvest. Annual perennial crops include cereals, pulses, roots and tubers, sugar crops, some oil-bearing crops, some fiber crops and vegetables, tobacco, and fodder crops. Perennial primary crops include fruits and berries, nuts, some oil-bearing crops and spices and herbs.

3.5 Non-cultivated biological resources

Non-cultivated biological resources consist of animals, birds, fish and plants that yield both once-only and repeat products over which ownership rights are enforced but for which natural growth or regeneration is not under the direct control, responsibility and management of institutional units. Examples are virgin forests and fisheries within the territory of the country. [SNA 10.182]

3.6 Water resources

Water resources consist of surface and groundwater resources used for extraction to the extent that their scarcity leads to the enforcement of ownership or use rights, market valuation and some measure of economic control. [SNA 10.184]

4. Valuables (SNA asset definition)

Valuables are produced goods of considerable value that are not used primarily for purposes of production or consumption but are held as stores of value over time. Valuables are expected to appreciate or at least not to decline in real value, nor to deteriorate over time under normal conditions. They consist of precious metals and stones, jewellery, works of art, etc. Valuables may be held by all sectors of the economy. [SNA 10.13]

4.1 Art objects, music instruments

Paintings, sculptures, etc., recognized as works of art and antiques are treated as valuables when they are not held by enterprises for sale. In principle, museum exhibits are included under valuables. [SNA 10.153]

4.2 Other valuables

Other valuables not elsewhere classified include such items as collections of stamps, coins, porcelain, books etc. that have a recognized market value and fine jewellery, fashioned out of precious stones, and metals of significant and realizable value. [SNA 10.154]

5. Inventories (SNA asset definition)

Inventories are produced assets that consist of goods and services, which came into existence in the current period or in an earlier period, and that are held for sale, used in production or for other use at a later date. [SNA 10.142]

5.1 Inventories of agricultural crops

Includes all primary crops; see FAO Indicative Crop Classification (ICC)

5.2 Inventories of agricultural inputs

Products used as inventories in production of crops; includes seeds, fertilizer, feed, and fodder.

5.3 Other inventories

Other inventories include all other produced assets aligned with SNA definition for inventories.

6. Household consumer durables

Household consumer durables are durable goods acquired by households, which are held over multiple accounting periods but are not used in a production process (and therefore not classified as assets). An example is privately owned automobiles. The Classification of Individual Consumption According to Purpose (COICOP), which is currently under revision, clarifies the difference between durable versus non-durable or semi-durable goods.

Disaster Risk Reduction Characteristic Activities (DRRCA) Classification

25. The Sendai Framework describes disaster risk reduction (DRR) as a scope of work "aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contributes to strengthening resilience. DRR encompasses all aspects of work including the management of residual risk, i.e. managing risks that cannot be prevented nor reduced, and are known to give raise to, or already, materialize into a disaster event."

26. The **DRR-characteristic activities** (DRRCA) classification is presented as a draft tool for defining and categorizing this specific domain of interest for the purpose of consistently producing statistics on expenditures and transfers/investments for DRR (see Chapter 5).

27. The terms and definitions used in the proposed DRRCA classification are extracted, as much as possible, from the Sendai Framework and terminologies agreed for Sendai Framework Monitoring (see UNGA, 2015 and UNISDR, 2017).

28. The DRRCA classification and its definitions are provided to help compilers with identifying and organizing the data and metadata from government finance statistics and should be applied and adapted with more detailed descriptions at the national level.

29. DRRCA is a classification of activities. As such, it has a relationship, conceptually, to the United Nations Standard Industrial Classification of All Economic Activities (ISIC), Revision 4. Most DRR-characteristics activities are a part of government (and thus would relate to Section 0 in ISIC, Revision 4: "Public Administration and Defence; compulsory social security"), but there can also be characteristic activities initiated by (or funded by) institutions outside of the public sector, such as domestic non-profit institutions or international development organizations.

DRRCA classification

1. Disaster risk prevention

Activities and measures to avoid existing and new disaster risks.

1.1 Risk prevention in advance of hazardous event

Risk prevention in advance of a hazardous event is a concept and intention to avoid potential adverse impacts of hazardous events. While certain disaster risks cannot be eliminated, prevention aims at reducing vulnerability and exposure in such contexts where, as a result, the risk of disaster is removed. Examples include dams or embankments that eliminate flood risks, land-use regulations that do not permit any settlement in high-risk zones, seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake and immunization against vaccine-preventable diseases.

1.2 Risk prevention in or after a hazardous event

Risk prevention in or after hazardous events relates to prevention measures taken to prevent secondary hazards or their consequences. Included are measures to prevent contamination of water supplies or measures to eliminate natural dams caused by earthquake-induced landslides and/or rock falls.

2. Disaster risk mitigation

Disaster risk mitigation includes activities and measures to reduce or lessen existing disaster risk or to limit the adverse impacts of a hazardous event. Mitigation differs from prevention in that it is reactive to an identified and currently existing risk or impending threat. Thus, the activities mitigate for specific threats, instead of general risk prevention.

2.1 Structural measures, constructions

Structural measures and constructions include any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard resistance and resilience in structures or systems. Common structural measures for disaster risk reduction include constructed dams, flood levies, ocean wave barriers, earthquake-resistant construction, and evacuation shelters. Structural measures will include "building back better" after a disaster.

2.2 Non-structural measures

Non-structural measures are any measures not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts through their integration in sustainable development plans and programmes, through policies and laws, public awareness raising, training and education typically to reduce vulnerability and exposure. Non-structural measures may include risk transfers paid/received (e.g. insurance purchases).

2.3 Land-use planning

Land- use planning can help to mitigate disasters and reduce risks by discouraging settlements and construction of key installations in hazard-prone areas, including consideration of service routes for transport, power, water, sewage and other critical facilities.

2.4 Early warning systems management

Early warning systems management incorporates inter-related sets of hazard warnings, risk assessments, communication and preparedness activities that enable individuals, communities, businesses and others to take timely action to reduce their risks.

3. Disaster risk management

Disaster risk management is the organization and management of resources and responsibilities for creating and implementing preparedness and addressing all aspects of emergencies and others plans to respond to, and to decrease the impact of disasters. The plans set out the goals and specific objectives for reducing disaster risks together with related actions to accomplish these objectives.

3.1 Preparedness

Preparedness is the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current disasters.

3.2 Emergency management

Emergency management includes national-level plans that are specific to each level of administrative responsibility and adapted to different social and geographical circumstances. The time frame and responsibilities for implementation and the sources of funding should be specified in the plan. Linkages to sustainable development and climate change adaptation plans should be made where possible.

3.3 Emergency supply of commodities

Emergency supply of commodities includes resources and responsibilities for providing emergency support of commodities during a disaster.

3.4 Other disaster responses

Other disaster responses include provision of emergency services and public assistance by private and community sectors, as well as volunteer participation.

4. Disaster recovery

Disaster recovery involves the restoring or improving of livelihoods and health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development and "build back better", to avoid or reduce future disaster risk.

4.1 Relocation

Relocation is t the movement of people, for different reasons or circumstances because of risk or disaster, permanently from their places of residence to new sites.

4.2 Rehabilitation

Rehabilitation involves the rapid and basic restoration of services and facilities for the return to normal functioning of a community or a society affected by a disaster.

4.3 Reconstruction

Reconstruction involves the medium and longer-term repair and sustainable restoration of critical infrastructures, services, housing, facilities and livelihoods required for full functioning of communities and livelihoods of residents in a region affected by a disaster.

5. General government, research and development, education expenditure

5.1 General government expenditure for disaster risk reduction

General government expenditure for disaster risk reduction is expenditure, which must be estimated indirectly, incurred by general government on both individual consumption goods and services and collective consumption services, with an explicit disaster risk reduction purpose.

5.2 Research and development, risk assessment, and information

Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios.

ISO 31000 defines risk assessment as a process made up of three processes: risk identification, risk analysis, and risk evaluation.

Risk information includes all studies, information and mapping required to understand the risk drivers and underlying risk factors.

5.3 Education for disaster risk reduction

Education for disaster risk reduction includes natural and engineering science, training of risks professionals and risk specialist medicine professionals.

CHAPTER 9: COLLECTION AND ANALYSES OF STATISTICS IN THE DISASTER RISK MANAGEMENT CYCLE

1. Statistics in this framework are derived from a wide variety of sources. Important data sources for compiling the basic range of disaster-related statistics include:

- Population and housing census, household surveys,
- Monitoring data from geophysical, meteorological and geographic organizations,
- The national accounts and its sources such as enterprise surveys,
- Administrative records on the population (e.g. CRVS) and on public services (e.g. education)
- Government finance statistics,
- Disaster management agency assessments and monitoring,
- Ministry of environment assessments and monitoring, administrative records of health and safety institutions
- specialized surveys targeting disaster-affected households and businesses (where possible)

2. Mapping the existing data sources with the prioritized requirements for a basic range of disasters related statistics is crucial for development of disaster-related statistics.

Before a disaster

3. Risk statistics are the baseline information about the population or infrastructure compiled prior to a disaster for risk areas whereas impacts statistics are information for describing a population affected by a specific disaster occurrence and affected area. However, the disaggregation of statistics on the human impacts, in many cases, simply mirror the categories that were identified in the vulnerability assessments – e.g. children, the elderly and the income poor. Eventually, collections and analyses of statistics before and after a disaster should become a systematic and mutually reinforcing set of linked processes used to improve one another and built upon the same basic initial data collections. For example, baseline statistics on economic activity for areas exposed to hazards are reused for estimating costs of damages in impacts assessments.

Components of basic range of disaster-related statistics: before a disaster

Exposure to Hazards
Vulnerability
Coping Capacity
DRR Activity

4. **Risk assessment** is a process to determine the nature, extent, and locations of risk, by analysing exposure and conditions of vulnerability to hazards and present coping capacities against all types of disaster impacts. A comprehensive risk assessment process consists of understanding of current situation, needs and gaps, hazard assessment, exposure assessment,

vulnerability analysis, loss/impact analysis, risk profiling and evaluation and formulation or revision of disaster risk reduction strategies and action plans.[49]

5. Risk assessment incorporates statistical information from past disasters in combination with a broad variety of current social economic statistics for developing risk profiles in relation to geographic data on potential hazards.

Population and social statistics for risk assessments

6. Population censuses and household surveys are critical sources of data on the population, including their location and basic demographic and social characteristics. These data are the basic inputs for measuring exposure and vulnerability to hazards.

7. Examples of descriptive statistics on the population used in risk assessment from the population and housing census and household surveys are:

- Population density by location
- Characteristics of dwellings (e.g. construction materials)
- Median household disposable income
- Education enrolment, by sex, age group and level of achievement
- Information on assets of households, such as type of dwelling
- Other human development statistics, by age group, including evidence related to nutrition and childhood health,

8. The primary sampling units for censuses (or census blocks) are instruments for organizing census collection operations and usually contain somewhere between 50-350 households, depending on the country and region. The level of geographic aggregation for census data that are available to most users is usually at the level of administrative region (e.g. provinces, municipalities or administrative level 01, 02 and 03 – e.g. districts, provinces, regions).

9. Since censuses, in principle, include everyone, then it is possible to analyse census data at a fine level geographic disaggregation as long as individual confidentiality is not compromised.

10. Estimation of exposure of population to hazards statistics on population is built upon at the population data at the most detailed geographic scale (highest geographic resolution) as available in order to overlay this information in GIS with the maps of hazard areas to calculate the numbers in the overlapping areas.

11. Generally, the higher the geographic detail of the population aggregates, the more accurate the estimates of population in hazard areas. Level of geographic disaggregation varies by data sources, but the information can be integrated using GIS and utilized for multi-scale analyses

[49] http://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/2Disaster%20Risk%20Reduction%20-%20Risk%20Assessment.pdf

12. For example, the Statistics Development Division of the Secretariat for the Pacific Community (SPC) has developed a methodology to estimate coastal populations with higher levels of geographic resolution than the administrative reporting areas, utilizing census data, see the SPC PRISM (see also Andrew et al., *forthcoming*). While the SPC mapping of coastal populations was not developed specifically for disaster risk assessment, it is a good example of the type of data and approach to compilations in GIS that is fundamentally important for risk assessment and feasible using currently accessible datasets, such as census data at the highest geographic level of disaggregation as available in the county.

13. Pilot studies for the population exposed to hazards estimation methodology conducted as part of the DRSF pilot studies were conducted based on public access (admin 02 or Admin 03) datasets and revealed that, with high quality data on built-up areas such as the DLR Global Urban Footprint (GUF) produced from radar satellite images (accessible at https://urban-tep.eo.esa.int/#), it is possible to use these census datasets to estimate exposures of population in relation to hazard areas.

14. Censuses are conducted, in most cases, on a 10-year cycle, with intra-census period updates made in between, based on projections and use of other sources like population administrative records and surveys. An active collaboration for producing and sharing of these statistics is needed between national statistics offices and the other entities in government with the relevant geographic information on location of hazards and agencies responsible for conducting risk assessments.

15. At the macroeconomic scale, summary statistics on structure of employment (e.g. shares of employment by main categories of activity.) and metrics for levels of inequality can be used for assessing vulnerabilities or coping capacity. Structural macroeconomic vulnerabilities can be measured, in some cases, such as aggregated statistics on shares of employment or production activities in agriculture, tourism, or other categories of potential interest for risk assessment. The potential for producing such aggregated economic statistics according to hazard area should also be investigated, such as via use of administrative data.

Mapping and environmental monitoring

16. One of the basic inputs for developing exposure statistics are land cover and land use maps and, where available, the cadastres of municipalities. Land cover and land use maps, among other kinds of geospatial information, provide the necessary baseline information for defining specific geographic objects of interest in risk assessment.

17. Development of hazard maps and profiles should include, as much as possible, data and lessons learntabout hazards from passed disasters. The other key components for developing hazard maps are a collection of standard collections of national mapping and environmental mapping agencies, such as:

- Elevation map, also known as the digital elevation model (DEM)
- Meteorological data (for predicting flood, landslide, drought)
- Distribution of solid types (important for predicting risk associated with earthquakes)
- Values for surface roughness (used in assessing tropical cyclone hazard)
- Slope and river flow values (flood)

- Slope and geological features for hillsides and mountain sides (landslide)
- Impervious surfaces (can increase risks associated with floods or storms)
- Scale, locations and other characteristics of investment in disaster risk reduction (such as technical infrastructure)
- Monitoring signals of slowly developing risks approaching thresholds to a potential disaster (e.g. changes of land use in disaster-prone areas, changing practices in agriculture or fishing).
- Urban versus rural distribution of exposed areas
- Mapping of ecologically important areas or 'hot spots' and protected areas
- Mapped statistics on ecological condition[50] or sites identified for environmental degradation, e.g. polluted water bodies

18. Hazard maps are developed utilising specialized expertise relevant to each hazard, e.g. earthquakes, volcanoes, extreme meteorological events, floods, tsunami, etc. Hazard data typically are produced as official products by national meteorological, geological, hydrological, disaster management, or other scientific organizations working within or in collaboration with governments.

19. Hazard mapping also involves probabilistic modelling, utilizing the available data and in relation to a defined time period (extreme events are more probable the longer the timespan under study) and a confidence interval chosen by the experts. Different degrees of exposure or probabilities of a hazard are used to produce multiple mapped layers according to different expected degrees of risk (high, medium and low exposure).

20. Internationally, compilation of hazard maps, derived from a variety of sources and with international scope can be found at UNEP-GRID[51], the Group on Earth Observations' Geoportal[52] and the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI).[53]

21. On the exposure side, land cover and land use maps, as well as other sources of related information, such as cadastres, maps of critical ecosystems or hotspots, maps of critical infrastructure, and a broad range of other geographic information can be important inputs for analyses in relation to hazards. In addition, statistics describing environmental condition, for example related to the quality of water bodies or characteristics of forests, which are also important inputs for use in measurement of factors of vulnerabilities to disasters.

22. GIS can be used for integration of a comprehensive repository of relevant geographic information. Multiple layers of mapped data can be integrated to produce statistics relatively simply if the maps can be gathered and consolidated into a centralized database for disaster risk reduction purposes.

23. One of the key data sources for risk assessment, including for producing hazard catalogues is remote sensing, and particularly satellite imagery. Land cover mapping and

[50]See Weber (2014)

[51] www.grid.unep.ch/

[52] http://www.geoportal.org/

[53] http://pcrafi.spc.int/

mapping of impervious surfaces, human settlements, and built-up areas, for example, can be produced as a snapshot at different moments in time from interpretation of various forms of satellite imagery, including visible light at daytime, night lights, radar imagery, and so on.

Disaster preparedness

24. In some cases, for example for slowly developing catastrophic risks like drought, high probability of disaster impacts can be anticipated and therefore pre-emptively counter-acted by localized boosting of coping capacities. This includes the development/enhancement of an overall preparedness strategy, policy, and institutional structure. Warning and forecasting of capabilities, and plans for helping at-risk communities by being alert and to hazards and ready for action are key preparedness functions of governments.

25. **Preparedness** is defined as the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current disasters. Preparedness exists at multiple scales, e.g.: household preparedness, preparedness of communities, preparedness of disaster response facilities, and preparedness of countries or regions within countries.

26. Statistics on household preparedness against disaster impacts have been collected in many countries from household censuses or surveys by incorporating the topic into the questionnaires (see examples in chapter 3 and in table B3 in the annex).

27. Where possible, statistics on the amounts and locations of investment in disaster risk reduction (see Chapter 5) are important for assessing coping capacities in risk areas and for monitoring effectiveness of such interventions, over time.

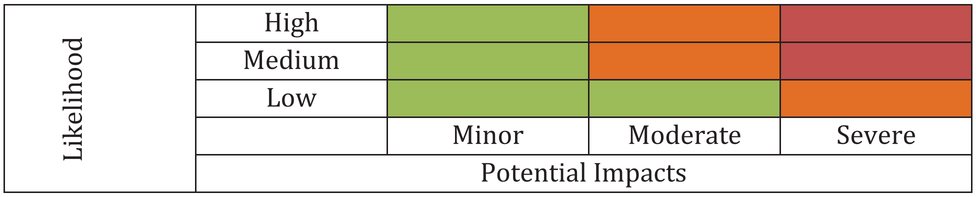
28. Relevant information at the community or higher scale of analysis include:

- Adoption and implementation national disaster plans;
- Type and number of shelters in place;
- Type and number of internationally certified emergency response and recovery specialists; early warning systems for all major hazards;
- Emergency supplies and equipment stockpiles;
- Number of volunteers;
- Expenditure on disaster risk reduction;
- Total official international support (ODA) for DRR.

29. One of the critical elements of preparedness for many hazards types is coverage of the population and business by **early warning systems management**. Early warning systems are designed based on an optimization of risk reduction utilizing the results of risk assessments.

1. Use of early warning systems in the case of impending disaster is informed by statistics on likelihood of the hazard and expected degree of impacts, according to the calculated exposure. Below is a simplified example of a decision matrix for applying available data on exposure.

Sample of impact matrix for informing preparedness initiatives or developing early warning systems



Source: World Bank (2016)

During a disaster

30. **Disaster response** are the "actions taken directly before, during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected." (UNGA, 2015).

31. A spatial data infrastructure (SDI) is an effective means for integrating relevant data sources from the pre-disaster compilations, along with real time information about the disaster occurrence for rapid assessment and decision-making by the disaster response authorities and for response putting resources in the right places for efficiently meeting needs.

32. This includes geo-referenced data on:

- Timing and geographic location of the hazard
- Population exposure in hazard area
- Vulnerable groups in hazard area
- Critical infrastructure, including disaster emergency response facilities and shelters inside and outside of hazard area
- Vulnerable areas, such as potentially hazardous areas which could increase the impact; storage or use of hazardous substances, landfills, polluted areas, etc.
- Businesses in hazard area
- Agriculture in hazard areas

33. Statistics fit for the purpose for disaster-response, at minimum, are geo-coded; attached with sufficient metadata to facilitate interoperability with operations systems; and are routinely accessible, with emergency protocols.

34. The UN Office for the Coordination of Humanitarian Assistance (OCHA) and several other cooperating agencies that work in humanitarian crisis situations have developed guidance for rapid assessment[54], as part of the emergency response during a disaster. Rapid assessments are tools used for coordinated emergency response, rather than for producing statistics. However, in many cases, the same data used for emergency assessments can be reutilized for estimation of statistics on disaster impacts after the emergency period.

[54] See, e.g., www.acaps.org

Data collected during a disaster occurrence

35. Immediately after a disaster, the responsible agencies must first acknowledge the situation of an emergency or of impacts to make a record for a disaster occurrence and assign a unique identifier for the occurrence (see Chapter 2). Once this is established, a part of the immediate disaster response will normally include a range of potential data collections for estimating and recording statistics on the impacts.

36. A part of the response to disasters is provisioning various types of support to households or enterprises. Depending on the nature of the disaster and capacities for response, this may include:

- Support for evacuation or relocation
- Transfers of other basic needs like food, water, and other supplies
- Medical assistance and other emergency response services
- Transfers of financial resources to help local institutions with recovery efforts.

37. Support to households or businesses by local or national government agencies is commonly accompanied by a system of registration and/or collection of basic information for those receiving support. These administrative records from disaster response and recovery can be digitally stored as non-public databases, from which statistics can be derived, including, if designed properly, disaggregated statistics by characteristics like age and sex, disability, employment, and income.

38. However, disaggregated information describing the characteristics of impacted population may not be known at the time of the disaster and compilation of statistics is not the priority during an emergency. Therefore, disaggregation of impacts may involve a secondary step of estimation and linking between multiple data sources after the disaster (see below). For cases where data on basic characteristics of people that were impacted are incomplete, the unknown cases should still be recorded and classified as unknown (e.g. categories are male, female, and sex unidentified), leaving the possibility for filling these gaps through estimation later.

39. The main responsibilities for compilation of statistics during the disaster are national disaster management agencies, line-ministries (such as the Ministry of Interior, Ministry of Agriculture, and Ministry of Health) and sub-national administrative bodies (such as municipal administrations). Also, research institutions and NGOs (e.g., Red Cross or Red Crescent) play an important role in disaster response and recovery, including collecting data during an emergency.

40. Noting that the verified statistics on disaster impacts may take some time to finalize, eventually the data collected during, and as part of, the emergency response from a disaster can be a crucial resource for producing impacts statistics and for potentially improving methodologies for future risk or post disaster assessment methodologies.

After a disaster

Statistics for post-disaster assessment

41. Disaster recovery is the process of restoring or improving of livelihoods and health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development and "**building back better**", to avoid or reduce future disaster risk. (UNISDR, 2017)

42. After an emergency period, NDMAs coordinate a process to compile data on impacts and produce assessments of the impacts, that are used for multiple purposes, including to inform the recovery but also for monitoring trends of impacts overtime (e.g. Sendai Framework monitoring) and as inputs into future risk assessments.

43. The post disaster recovery may include:

- Relocation of people who, for different reasons or circumstances because of risk or disaster, have moved permanently from their places of residence to new sites.
- Rehabilitation: the rapid and basic restoration of services and facilities for the return to normal functioning of a community or a society affected by a disaster.
- Reconstruction: the medium and longer-term repair and sustainable restoration of critical infrastructures, services, housing, facilities and livelihoods required for full functioning of communities and livelihoods of residents in a region affected by a disaster.

44. These elements of recovery may be captured in statistics through a combination of direct observations by recovery organizations or related institutions along with estimations based on analysis of trends in economic and social data (e.g. population movement and construction activities) collected before and after a disaster as a part of the usual compilations of official statistics. In this case many of the key data sources mentioned for risk assessment before the disaster (e.g. census, economic statistics or land cover maps) come back into use, but with the new post-disaster compilations, for making comparison to the pre-disaster situation.

45. Measures for the various forms of direct impacts (found in C, D, E, F, and G tables in the annex) are also compiled in post disaster assessments, including Post-Disaster Needs Assessment (PDNA) studies, using the conceptual framework and methodologies developed initially by the Economic Commission for Latina America and the Caribbean (ECLAC) and now managed by the UN Development Group, the World Bank and the European Union.[55]

46. PDNAs contain two perspectives: the quantifications of physical damages and economic losses and the identification of socio-economic recovery needs based on information obtained from the affected population.[56] PDNAs also typically incorporate estimations for both direct and indirect economic impacts. The DALA methodology "focuses on the conceptual and methodological aspects of measuring or estimating the damage caused by disasters to capital stocks and losses in the production flows of goods and services, as well as any temporary effects on the main macroeconomic variables." (ECLAC, 2003).

[55] http://www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/pdna.html

[56] http://www.worldbank.org/en/events/2017/06/12/post-disaster-needs-assessment-for-resilient-recovery

47. Utilizing, where possible, data collected before and during a disaster to evaluate and provide the context for measuring impacts, most of the basic range of impacts statistics will be compiled through a combination of data sources in the weeks and months or years after a disaster.[57]

Post-disaster assessment data sources

48. The common data sources and actions for collecting data for impacts statistics after a disaster are summarized as follows.

49. First, there may have been a primary observation of material or human impact during a disaster. These are the initial reports, during or immediately following an emergency, which are subject to revision. An example is the disaster management agency or estimations of numbers of dwellings damaged and destroyed based on observations during disaster recovery.

50. Second, compilations of statistics from administrative records from disaster response and recovery along with related estimations of human impacts, such as number of individuals affected by the damaged and destroyed dwellings.

51. Third, records from government authorities, insurance companies, or other sources of data on degree of magnitude and monetary values for the material impacts and disruptions to basic services.

52. Fourth, targeted follow-up surveys are designed, where possible, to collect additional information and to fill gaps in information on impacts to the population and to businesses in the affected area.

53. Fifth, analyses of regular sources of time series statistics, available before and after a disaster, are used to test hypotheses and produce estimations on impacts. Relevant sources for these impact assessments could include virtually all types of sources used in official statistics. Key examples include the population and housing census, household surveys, business surveys and censuses, the national accounts, employment surveys, and before-and-after satellite imagery.

54. For the economic valuation of the material impacts to assets from disasters (direct economic loss), many sources need to be considered, especially: values for insurance claims, data collected from establishment surveys or administrative records on reconstruction and recovery, and estimations based on baseline statistics on infrastructure, average construction costs, and detailed data from the sources of agriculture statistics (see Chapter 4).

55. Costs of disaster risk reduction characteristic activities, especially relevant expenses after a disaster like reconstruction expenses related to the recovery, but also interventions for mitigating impacts after disasters are compiled from common data sources, used in national accounts, especially, in this case, administrative records on government expenditures.

---

[57]Previous studies (e.g. Groppo and Kraehnert) have shown the possibility for identifying potential long-term impacts from disasters up to 10 years after the initial emergency because disasater may have effects on fundamental development capacities such as education and early childhood development There is no current standard time frame for a length of time reference for studying the effects of disasters. The time period may depend, among other factors, on the nature of the hazard and the coping capacity of impacted communities.

56. Although, the national accounts are not a primary source of statistics for assessing direct economic impacts of disasters, in principle all of the direct and indirect impacts of disasters are incorporated in the national accounts, implicitly or explicitly.

57. For most countries in Asia and the Pacific, Africa and Europe, producing national accounts is a responsibility of national statistics offices. However, in some countries, including in most of the countries in Latin American and the Caribbean, national accounts are compiled by Central Banks. Another arrangement (e.g. in the United States and in Thailand) is production of national accounts by a specialized economic advisory council within the government. Regardless of the institutional arrangements of a particular country, exchange of data and metadata and a collaboration between national accounts and the centralized database on disaster impacts statistics is an important step for validation, for creating coherence across the national statistical system, and for identifying inputs for modelling the indirect impacts of a disaster.

Population and health administrative data after a disaster

58. The usual source of official records for deaths and causes of death, where it could be determined, are civil registration authorities and the Ministry of Health, which is responsible for maintaining and monitoring health information systems. In the event of a disaster, particularly for large scale disasters, records for deaths or missing is, in the short-term, commonly tabulated as part of the emergency response and initial assessment of human and material impacts from disasters. These figures are reported by and to the different levels of local and national government and usually at some stage are shared in official reports to the public.

59. For countries with well-functioning systems for registration of deaths, mortality statistics are derived from administrative records (i.e. civil registration systems), which record all deaths and causes of deaths. As most countries do not yet have fully comprehensive systems for recording vital events, often surveys are used to supplement for producing statistics on deaths. These statistics have many important uses for the broader statistical system, including for estimating the rate of growth of populations and for investigating public health issues, such as trends in mortality from different types of health challenges. These civil records are complemented by broader health information systems (HIS), which are managed by health ministries, in collaboration with resident health institutions, like hospitals. Health administrative records contain confidential information, but can be utilized to produce broad summary statistics that describe trends in the population without revealing private information about individuals.

60. A critical step for ensuring consistency in the statistical systems and completeness of data across different applications of mortality statistics, is that the cases of deaths resulting from disasters are also incorporated correctly and completely into the broader civil registration system and aggregated mortality statistics for the country.

61. In principle, deaths are recorded in civil registers and/or in health information systems according to a standard classification for causes of death. The current international classification is called the international Statistical Classification of Diseases and Related Health Problems – 10th revision, or ICD 10 (2016).[58] ICD 10 is managed by the World Health

[58] http://apps.who.int/classifications/icd10/browse/2016/en, https://icdlist.com/icd-10/index

Organisation (WHO). ICD10 does not include specific coding for deaths from disaster, but includes a general category for "External Causes for Morbidity and Mortality" (codes V01-Y98), which includes classes for exposure to many different types of hazards that are either related to or beyond the scope of the Sendai Framework.

62. The first group of external causes of mortality in ICD10 are related to accidents, particularly transport accidents, which may or may not be relevant the scope of disaster risk reduction, depending on if there was a direct relationship with a hazard fitting within the scope of the Sendai Framework. The second group of external causes of mortality in the ICD10 index include exposure to fire, smoke, or heat (X00-X19), or other types of hazards or "forces of nature (X30-X39), and "accidental exposure to other specific factors" (X52-X58).

63. Many countries face challenges for producing statistics from civil registration of good coverage for cause of death. Attributing deaths to disasters has special challenges. Where possible, the preferred practice for official records on cause of deaths is diagnosis by a trained medical professional. These professionals are trained for identifying diseases and other likely internal causes of death. Typically, medical professionals are not trained and may not be authorized to attribute deaths to a specific external event like a disaster.

64. A useful example to learn from and potentially to emulate for disaster-related deaths is current practices for collecting, compiling and reporting statistics on traffic accidents. As explained in an Information Note for by the Secretariat for the Pacific Community (SPC) and the Brisbane Accord Group[59], there are three main interacting sources of data used for compiling statistics on road-related deaths:

- National Health Information Systems (HIS): for data on hospital admissions and emergency room attendance due to traffic crashes and their outcomes, and deaths certified by a medical practitioner.
- National Civil Registration (CR) Systems: for data on deaths both in and outside of hospitals. These systems usually record cause of death (linked to the health information systems and police records) as well, and may include outcomes from coroner's cases in countries where those processes are applicable.
- Police Incident Information Systems: for data on traffic incidents attended, including data on both the outcome (in the case of an injury or death), and conditions that contributed to the crash occurring. Other systems to collect data from first responders - such as data from paramedical services (ambulance or fire service) may also exist within the police information systems, health information systems or independently.

65. Overall, improvements to national systems for vital statistics, especially mortality and cause of death statistics is an important priority for statistical development in many countries and further progress in this domain more generally could also benefit the reliability and completeness of statistics on disasters.

66. One of the other crucial uses for administrative data for disaster-related statistics is for linking records of individuals from various administrative sources (including civil registration, but also other sources related to, e.g. education enrolment, tax enrolment, etc.) with data collected on disaster impacts. Linking with administrative data is a potential method for describing the population affected in terms of relevant disaggregation categories – e.g. by sex,

[59] http://www.pacific-crvs.org/images/doc/CRVS_Notes/Road_Related_Deaths.pdf

age, disability, income, etc. These are estimated calculations for each category, based on linking records between microdata on human impacts with the relevant administrative sources. Protection of confidentiality is an important point for emphasis in the use of the administrative records after a disaster, because these records need to be protected against use for identifying individuals.

Mapping and environmental monitoring

67. The prediction of probabilities of future events can be improved by information from past disasters. Probability of hazards is dynamic (for example due to climate change). Therefore, the probabilistic models need to be updated at regular intervals, integrating new information as it becomes available.

68. The basic physical information, including areas affected by a hazard should be compared, where feasible to the pre-disaster predicted hazard areas. Over time, mapping of information on actual hazards, especially relatively frequent hazards, could be utilized to evaluate and improve the accuracy of hazard mapping for disaster risk measurement and for risk reduction interventions. However, the possibilities for mapping the disaster area (or 'disaster footprint') vary depending on the hazard type and currently there are no standard methodologies yet for post-disaster footprint mapping.

69. In addition to mapping the physical hazard, another post-disaster mapping exercise that is potentially relevant both for improving pre-disaster risk assessments but also as a tool for impacts assessment, is to define contiguous areas in which direct material impacts could be observed.

70. Flood hazards are one the relatively simple cases. Flood areas can be mapped after a disaster utilizing remote sensing to define the inundation area. An example was produced by Columbia University, Center for International Earth Science Information Network (CIESIN) and NASA Socioeconomic Data and Applications Centre (SEDAC), in which mapped data on historical flood hazards from 1985-2003 was used to produce a global map of flood hazard frequency and distribution.[60] With the continuous development of disaster-related statistics globally, GIS-compatible statistics for will become progressively accessible to governments for use in reducing risks before and after disaster.

[60] http://sedac.ciesin.columbia.edu/data/set/ndh-flood-hazard-frequency-distribution