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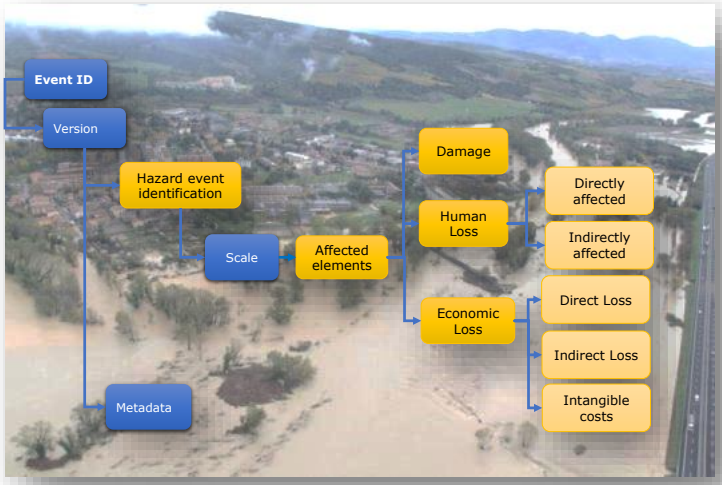
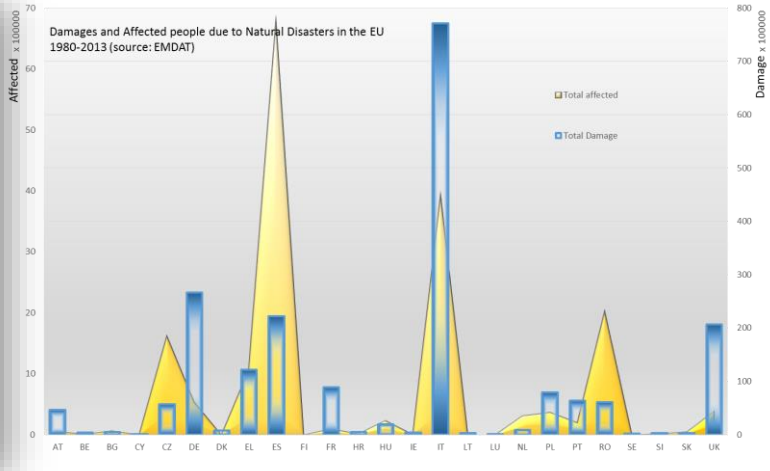
Guidance for Recording and Sharing Disaster Damage and Loss Data

Towards the development of operational indicators to translate the Sendai Framework into action

EU expert working group on disaster damage and loss data

2015





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Abstract

This report provides guidance to Member States in improving the coherence and completeness of the national disaster damage and loss data recording process, necessary for supporting evidence-based disaster risk management policies and actions. It proposes essential elements of an assessment methodology for recording damage and loss data and recommends simplified aggregate figures for sharing the data following a common data exchange format. The proposed common framework for damage and loss data recording directly supports reporting on indicators for global disaster risk reduction targets, envisaged as part of the EU commitment to the post-2015 Sustainable Development Goals and to the Sendai Framework for Disaster Risk Reduction. The guidance provided herein is a first iteration and is expected to evolve with further consultation and experience from the multiple stakeholders from Member States.

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CONTENT

1 INTRODUCTION

The reformed **Union civil protection legislation (Decision on a Union Civil Protection Mechanism)**[1], which entered into force on 1 January 2014, is paving the way for more resilient communities by including key actions related to disaster prevention such as developing national risk assessments and the refinement of risk management planning. Under the Decision, Member States agreed to "*develop risk assessments at national or appropriate sub- national level and make available to the Commission a summary of the relevant elements thereof by 22 December 2015 and every three years thereafter"*[2]. The Decision also requires Member States, together with the Commission, to develop guidelines on the content, methodology, and structure of risk management capability assessments. The Commission has published risk assessment and risk mapping guidelines[3] to assist Member States with their national risk assessments. Risk management capability assessment guidelines were also developed[4].

Systematically collected, comparable and robust disaster damage and loss data are an essential element of the risk assessment and management processes. Thus, the Council Conclusions on risk management capability[5] call on the Commission to *'Encourage the development of systems, models or methodologies for collecting and exchanging data on ways to assess the economic impact of disasters on an all-hazard basis.*'

The current practice in disaster loss data recording across the EU shows that there are hardly any comparable disaster damage and loss data: differences exist in the methods of data recording as well as in the governance approaches to managing disaster damage and loss data. The lack of standards for damage and loss data collection and recording represent the main challenge for damage and loss data sharing and comparison, especially for cross-border cooperation within the EU.

These guidelines have been prepared in consultation with experts from Member States in line with the Council conclusions on risk management capability, and in order to support and enhance the different strands of disaster prevention such as risk assessment and risk management. They take into account existing good practices in Member States. They build on the findings and recommendations of the report on "Current status and best practices for disaster loss data recording in the EU" (De Groeve et al., 2014) and on the Technical requirements for loss data recording within the EU context (De Groeve et al., 2013).

[1] Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism, OJL(347), 20.12.2013
[2] Art. 6 (a), Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism, OJL(347), 20.12.2013
[3] Commission Staff Working Paper 'Risk assessment and risk mapping guidelines for disaster management', SEC(2010)1626 final
[4] *Reference to be provided once published*
[5] Council Conclusions on risk management capability, 13375/14 of 24 September 2014

2 SCOPE AND OBJECTIVE

2.1 SCOPE OF THE GUIDANCE DOCUMENT

The guidance document proposes an assessment methodology that can be adapted according to the needs of each Member State. It should be seen as a common starting point setting out elements that every national disaster loss recording mechanism should include. It is non-binding, therefore it does not infringe the priority, legal or otherwise, of national standards.

For sharing loss data across organisations, among EU Member States and with EU and international institutions, this guidance document proposes **a minimum set of loss indicators** that should be part of any operational disaster loss database. To overcome the complexity of the loss recording process within the national contexts, the guidance document recommends **simplified aggregate figures following a common data exchange format**. Recording damage and loss data is a complex process and a complete data recording methodology should consider national legislation, context and existing practices.

The guidance document addresses not only national, but also appropriate subnational levels depending on Member States' disaster management structure and extends to the European and international dimensions of disaster loss recording.

2.2 OBJECTIVE OF THE GUIDANCE DOCUMENT

The objective of the guidance document is to help Member States improve the coherence and completeness of the loss data recording process. For Member States with well-established national loss databases, the guidance document provides a framework for reporting disaster losses in a structured manner. For Member States who are in the process of building loss databases, the guidance document can inform decisions on the minimum set of loss information that should be recorded following a disaster independently of the type of hazard.

The guidance document can facilitate the sharing of loss data at EU level. For Member States, sharing loss data is important to better understand the trans-boundary and/or pan-European effects of disasters and accordingly to better plan the coordination and management of future disasters.

From an international perspective, having a common framework for damage and loss data recording with comparable datasets would bring significant value and advantages to the systematic reporting on indicators for global disaster risk reduction targets, envisaged as part of the EU commitment to the post-2015 Sustainable Development Goals and to the Sendai Framework for Disaster Risk Reduction[6]. It also responds to a recent recommendation of the Organisation for Economic Co-operation and Development (OECD) to develop standardized accounting frameworks for expenditure on disaster risk reduction and disaster losses in order to evaluate the economic benefits from their disaster risk investments (Organisation for Economic Co-operation and Development (OECD), 2014).

[6] Sendai Framework for Disaster Risk Reduction 2015-2030.
http://www.wcdrr.org/uploads/Sendai_Framework_for_Disaster_Risk_Reduction_2015-2030.pdf

3 THE ACTORS OF THE DISASTER DAMAGE AND LOSS DATA RECORDING PROCESS

Different scenarios exist for implementing a disaster damage and loss database within a country. The scenarios along with a cost-benefit analysis and appropriateness for different policies are described in De Groeve et al. (2013). The main difference is in the organisation that will be mandated to collect the data:

- Scenario 1: Local civil protection
- Scenario 2: National/Regional assessment centres
- Scenario 3: Hazard specific national authorities

Independently of the level of implementation of the disaster damage and loss database, an appropriate loss data recording process should rely on a well-designed organizational structure involving different stakeholders all of them falling under the coordination and/or responsibility of the data coordinator. The functions and responsibilities described in this guidance are not exhaustive. The actors of the damage and loss data recording process and the relationships between them may vary depending on the scenario of implementation and on the local, regional and national settings.

3.1 THE EUROPEAN COMMISSION

Sharing data in the EU within a common framework for damage and loss data recording is important for understanding and managing the trans-boundary and continent-wide impacts of disasters, loss trends and spatial patterns. Furthermore, this will lead to greater transparency and facilitate cooperation to reduce the impacts of disasters within the EU. In the long-term, shared disaster damage and loss data are essential indicators on the impacts of EU policies such as the Union civil protection legislation, the Floods Directive[7] and the EU Climate Change Adaptation Strategy[8].

The main role of the European Commission within the process of damage and loss data recording is:

- in assisting Member States with technical advice on the implementation of minimum requirements in implementing the current guidance document and,
- in providing guidance to Member States in their choice of implementing a disaster loss database.
- in assisting Member States with sharing their loss data where they choose to do so.

3.2 THE DATA COORDINATOR

Damage and loss data recording needs to be coordinated either at one national or sub-national entity. The coordinator must ensure the application of a coherent methodology and foster the sharing of good practices. At the same time, the level of the assessment – either national or appropriate sub-national level – will be decided by each Member State based on its own governmental system.
The coordination body is a person or a group of persons in an administration cited under scenarios 1, 2 and 3 depending on the country's arrangement, who is responsible for collecting and

[7] Directive 2007/60/EC on the assessment and management of flood risks in all available languages (OJ L288, 6.11.2007, p.27)
[8] COM (2013) 216 - An EU Strategy on adaptation to climate change

assembling data coming not only from different sources (field survey, satellite data, other datasets) but also for proactively asking them from other administrations.
The data coordinator also maintains the information management system for storing loss data of different formats. He/she is responsible for the training of personnel to process the collected data before they are entered into the system and takes care of existing links (and compatibility) to external databases.
The data coordinator is the contact point with the European Commission ensuring a proper delivery of aggregated loss data following the common data exchange format proposed in this guidance document.

3.3 THE DATA CURATOR

The data curator is responsible for processing the collected data 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,
- 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.

3.4 THE DATA QUALITY MANAGER

The data quality manager is responsible for ensuring that the disaster damage and loss data is recorded according to the four principles defined in De Groeve et al., (2014) and which are:

- Precision: ensuring the correct use of terminologies and the consistency of the loss indicator.
- Comprehensiveness: ensuring that the entire required loss indicators are entered.
- Comparability: ensuring that loss data are event based and that each event is accompanied by a unique identifier to allow the comparison of disaster impacts among the same hazard types, among different hazard types, across countries, across sectors and through time.
- Transparency: ensuring that damage and loss data have a geographical location, are accompanied with temporal information and are associated with an uncertainty value.

4 MODEL OF DISASTER LOSS DATABASE

A data model is the description of the classes together with the definition of the data fields as well as relationships among the classes. It determines the logical structure of a database, and in which format data can be stored, organized and manipulated.

It is outside the scope of the document to propose a full data model. The data model must be locally developed by the coordination body responsible for collecting and recording data and is usually part of a larger data management system. The model must take into account local requirements, including factors such as language, staff management, and access and security. The guidance document outlines the elements of the data model that are important and that should be reflected in national data models. The design requirements of loss databases depend on the application area.

Four main application areas were identified in De Groeve et al. (2014): loss compensation, loss accounting, forensic analysis and disaster risk modelling. The information needs for the four application areas are overlapping, even if the forensic and modelling applications require information at higher detail.

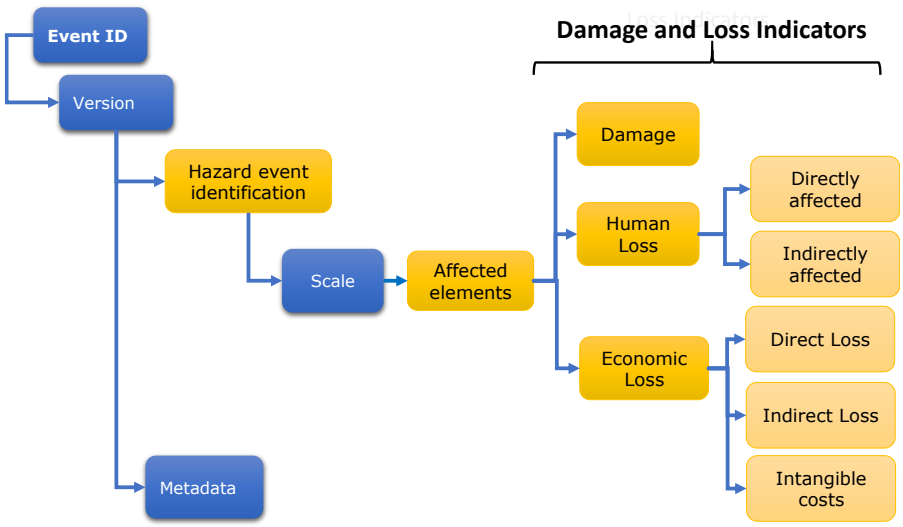

Figure 1. Conceptual data model for damage and loss data recording. For each field of the damage and loss indicators (damage, human and economic losses), it is recommended to assign an uncertainty value.

Figure 1 shows a conceptual data model used for discussions in this document. It starts from a **disaster event**, identified unambiguously (likely with an event identifier). There may be several **versions** of loss records associated to the event, e.g. through updates and corrections (where data becomes available), temporal versions to capture event dynamics (evolution of losses), or estimates of different organisations. For each version, **three sets of indicators of disaster losses** (hazard event identification, the affected elements, the damage and the loss indicators) can be recorded after the occurrence of a disaster as well as **metadata** and **quality assurance** information. **Metadata** contains information such as entry date, author, validation status and information on the methodologies used for assessing the damage and estimating the human and economic losses. It is recommended to create INSPIRE compliant metadata[9]. The affected element may correspond to a house, a municipality, a province or a country, etc. A Member State may choose to record damage and loss data at given scale and the aggregate at coarser scales (e.g. the municipality level may be obtained by aggregating losses recorded at asset level or it may be assessed directly). The scale at which damage and loss data are recorded influences directly the quality of aggregated losses. Collecting data at the asset level will decrease uncertainty of loss indicators and increase the transparency of economic losses caused by a disaster.

[9] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). Even if aggregate disaster damage and loss data are strictly speaking not spatial datasets, the database is spatial and it is recommended to adhere to the Natural Risk Zones specifications (http://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_NZ_v2.0.pdf). The EU working group on disaster damage and loss data is working closely with INSPIRE to align disaster damage and loss guidance and INSPIRE data specifications.

5 INDICATORS OF THE DISASTER DAMAGE AND LOSS DATABASE

The indicators described in this document represent the type of information on the disaster and its impacts that needs to be recorded in a disaster loss database as well as the recommended classifications and standards to define them. Extensive information on each of these fields can be found in De Groeve et al., (2013, 2014). For each indicator, the present guidance document defines a set of minimum requirements necessary for a loss data-sharing standard. The minimum requirements are summarized with the help of the template outlined in chapter 6.

5.1 HAZARD EVENT IDENTIFICATION

A disaster damage and loss database is an event-based database, i.e. loss data are related to a specific hazard event which should be uniquely identified (spatially and temporally), classified to provide basic summary statistics (e.g., aggregation by peril type, year), and recorded by severity level to relate to the probability of occurrence for calculation of average annual losses. Hazard event identification allows attributing the losses to a peril. The attribution assumes a peril classification. The INSPIRE natural hazard category defined in the INPIRE data specifications for Natural Risk Zones (INSPIRE Thematic Working Group Natural Risk Zones, 2013) should be used as standard for the classification of natural hazards. It is feasibly extensible with the peril classification of the IRDR DATA working group (IRDR DATA working group, 2014).
A hazard event identification number similar to the Global Disaster Identifier number (GLIDE)[10] number should be adopted. It would allow for an unambiguous linking of loss records associated to the same disaster event and enable interoperability among different loss databases. The hazard event identification number should enable dealing with cascading events (using prefixes) and with hierarchical spatial units (countries, provinces, districts; using suffixes) similarly to the GLIDE number. In case a cut-off threshold or an inclusion criterion is applied for recording events (e.g. excluding low-impact events), this needs to be specified in the metadata of the database.

Table 1. The fields, standards and minimum requirements for the "Hazard event identification" indicator.

Hazard event identification	Fields	Standards or currently good practices to be considered	Minimum Requirement
	Geographical information	INSPIRE Administrative Units Theme Unit of administration where a Member State has and/or exercises jurisdictional rights, for local, regional and national governance.	**Subnational level (NUTS2/NUTS3) and Units of Management[11]**
	Temporal information	INSPIRE Attribute- validFrom The time when the observed event started to exist in the real world INSPIRE Attribute- validTo The time from which the observed event no longer exists in the real world. (For slow onset disasters (e.g. droughts) where a start and an end date cannot be determined, the validFrom and the validTo	**X**

[10] http://www.glidenumber.net/glide/public/about.jsp
[11] For hydrological events: Units of Management as defined in article 3 of the EU Floods Directive (2007/60/EC) http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060

		attributes must be the dates of occurrence of the first and the last damages or losses respectively caused by the disaster).	
	Hazard event classification	INSPIRE Data Type– NaturalHazardClassification A generic classification and a specific classification of the type of hazard (extensible with the IRDR peril classification)	**X**
	Event type specific attributes	INSPIRE Data type- LevelOrIntensity An expression of the magnitude or the intensity of a phenomenon (it may address a value within the Richter scale or a description of the European Macro-seismic scale or flood flow, etc.)	
	Hazard event identification number	Hazard event code[12]-yyyy-ID number-Country ISO code See also: INSPIRE inspireId	**X**
Notes: Refer to INSPIRE data specifications pertaining to: - **Administrative Units consolidated UML Model:** **http://inspire.ec.europa.eu/data-model/approved/r4618-ir/html/index.htm?goto=2:1:2:1:7106** - **Natural Risk Zones consolidated UML Model:** **http://inspire.ec.europa.eu/data-model/approved/r4618-ir/html/index.htm?goto=2:3:12:1:8552**			

5.2 AFFECTED ELEMENTS

An affected element can be a human or a physical asset (i.e. building). The type of the affected element defines the associated loss indicators as well as the methodology of collection. The set of the affected elements is a subset of all exposed elements (elements at risk) located in the affected area. The affected area may be assessed either using the location of the affected elements or – at coarser scale – by locating the municipalities or administrative units that include affected elements. The data specifications for the affected elements are described under the "Exposed Element" feature in the INSPIRE Natural Risk Zones Data Specification.

Other pre-event characteristics of the affected elements allow even more profound analysis in all application fields, such as loss accounting by spatial unit, sectors or loss ownership; disaster forensic expertise of lessons learnt based on hazard dependent characteristics; and exact location of affected elements for risk modelling.

It is not required to record information on the affected elements for the purpose of data-sharing. However, efforts in addressing more specific, numerous and detailed fields are strongly encouraged for linking loss accounting to other application with local benefit (such as disaster forensics and risk modelling).

[12] The event code can consist of two letters to identify the disaster type similarly to the code used in the GLIDE number.

Table 2. The fields and standards for the "Affected elements" indicator. There are no minimum requirements to apply.

Affected elements	Fields			Standards or currently good practices to be considered
Geographical information				INSPIRE Administrative Units Theme
Classification of the affected element				INSPIRE Data type: ExposedElementClassification
Social	People	Age/gender/marital status, etc.		ECLAC based
Economic	Property	Building	occupancy classification /height/construction material/no. of stories/year of construction	Eurostat (Classification of types of construction, CC)[13]
			hazard dependent classification	Syner-G[14] or HAZUS[15] (earthquake), HAZUS (flood), HAZUS (wind)
		Content/ Equipment	depends on the occupancy classification	
		Vehicles	type classification	
		Products/ Stock/ Crop	type classification	
	Infrastructure	Any object considered as a structure providing a service, such as a road, a bridge, a military facility	type classification	HAZUS
			size/length	
			hazard dependent classification	
	Economic activity	Any object representing an economic activity, such as an industry.		International Standard Industrial Classification of all Economic Activities (ISIC)-version 4 (2008)
	Owner	Individuals/ business/ government/ non-governmental organizations and insurance companies		(National Research Council (NRC), 1999)
	Who bears the loss	Individuals/ business/ government/ non-governmental organizations and insurance companies		(National Research Council (NRC), 1999)
Environment	Source of pollution	Natech[16] classification		
	Protected area	An area that is protected (protected ecosystems/habitats)		-Habitats Directive" (92/43/EEC)[17] -CORINE Land Cover - European database[18]/Land Use classes, LUCAS[19]
	Water body	Any significant accumulation of water		-High Resolution Layers HRL for permanent water bodies (PWB) and wetlands (WET)[20] -LUCAS
Heritage	Cultural asset	Any object considered to be relevant from a cultural perspective, such as a stadium, a theatre, a museum, etc.		
	Historical asset	Any object with a historical relevance		
	World heritage asset	A place (such as a forest, mountain, lake, desert, monument, building, complex, or city) that is listed by the UNESCO as of special cultural or physical significance.		

[13] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Classification_of_types_of_construction_%28CC%29
[14] http://www.vce.at/SYNER-G/files/project/proj-overview.html
[15] https://www.fema.gov/hazus
[16] Natech accident is defined as a technological accident caused by a natural hazard
[17] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
[18] http://www.eea.europa.eu/publications/COR0-part2
[19] http://ec.europa.eu/eurostat/ramon/other_documents/lucas/index.htm
[20] http://land.copernicus.eu/pan-european/high-resolution-layers

5.3 DAMAGE AND LOSS INDICATORS

Damage and loss indicators, which comprise, damage, human and economic losses, are the core of the disaster loss database. They describe the level of damage on individual assets or on a number of damaged/destroyed assets covering several dimensions to thoroughly record the impact of the disasters. The degree of detail of damage depends on the availability of quantitative information in the area affected. Therefore the damage and loss indicator is not only a name of data field with the value and the physical unit but it is also accompanied with metadata including the time of recording/updating, the source and uncertainty as well as information on the assessment methodology. The unit should be standardized: for example, the unit for affected population should be persons. Data in other units (families, households) should be converted to number of persons, with an associated uncertainty estimate. Uncertainty is discussed further in section 5.4.
Definitions of the fields, the format of their codified value (as well as a variety of information about the codified value that also needs to be collected, managed and shared to assure their quality) should follow standard definitions to provide comparability and consistency.

5.3.1 HUMAN LOSS INDICATORS

The human loss indicators should be desirably defined according to the following principles:

- **Precise**: human loss indicators must have clear and preferably mutually exclusive definitions (one person is counted only once);
- **Comprehensive**: human loss indicators must cover all affected people (every affected person is counted);
- **Measurable**: human loss indicators are measured by public, private or media organizations, or can be assessed in the field under current emergency management practices;
- **Practical**: human loss indicators must match existing practices (one to one match with fields in existing databases) or required changes are kept to a minimum.

The human loss framework proposed in De Groeve et al. (2014) is considered as a possible model for harmonization of human loss indicators. Other frameworks, such as the one proposed in the IRDR Guidelines on Measuring Losses from Disasters: Human and Economic Impact Indicators (IRDR DATA working group, 2015) can also be used as a standard.

The human loss framework developed by De Groeve et al. (2014), shows a breakdown based on:

- **Directly affected people:** are a subset of *exposed* people (people living in the affected area that are thereby subject to potential losses) that suffered either:
  - impacts on their livelihood immediately after the disaster: people displaced, isolated and impaired
  - impacts on their physical integrity: injured people

- **Indirectly affected people:** correspond to people in the affected country that suffer indirect effects of the disaster and can be within or outside the affected area, which divides them into secondary and tertiary level of indirectly affected people.

- **Deaths:** correspond to the number of people who died during the disaster, or some time after, as a direct result of the disaster.

- **Missing:** correspond to the number of persons whose whereabouts since the disaster are unknown. It includes people presumed dead without physical evidence. Data on deceased and missing persons are mutually exclusive.

Table 3. The fields, standards and minimum requirements for the "Human loss" indicators.

Human Loss indicators	Fields	Standards or currently good practices to be considered	Minimum Requirement
	Directly affected*	- Human loss framework proposed in De Groeve et al., (2014) - DaLA (The International Bank for Reconstruction and Development/The World Bank, 2010)	**X**
	Indirectly affected*		
	Deaths	- Human loss framework proposed in De Groeve et al., (2014) - IRDR Guidelines on Measuring Losses from Disasters (2015)	**X**
	Missing		**X**
***** - A similar approach has been used in DaLA guidance notes (The International Bank for Reconstruction and Development/The World Bank, 2010) for dividing the affected people. - Recording the total of directly affected people is a minimum requirement at EU level, while the disaggregation in subclasses is optional (as different countries may use different definitions). This will allow the EU to be compliant with the Sendai framework for disaster risk reduction.			

5.3.2 DAMAGE INDICATORS

This set of indicators correspond to the total or partial destruction of physical assets existing in the affected are. They represent a summary of the damages in the cases where aggregates are generated. The intention of these indicators is twofold:

- to provide a minimum set of physical damage indicators in the form of a set of aggregated figures at spatial units above the asset level (i.e. municipality, region, country, etc.). Whenever the damage data collection does not occur at asset level, these indicators will allow to a large extent the validation and calibration of economic loss assessments and are useful in many ways as part of risk assessment and disaster forensic processes.
- to ensure computability with the global targets for disaster risk reduction set in Sendai.
- to establish a minimum degree of compatibility with the United Nations loss data collection initiative, based on DesInventar V10.0 (2015).

The minimum fields for damage indicators, based on Sendai global targets and the recommended measurement units are the following:

- **Houses destroyed:** The number of household units levelled, buried, collapsed or damaged to the extent that they are no longer habitable/repairable.
- **Houses damaged:** The number of household units with minor damage, not structural or architectural, which may continue being lived in, although they may require some repair or cleaning.
- **Education centres:** The amount of schools, kindergartens, colleges, universities, training centres etc., destroyed or directly damaged or destroyed by the disaster.
- **Health facilities:** The number of health centres, clinics, local and regional hospitals destroyed and directly or indirectly affected (damaged or destroyed) by the disaster.

Additional aggregated damage indicators, based on DesInventar, may also be recorded such as:

- **Crops and woods**: The total area of cultivated or pastoral land or woods destroyed or affected, expressed in hectares.
- **Livestock:** The number of 4-legged animals lost regardless of the type of event (flood, drought, epidemic, etc.).
- **Government buildings:** The number of governmental and administrative buildings directly damaged or destroyed by the disaster belonging to national, regional or local government.
- **Industrial facilities:** The number of manufacturing and industrial facilities directly affected (damaged or destroyed)
- **Commercial facilities:** The number of individual commercial establishments (individual stores, warehouses, etc.) damaged or destroyed.
- **Transportation:** The length in kilometres of damaged/destroyed roads and railways; number of damaged/destroyed bridges, airports, marine ports.

Table 4. The fields and minimum requirements for the "Damage" indicators.

Damage Indicators	Fields	Standards or currently good practices to be considered	Minimum Requirement
	Houses destroyed	- DesInventar (V10.0) - IRDR Guidelines on Measuring Losses from Disasters (2015)	Total number
	Houses damaged		Total number
	Education centres		Total number
	Health facilities		Total number

5.3.3 ECONOMIC LOSS INDICATORS

The economic losses represent market-based negative economic impact of a disaster. These consist of **direct, indirect losses** and **intangible costs**:

- **Direct loss** is the monetary value of physical damage to capital and tangible wealth assets. Direct losses may be also measured in terms of flows of foregone production, but for the scope of this guidance, this is not pursued.
- **Indirect losses** include lower output from damaged or destroyed assets and infrastructure and loss of earnings due to damage to transport infrastructure such as roads and ports, including business interruption. Indirect loss may also include costs such as those associated with the use of more expensive inputs following the destruction of cheaper sources of supply.
- **Intangible costs:** Costs that accrue to assets without an obvious market price (difficult to depict in monetary terms)

Several frameworks exist for the assessment of economic losses: the Damage And Loss Assessment methodology (The International Bank for Reconstruction and Development/The World Bank, 2010), the OECD Framework For Accounting National Risk Management Expenditures And Losses of Disasters (2014), the IRDR Guidelines on Measuring Losses from Disasters (2015). These frameworks can hence be considered for defining the fields pertaining to economic losses.

Based on these initiatives, the present guidance document defines a structure for reporting economic losses at EU and international levels. Bearing in mind that loss databases are expected to be implemented at national level in Member States while, for loss data-sharing, only summary or aggregated statistics are needed, the following recommendations are given:

- Data on economic losses should be event based (i.e. data must be related to the specific event);
- Direct losses are concrete, comparable, verifiable, and easier to measure than indirect losses. **For the scope of this document, direct losses need to be reported as a minimum requirement**;
- For loss data recording, national currencies are recommended. For loss data sharing, the losses should be converted into euros at the Eurostat exchange rates[21] of the month in which the recorded event has occurred.
- To determine the overall amount of disaster impacts, economic losses for all affected sectors must be included, avoiding possible gaps or double accounting;
- For loss data-sharing purposes, **only the sum of direct losses over all sectors is needed**. (For transparency, this can be accompanied by a list of the top-level sectors that have been considered and those that are missing).
- It is recommended to define the type of the owner (individuals, business, government, non-governmental organizations). This allows for providing statistics on losses in the public sector, the industry sector, private citizens and so on. Separate from the owner type of the building, the losses of a particular building are typically borne partially by the insurance industry, partially by the owner and partially by public funds (e.g. disaster compensation funds). The loss owner, those that bears the losses (individuals, business, government, non-governmental organizations and insurance companies) should be recorded. In case not all losses are recorded (e.g. only insured losses), it is recommended to develop a method for estimating the total losses across all loss-bearing entities (e.g. applying a coefficient factor on insured losses).
- It is recommended to record not only the results of economic loss assessments, but also the way the estimates have been produced, including well-documented method/model, auxiliary data used, and assumptions made in the assessment in the form of metadata.
- The costs of planning and implementation of risk prevention measures are not considered here as they relate to risk management expenditures rather than to disaster losses.

Table 5. The fields, standards and minimum requirements for the "Economic Loss" indicators.

Economic Loss indicators	Fields		Standards or currently good practices to be considered	Minimum Requirement
	Direct loss	**Economic Sector**: • Productive sectors (agriculture/industrial/commerce /tourism) • Social sectors (housing/education/health) • Infrastructure (electrical/water supply and sanitation/transport)	DaLA (The International Bank for Reconstruction and Development/The World Bank, 2010)	**X** (Total of all sectors, owners and loss bearers)
		Owner: Individuals/ business/ government/ non-governmental organizations	National Research Council (NRC), 1999	

[21] http://ec.europa.eu/eurostat/web/exchange-rates/data/database

		Status of ownership (who bears the loss): Individuals/ business/ government/ non-governmental organizations and insurance companies	National Research Council (NRC), 1999
		Cost of Emergency services	
		Clean up costs	
	Indirect loss	• Price increases • Increase in unemployment • Decline of GDP • Increase in government debt • Negative impacts on stock market prices • Business interruption	- DaLA methdology (The International Bank for Reconstruction and Development/The World Bank, 2010) - OECD Framework For Accounting National Risk Management Expenditures And Losses of Disasters (December 2014), - IRDR Guidelines on Measuring Losses from Disasters (2015).
	Intangible costs	• Environmental losses • Health impacts • Heritage losses • Loss of reputation • Psychological stress	OECD Framework For Accounting National Risk Management Expenditures And Losses of Disasters (December 2014)

5.4 Uncertainty and Quality Assurance

Loss databases should be evidence-based and transparent. 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.

For loss-data sharing, it is recommended to include information regarding the reliability of loss indicators such as a quality score or an uncertainty level to aid data users in their interpretation of the information.

An approach to loss data quality assessment was proposed in De Groeve et al. (2014) which merges an update of the uncertainty classification framework of Skeels et al., (2010) and the Pedigree parameter of the numeral unit spread assessment pedigree (NUSAP) method (Boone et al., 2010). The following uncertainty types are considered: measurement, completeness, human error, disagreement and credibility. For each criteria, a quality score (ranging between one and five) is assigned. Following this approach, a score of Pedigree matrix can be established for each loss indicator and a global average (i.e., the average of all Pedigree matrices scores) can be used to assess the quality of the current system in the country.

Table 6. The fields, standards and minimum requirements for "Uncertainty and quality assurance".

Uncertainty and quality assurance	Fields	Standards or currently good practices to be considered	Minimum Requirement
	Pedigree score (for each loss indicator considered in the minimum requirements)	Skeels et al., 2010 and NUSAP method	X
	Average Pedigree score		X

6 SUMMARY OF THE MINIMUM REQUIREMENTS FOR DAMAGE AND LOSS DATA SHARING

Minimum requirements advised in this guidance document refer mainly to the data model for the damage and **loss data-sharing standard**. Considering that the principle of transparency is characteristic of a good governance in the national context, it is then recommended that damage and loss data would be shared among EU countries, with EU institutions and international organisations. Damage and loss data at asset level is not necessary; aggregation of data geographically at appropriate subnational levels (NUTS2/ NUTS3) and at the Units of Management (UoM) for hydrological disasters can be sufficient for accountability and for supporting trans-boundary and international disaster risk reduction processes, namely the post-2015 Framework for Disaster Risk Reduction.

The following tables provide a generic format for sharing damage and loss data. It is expected that damage and loss databases would include the minimum indicators outlined in chapter 5. As damage and loss recording improves, expansion of databases to include more detailed indicators as refinements is highly desirable in order to provide a more comprehensive view of the socio-economic impacts of disasters.

Table 7. Minimum requirement: Damage and loss for a specific hazard per NUTS2/NUTS3 and Unit of Management (UoM), by year

Hazard type	Indicator fields	Value	Pedigree score
< NaturalHazardClassification >	**Year**	< 20XX >	n/a
	Geographical location	< NUTS2/NUTS3 or UoM >	n/a
	Houses destroyed	<total number>	<value between 1-5>
	Houses damaged	<total number>	<value between 1-5>
	Education centres	<total number>	<value between 1-5>
	Health facilities	<total number>	<value between 1-5>
	Directly affected	< number of persons >	<value between 1-5>
	Deaths	< number of persons >	<value between 1-5>
	Missing	< number of persons >	<value between 1-5>
	Direct loss for all sectors	< total in monetary value >	<value between 1-5>

Table 8. Extension 1: For a specific event, damage and loss per NUTS2/NUTS3 and Unit of Management (UoM)

Hazard event	Indicator fields	Value	Pedigree score
< identification number >	**Geographical location**	< NUTS2/NUTS3 or UoM >	n/a
	Temporal information	< validFrom > < validTo >	n/a
	Hazard event classification	< NaturalHazardClassification>	n/a
	Damage		
	Houses destroyed	<total number>	<value between 1-5>
	Houses damaged	<total number>	<value between 1-5>
	Education centres	<total number>	<value between 1-5>
	Health facilities	<total number>	<value between 1-5>
	Human Loss		
	Directly affected	< number of persons >	<value between 1-5>
	Deaths	< number of persons >	<value between 1-5>
	Missing	< number of persons >	<value between 1-5>
	Direct loss for all sectors	< total in monetary value >	<value between 1-5>

Table 9. Extension 2: For a specific hazard, damage and loss per NUTS2/NUTS3 and Unit of Management (UoM), by economic sector and by owner and by status of ownership (who bears the loss).

Hazard type	Indicator fields		Value	Pedigree score
< NaturalHazardClassification >	**Year**		<20XX>	n/a
	Geographical Location		< NUTS2/NUTS3 or UoM >	n/a
	Damage	Houses destroyed	<total number>	<value between 1-5>
		Houses damaged	<total number>	<value between 1-5>
		Education centres	<total number>	<value between 1-5>
		Health facilities	<total number>	<value between 1-5>
	Human Loss	Directly affected	< number of persons >	<value between 1-5>
		Deaths	< number of persons >	<value between 1-5>
		Missing	< number of persons >	<value between 1-5>
	Direct Loss	**Economic Sectors**		
		Agriculture	<in monetary value>	<value between 1-5>
		Industrial	<in monetary value>	<value between 1-5>
		Commerce	<in monetary value>	<value between 1-5>
		Tourism	<in monetary value>	<value between 1-5>
		Housing	<in monetary value>	<value between 1-5>
		Education	< in monetary value>	<value between 1-5>
		Health	<in monetary value>	<value between 1-5>
		Electrical	<in monetary value>	<value between 1-5>
		Water supply	<in monetary value>	<value between 1-5>
		Transport	<in monetary value>	<value between 1-5>
		Owner		
		Individuals	<in monetary value>	<value between 1-5>
		Business	<in monetary value>	<value between 1-5>
		Government	<in monetary value>	<value between 1-5>

	Non-governmental organizations	<in monetary value>	<value between 1-5>
	Status of ownership		
	Individuals	< in monetary value>	<value between 1-5>
	Business	< in monetary value>	<value between 1-5>
	Government	< in monetary value>	<value between 1-5>
	Non-governmental organizations	< in monetary value>	<value between 1-5>
	Insurance companies	< in monetary value>	<value between 1-5>

7 RECOMMENDATIONS FOR DISASTER DAMAGE AND LOSS DATA RECORDING

These final recommendations aim at supporting Member states in their choice of implementation while giving them enough freedom to decide which application areas are of their interest (loss compensation, accounting, disaster forensic and risk modelling).

For the loss recording process to be successful, the practices would need to be strengthened to make the data useful at national level beyond narrowly defined objectives, e.g. for prevention policy and risk assessment. Moreover, to make the databases compatible with requirements for sharing data among Member States and with international organisations, the following actions are recommended:

- The **role and utility of loss data** should be discussed across government departments, including emergency management, urban planning, and government budget and across all government scales and participative governance fora (local to national). High-level requirements should be informed by public and private needs across sectors. Implementation might be embedded in a Public-Public Partnership (PUP) and/or Public Private Partnership (PPP) to ensure participation and ownership of all stakeholders.
- Loss data should be recorded in **advanced (distributed) IT systems**, implementing an appropriate data model (linked to or integrated with other government databases) and supporting user-friendly data visualization and sharing options for a wide range of users.
- **Summary or aggregate statistics** should be shared using an open data policy in a common data standard to support trans-boundary and international processes (including the Sendai Framework for Disaster Risk Reduction).
- The proposed guidance document strives to achieve full compliance with implementation other EU legislation, including the INSPIRE Directive, the Flood Directive and the Solidarity Fund. The EU expert working group on disaster damage and loss data maintains active dialogues with the respective counterpart experts to further align all implementation frameworks.
- The guidance document will be updated with an annex on examples of implementation of the proposed framework for damage and loss data recording considering different types of hazards (e.g. floods, droughts, landslides, etc.). The sample case studies will allow testing the practicability of the proposed frameworks and identifying areas of improvement.

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9 ANNEX 1: TERMINOLOGY

The terminology used in this document is largely based on existing definitions, with some adapted and new terms.

DISASTER

Source: UNISDR, 2009[22]

A disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope with using its own resources.

Comment: Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation (UNISDR, 2009).

DISASTER RISK

Source: UNISDR, 2009

The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.

Comment: The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses, which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least (UNISDR, 2009).

DISASTER IMPACT

Source: NRC, 1999[23]

The impact of a disaster represents the overall effects, including positive and negative effects, of the disaster.

Comment: Still, in most cases, one refers to the impacts of disasters that are predominantly undesirable. Furthermore, these impacts include market-based impacts (e.g. destruction of property or a reduction in income) and non-market effects (e.g. loss of life, environmental consequences, loss of cultural heritage or psychological effects suffered by individuals).

[22] UNISDR terminology on disaster risk reduction, 2009. http://www.unisdr.org/we/inform/terminology#letter-r
[23] National Research Council, 1999. The Impacts of Natural Disasters: A Framework for Loss Estimation, March 1999

DISASTER DAMAGE

Source: ECLAC, 2003[24]

Total or partial destruction of physical assets existing in the affected area.

Comment: Damage occurs during and immediately after the disaster and is measured in physical units (i.e. square meters of housing, kilometres of roads, etc.). Its monetary value is expressed in terms of replacement costs according to prices prevailing just before the event (ECLAC, 2003). Direct damage is a physical damage to properties due to direct physical contact with the hazard, i.e. the physical destruction of buildings, inventories, stocks, infrastructure or other assets at risk (Smith and Ward, 1998[25]).

ECONOMIC LOSS

Source: NRC, 1999

The economic losses of a disaster represent marked-based negative economic impact. These consist of direct and indirect losses.

DIRECT LOSS

Source: adapted from ECLAC 2003 and Benson and Clay, 2000[26]

Direct loss is the monetary value of physical damage to capital assets and tangible wealth assets.

Comment: Direct losses may be also measured in terms of flows of foregone production,

INDIRECT LOSS

Source: adapted from Benson and Clay, 2000

Indirect losses refer to the damage to the flow of goods and services.

Comment: Indirect loss include lower output from damaged or destroyed assets and infrastructure and loss of earnings due to damage to marketing infrastructure such as roads and ports. Indirect loss may also include costs such as those associated with the use of more expensive inputs following the destruction of cheaper sources of supply.

[24] Economic Commission for Latin America and the Caribbean (ECLAC), 2003. Handbook for Estimating the Socio-Economic and Environmental Effects of Disasters.
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DIRECTLY AFFECTED PEOPLE

Source: JRC

Directly affected people: are a subset of exposed people (people living in the affected area that are thereby subject to potential losses) that suffered either:

- impacts on their livelihood immediately after the disaster: people displaced, isolated and impaired
- impacts on their physical integrity: injured people

Comment: definitions of directly affected people vary widely among disaster loss databases and publications. To make it an effective metric, a precise definition is necessary. The proposed definition follows the logic of ECLAC for economic disaster losses, and is based on a rigorous definition of various groups of directly affected people (see De Groeve et al., 2014)

INDIRECTLY AFFECTED

Source: JRC, adapted from ECLAC (2003)

Indirectly affected people correspond to people in the affected country that suffer indirect effects of the disaster and can be within or outside the affected area, which divides them into secondary and tertiary level of indirectly affected people respectively.

DEATHS

Source: JRC

Deaths correspond to the number of people who died during the disaster, or some time after, as a direct result of the disaster.

MISSING

Source: JRC

Missing correspond to the number of persons whose whereabouts since the disaster are unknown. It includes people presumed dead without physical evidence. Data on deceased and missing persons are mutually exclusive.

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