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Data and Digital Maturity for Disaster Risk Reduction

Informing the Next Generation of Disaster Loss and Damage Databases

Data and Digital Maturity for Disaster Risk Reduction
Informing the Next Generation of Disaster Loss and Damage Databases

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Informing the Next Generation of Disaster Loss and Damage Databases

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Acronyms and abbreviations

AHP	Analytical hierarchy process
ANOVA	Analysis of variance
DDRRMM	Digital Disaster Risk Reduction Maturity Model
DLAS	Disaster loss accounting system
DRR	Disaster risk reduction
GIS	Geographic information system
ICT	Information and communication technology
SDG	Sustainable Development Goal
SFM	Sendai Framework Monitor
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction

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Foreword

Monitoring disaster loss and damage is an integral part of risk governance, humanitarian programming, and public and private investments. Disasters of all dimensions, simple or complex, acute or protracted, are all felt at the local level; therefore, tracking disaster losses at this level is of critical importance.

This has provided the motivation for the United Nations Office for Disaster Risk Reduction (UNDRR) and the United Nations Development Programme (UNDP) to support countries in strengthening their risk governance. Both organizations have been supporting a disaster loss accounting system called DesInventar, established in 1994. DesInventar forms the basis for national disaster loss and damage databases in about 110 UN Member States. The extent to which countries have adapted it over the years has enabled them and other users to obtain a comprehensive picture of human, economic and asset losses at national and subnational levels.

Given the recent advances in technologies, efforts are under way to develop a new generation disaster loss accounting system. The new system, fully aligned with the Sendai Framework for Disaster Risk Reduction, will strengthen risk information and evidence in development and humanitarian settings. It will provide an adaptive tool in data management, hazardous event monitoring and analytics to address the complex nature of risk to better understand its cascading impacts. The new system, hence, will be developed as a collaborative effort between UNDP, UNDRR and other partners.

The present report enhances our current understanding of data and digital maturity for disaster risk reduction across countries, as a key contribution in planning technical support and capacity development of countries. This exercise aimed to provide a forensic evaluation of what went well and what did not for countries that have had similar but not the same disaster loss databases. Such documented experience is a critical step to inform the development and design of the new system.

We hope this assessment of digital maturity for disaster risk reduction, while providing the required insight for the new generation of disaster loss accounting system, will also motivate countries to internalise an assessment of their own digital maturity that could help them strengthen their loss accounting and more importantly their risk governance. We would like to reiterate the commitment of UNDRR and UNDP to supporting governments, United Nations Country Teams and other national and local partners to achieve risk-informed development through an improved understanding of risks, given their increasingly systemic nature.

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Executive summary

This report documents the assessment of the status of national disaster loss databases in 13 countries and presents lessons to guide the next generation of disaster loss accounting systems (DLAS). The study builds on two internal reports developed by the United Nations Office for Disaster Risk Reduction (UNDRR) concerning the needs and analysis of DLAS and has been undertaken with the objectives of:

- documenting country experiences in DLAS solutions using a holistic model for digital transformation;
- analysing challenges, lessons learned and good practices in countries under study; and
- making recommendations to inform the next generation of disaster loss databases tailored to the digital maturity of each country.

As a joint output of the United Nations Development Programme (UNDP) and UNDRR, the study conducted an in-depth analysis of the current status of national disaster loss databases and captured the demand, lessons learned, and challenges faced by government and other stakeholders in Asia-Pacific, Europe and Central Asia, the Arab States, Africa, and Americas, and the Caribbean. Some of the selected countries are still in the process of developing their disaster data systems, some have been using them for a while but are yet to realize their full potential, and some are considered good examples of disaster data systems – thus permitting analyses of countries at different stages of data and digital maturity.

The Digital Disaster Risk Reduction Maturity Model (DDRRMM) that was developed by UNDP was used as a framework to contextualize the challenges, lessons learned, good practices and demands for disaster data systems. The model covers seven components of such systems: data access and sharing; digital applications and services; information and communication technology (ICT) infrastructure; staff competencies; institutionalization and partnership programmes; data governance; and alignment with disaster risk reduction (DRR). The DDRRMM aligns well with the United Nations Secretary-General's Data Strategy and the UNDP Digital Strategy, which established improved data access and sharing, effective data management, and enhanced data governance and collaboration as strategic outcomes.

The consultative process resulted in qualitative analyses of challenges, lessons learned, good practices and demands across the seven components of the DDRRMM, while DDRRMM scores were used to classify the surveyed countries into three levels of digital maturity. Subsequent consultations helped prioritize recommendations across the three maturity clusters.

Broad takeaways

- **Government leadership**: Disaster data systems under or with formal attachments to government (departments or a national coordinating entity) are more likely to operate smoothly and effectively.
- **Context specific**: To be able to serve as an important tool for disaster preparedness, risk assessment and risk-informed development planning, future disaster data systems need to consider the context of countries and be tailored to national and local requirements.
- **Capacity and skills**: National and local leadership should be complemented with enhanced capacity and technical skills of government staff in data and digital management and technology.
- **Decentralisation**: Disaster data collection and management at sub-national and decentralized levels is critical for the sustainability of data systems and to support national agencies.
- **Global standards with country adaptation**: Global data systems need to acknowledge that countries have varying degrees of data and digital maturity. Therefore, while aiming to develop internationally comparable systems

that meet global data standards, the system should be flexibly adaptable based on countries' varying degrees of data and digital maturity. An even balance of global standards and country-specific adaptation will be key to the new generation of DLAS.

- **The digital ecosystem**: Disaster data systems need to be embedded in a larger digital ecosystem that extends well beyond data and technology issues, including people, procedures, governance and financial resources.
- **Learning and sharing**: Mutual learning and sharing platforms are needed to facilitate knowledge-sharing across countries and provide a basis for active interaction, including online sharing of resources, training materials and other forms of support.

Maturity clusters

Cluster 1 (maturity score: 0–33 percent)

- Interventions in this cluster should focus on critical priority issues (e.g. developing tools to support disaster tracking; geospatial mapping and analysis) before seeking to address core technical data challenges (such as setting up a formal database scheme, applying quality assurance procedures or considering big data applications).
- Interventions related to tools and applications should be aligned with those applied to improve data-sharing and access, so that decisions concerning the scale-up of specific tools can be timed with the presence of sufficient data resources that these tools need.
- Interventions concerning ICT infrastructure and its alignment with DRR should be preceded by discussions with respective stakeholders to reveal the context-specific challenges of these areas.
- Interventions should be directed towards building a competent cadre of human resources in data sourcing, analysis and application.
- Finally, under the 'institutionalization' and 'governance' components, related interventions should provide guidance and recommendations to countries at their early stage of system development, to establish communities of practices and shared interest among stakeholders and to develop legislation that aligns DLAS with the governments' missions.

Cluster 2 (maturity score: 34–66 percent)

- In addition to the recommendations outlined for Cluster 1 (depending on the context), recommendations for Cluster 2 include:
  - data specification, formal database schema, and standardization of data collected;
  - real-time processing of data, modelling and geographic information system (GIS) mapping (for the digital applications and services component);
  - dedicated training-of-trainers programmes, training personnel for data collection and ICT, and workshops to inform decision-makers;
  - increased awareness and incentivization policies (for institutionalization); and
  - promoting legislative frameworks and the adoption of standard operating procedures (for governance).
- When countries are in transition, they face equal chances of both setbacks and acceleration. Therefore, interventions designed to address issues faced by countries in this cluster should be carefully planned and extremely sensitive to the context of each country.

Cluster 3 (maturity score: 67–100 percent)

- The focus of interventions in this cluster should be on improving current conditions and keeping pace with technological development and state-of-the-art practices.
- Interventions are recommended to focus on innovation, optimization and harmonization.

Overall recommendations

- Embrace a holistic view of digital ecosystem transformation to underlie the vision, mission, programmes and projects of the implementation roadmap for the next generation of DLAS.
- Develop and pilot national data ecosystem prototypes (with data visualization and applications), and in a few countries build a system with participation from the government, the private sector, international organizations and others as producers, supplies and users of data, to identify risks and help develop analogue and digital solutions.
- Brand the next generation of DLAS to demonstrate the multiple applications of such valuable data, besides formal and multilateral reporting processes, supporting integrated DRR and risk-informed development.
- Adopt successful software models in developing the next generation of DLAS by creating a comprehensive value chain, consisting of all stakeholders (technical support, technical development, education centre, data advisers, etc.), that addresses all areas of digital transformation (data, technology, ICT, etc.).
- Adopt a value chain model to develop DLAS and promote digital transformation in countries across key sectors. The model should depict the value of each data item stored in the DLAS and show stakeholders how it is used to support decision-making, risk management and risk-informed development.
- Engage with end-users (stakeholders from government agencies, non-governmental organizations, consultants, United Nations organizations, etc.) to shape DLAS product delivery (technology features and capabilities, supported data, training modules, etc.) via an agile methodology.
- Use analytics and key performance indicators to better capture the value and degree to which stakeholders and users understand the importance of information products provided by the DLAS.
- Develop multiple solution packages and product editions that speak to different contexts and stakeholders at various maturity levels.
- Document case studies and user experiences, and nurture communities of interest and practice on all aspects related to DLAS, from technology and data to governance and institutions.
- Enable third-party integration via application programming interfaces and services. Third-party developers and users are often faster to create needs that speak to very specific problems.
- Develop awareness campaigns for governments on the value of DLAS that explain the return on investment and provide a cost-benefit analysis, along with case studies and success stories.
- Promote disaster data as a public good to enhance accountability in risk governance and foster the use of data for resilience building. This necessitates that government leadership should be underscored with a whole of society approach, with effective engagement of all stakeholders, including the private sector, civil society, and the science and technology community.

01 Introduction

The Sendai Framework for Disaster Risk Reduction 2015–2030[1] prioritizes actions for: (1) understanding disaster risk; (2) strengthening disaster risk governance to manage disaster risk; (3) investing in disaster risk reduction (DRR) for resilience; and (4) enhancing disaster preparedness for effective response. These actions enable countries to build resilience and reduce losses and damages from various threats, whether they are natural, technological or human-induced. Lessons from the COVID-19 pandemic highlight the need to improve our understanding of how risks cascade and compound across systems and sectors, and better data can help us make better decisions. The availability of data and information that inform these actions is repeatedly singled out as essential evidence for sound policymaking, risk-informed development, and evaluating progress towards realizing both Sendai Framework targets and the Sustainable Development Goals (SDGs).

Implementing data solutions at various levels—national, provincial and local—has been recognized as a critical step towards building capacities of relevant stakeholders to understand disaster trends and their impacts and improve prevention, mitigation and preparedness measures. Solutions such as DesInventar[2] have been implemented since 1994 to record disaster loss and damage data and capture trends and patterns of disaster impacts. Since the launch of the Sendai Framework Monitor (SFM), DesInventar has also helped in monitoring progress against the Sendai Framework and related SDG indicators. The system is currently being used by 110 UN Member States and several Non-Self-Governing Territories

1 United Nations Office for Disaster Risk Reduction, 'Sendai Framework for Disaster Risk Reduction 2015-2030', Geneva, 2015, https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030.

2 www.desinventar.net

However, despite the confluence of major trends in cloud computing, new data source advances in algorithms, and the rise of the 'Internet of Things', databases in many countries have not kept pace with technological innovations; nor have they evolved to operationalize the paradigm shift towards a holistic and integrated view of DRR.

> The next generation of disaster loss accounting systems should be designed to overcome many challenges and hurdles, which include but are not limited to the timeliness of the data required for proactive risk management, the presence of location- and activity-specific factors impacting the credibility of information (e.g. unvalidated volunteered/crowd data sources), and the lack of appropriate data for supporting the integration of risk information into the daily activities and decision-making of other domains, such as urban planning and economic development.

Moreover, the COVID-19 pandemic and its cascading effects and impacts on health, displacement, business discontinuity, disrupted government services, job and income losses, and erosion of citizens' trust and social cohesion have revealed serious gaps between theory and practice and between the ideal goals for which disaster data solutions are designed and what is being implemented. Increasing complexity of risk requires a transformative change in our ways of working, building not just new skills but a new culture which embraces complexity and actively manages risks to expand human capabilities through strengthened data for risk-informed development.

However, in many countries, the level of digitalization of disaster data is inadequate for risk-informed development. There is a pressing need to go beyond the 'inventory model' (reflected in the very name 'DesInventar'), with the sole focus of gathering and reporting disaster impacts, to an extended data value chain that records both the origin of hazards and hazardous events, and resulting disasters and cascading impacts. Reporting on disaster loss is indeed an integral part of the life cycle, but this can greatly benefit from stronger analytics and heuristic rules to gain insights into disaster risks and inform integrated models for risk and vulnerability assessments. The product of such data systems can be translated into actionable information to support a range of DRR decision-making processes in recovery, preparedness, mitigation and policy design.

There is also a broad misconception that limits digital transformation in disaster loss accounting systems (DLAS) to the use of digital data. Although data are a critical element in the digital transformation process, other digital ecosystem features, such as tools, computing infrastructure, people, processes, collaboration, information policies, etc., are equally important. When one or more of such features is weak or not realizing its full potential, the digital ecosystem will be rendered ineffective and unsustainable to some degree and unable to deliver the full promise of digital transformation in disaster risk management. On the other hand, when various elements of the digital ecosystem are intact and balanced, we have a healthy digital ecosystem that supports data-driven decision-making processes, creates actionable information, and streamlines collaboration and operations which inform anticipatory action and foresight for resilient human development.

1.1 Overview of background analysis

Recognizing the need to rebuild the current DesInventar system, and inspired by the progress in data strategy development in the United Nations system, the United Nations Office for Disaster Risk Reduction (UNDRR) conducted a discovery and needs analysis that reviewed current and planned initiatives and conducted end-user consultations to better understand the nature of demand for and the level of supply of information. Based on this analysis, UNDRR also developed a vision and roadmap to guide the transformation of DesInventar into a comprehensive DLAS for governments and stakeholders to support risk-informed development.

The discovery and needs analysis was designed to assess user needs and requirements to transform DesInventar into an innovative DLAS for governments to support risk-informed development. Based on stakeholder consultations, the analysis covered five areas: (1) user experience and future requirements; (2) usefulness and importance of current disaster loss data systems; (3) data collection and management; (4) stakeholders (producers and users); and (5) governance and institutionalization. The vision and roadmap built on the assessment findings to recommend a roadmap for UNDRR to support governments to reduce damage, loss and risk through the institutionalization of collaborative, user-driven and Sendai Framework-aligned national DLAS.

Further, a baseline analysis was also conducted in 76 countries, building on a similar analysis done in 57 countries conducted by the United Nations Development Programme (UNDP) in 2013,[3] most of which are currently using or have developed national data solutions building over the DesInventar system.

The present analysis of digital maturity builds on these internal reports to provide a substantive basis for a new generation of DLAS.

1.2 Scope of the present assessment

The present study aims to capture experiences in disaster databases and data solutions, guided by a holistic model for digital transformation. The report includes in-depth analysis of selected databases, aiming to capture the challenges, lessons learned, best practices and demands of such solutions in selected countries. Information was captured from the experiences and insights of government officials and stakeholders and their recommended potential action items for successful institutionalization and continued improvement.[4]

> Digital transformation is not only about data (which are indeed a critical element in the transformation process); it is also about the tools, computing infrastructure, people, processes, collaboration, information policies, and other features that together (i.e. these components and their interrelationship) make up the digital ecosystem for DRR management.

The UNDP's Digital Disaster Risk Reduction Maturity Model (DDRRMM)[5] was the framework used to analyse the challenges, lessons learned, best practices and demand for disaster data solutions. Digital DRR operationalizes the holistic assessment of digital ecosystems in which data solutions are embedded. **The DDRRMM covers seven components of disaster data systems**: **data access and sharing; digital applications and services; information and communication technology (ICT) infrastructure; staff competencies; institutionalization and partnership programmes; data governance; and alignment with DRR.** This approach to digital diagnostics enables comprehensive coverage of existing disaster data solutions and facilitates the drafting of recommendations along the same dimensions.

3 United Nations Development Programme, 'A Comparative Review of Country-level and Regional Disaster Loss and Damage Databases', New York, 2013, http://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/asia_pacific/lossanddamagedatabase.pdf.

4 The survey was split into an internal survey within UNDRR and UNDP and an external survey covering 69 responses from academia (14), development partners (12), consultants and contractors (11), government staff (8), organizations, including non-governmental and civil society (8), community (2), and with disability (2), the private sector (2) and media (1).

5 T. Rashed, 'Digital Disaster Risk Reduction Maturity Model (DDRRMM) White Paper', United Nations Development Programme Bangkok Regional Hub, Bangkok, 2021.

The DDRRMM framework aligns well with both the United Nations Secretary-General's Data Strategy[6] and the UNDP Digital Strategy,[7] which establish improved data access and sharing, effective data management, and enhanced data governance and collaboration as strategic outcomes. For example, the UN Secretary-General's Data Strategy sets four enablers to accelerate progress and generate more value from data: (1) people and culture (focusing on building data skills and talents, and creating a culture for collaboration and sharing); (2) data governance and strategy oversight (focusing on governance mechanisms to manage data); (3) partnerships (focusing on expanding the value of the data by connecting to other data ecosystems outside the United Nations system); and (4) technology environment (focusing on empowering users with tools and processes to turn data into insight and actions). Likewise, the UNDP Digital Strategy sets out a vision to achieve digital transformation through two pathways: (1) a focus on innovation in the delivery models, co-creation, collaboration and advocacy journeys in using digital technologies to solve development challenges; and (2) a focus on knowledge-sharing, improved data usage and greater efficiency to leverage the quality, relevance and impact of UNDP's work.

The overall objective of this assessment was to outline good practices and provide recommendations to guide implementation of the next generation of DLAS in a way that is tailored to the digital maturity of each country.

These objectives were achieved via the following activities:

- Establishing an indicative baseline for disaster loss databases through a sample of countries, analysing current status, in-depth consultations and review of existing reports;
- identifying key agencies, government officials and other relevant stakeholders in each of the selected countries and interviewing them to understand the key aspects of success and failure and derive lessons to guide the development of the next generation of DLAS;
- conducting key informant interviews with identified government officials;
- undertaking digital diagnostics of existing disaster loss databases based on available data and interviews;
- conducting follow-up webinars with government stakeholders to validate responses and rank them in order of importance; and
- documenting the analysis and findings, and providing recommendations for the way forward in a short report.

1.3 Report organization

This report is organized in the following chapters:

- **Chapter 1 (Introduction)** introduces the present document and covers the background, context and scope of the consultancy assignment.
- **Chapter 2 (Assessment methodology)** presents the assessment approach, its guiding framework, methodology, tools for data collection, and assumptions and limitations.
- **Chapter 3 (Findings of the assessment)** covers the interpretations emerging from the semi-structured interviews and ranking workshops.
- **Chapter 4 (Recommendations)** covers recommendations for the next generation of dlas emerging from the findings of the consultancy assignment.
- **Appendices** include details about the theoretical frameworks and methodology underlying the assessment, results of the interviews held with the stakeholders, etc.

6 https://www.un.org/en/content/datastrategy/index.shtml
7 United Nations Development Programme, 'UNDP Digital Strategy: Future forward', New York, 2019, https://digitalstrategy.undp.org/. UNDRR's Data Strategy was under development at the time of the drafting of this report.

02 Assessment methodology

2.1 Approach

The current assessment used a mixed-methods approach to explore and assess the country-specific contexts of disaster databases and recommend ways to guide the next generation of DLAS. This approach uses a blend of qualitative assessment (semi-structured key informant interviews) and quantitative assessment to prioritize and assign weights to good practices and action items recommended by the stakeholders interviewed. The approach followed a stakeholder-centric, participatory and collaborative process to derive insights from the user's perspective. Adopting this user-centric approach helped arrive at sustainable and innovative recommendations for a DLAS with global relevance and local appeal. The overall design of the assessment is depicted in Figure 1.

Figure 1. Assessment approach

Assessment approach: DDRRMM framework and country-specific co-creation

Data collection

- Country sample selection
- Key informant interviews
- Ranking workshops

Data analysis and interpretation

- Calculation of average and equally weighted DDRRMM scores
- Creation of maturity clusters
- Ranked action items per maturity cluster

Recommendations

- Revised strategy for next generation of DLAS
- Proposed roadmap/ service offers
- Pilot programmes

Appendix B of this report provides details of the guiding frameworks underlying the assessment approach. Appendix C includes the methodology used to operationalize the approach.

2.2 Assumptions and limitations

Assumptions

- Government stakeholders who participated in the interviews were knowledgeable and able to clearly understand their country-specific context surrounding the use of DesInventar or other disaster loss databases they are implementing.
- Stakeholders who participated in the interviews were knowledgeable and able to provide valid, fair and unbiased inputs and assessments of the 23 subcomponents of the seven DDRRMM components.
- Stakeholders who participated in the interviews were knowledgeable and able to recommend good practices or raise issues concerning their 'wish list' of actions that need to be taken.

Limitations

- Due to a lack of baseline information from some countries on the status of their disaster loss databases, old data (from the 2013 UNDP report on country-level and regional disaster loss and damage databases) for these countries had to be included.
- While most country-specific semi-structured interviews were attended by two or more stakeholders covering various aspects of the DDRRMM assessment (technical, managerial etc.), a few countries had an inadequate number of stakeholders participating in the process, resulting in a potential bias towards technical or managerial issues (depending on the representation received).
- For various reasons (such as the limited availability of stakeholders, delayed or no response from the countries, etc.), some of the initially identified countries could not be included in the assessment.
- The vast difference between the countries' time zones made it impossible to conduct the ranking workshops as per the three maturity groups identified (and as planned earlier). As a result, all the action items across the entire selection group were compiled together, and a common action item list was used for the analytical hierarchy process (AHP) in the ranking workshops.
- Due to the tight timelines of the process, stakeholders from two countries who participated in the maturity assessment could not participate in the ranking webinars.

03 Findings of the assessment

This chapter presents the analysis and interpretation of the interviews and the ranking workshops. The interviews were intended to understand each country's context, maturity level and 'wish list', and the findings correspond to these objectives. The results of the interviews cover: (1) country-specific DDRRMM scores; (2) issues raised regarding challenges, lessons learned and best practices; and (3) demands/wish list items. Similarly, the results from the ranking workshops were organized into ranked action items, with a weight assigned to each action item depicting its relevant importance from the stakeholder's perspective. The ranking was done for each maturity cluster to enable cross-cluster comparisons.

3.1 Maturity clusters

The maturity scores of the target countries were calculated according to the method described in Section C.2 in Appendix C. Countries were then grouped into three clusters according to their maturity scores (see details in Appendix C). Countries were assigned to a given cluster based on their overall DDRRMM score calculated based on inputs provided by government stakeholders in each country during the interviews. Table 1 also shows the average scores (0–5) assigned to each cluster for each DDRRMM component. Figure 2 shows a radar chart of DDRRMM components' maturity scores among the cluster, while Figure 3 shows results from the analysis of variance (ANOVA) in maturity scores within and among the clusters.

Table 1. DDRRMM component scores assigned to the three maturity clusters

Average normalized scores (1–5) per ddrrmm dimension							
Cluster	Data	Tools	ICT Infrastructure	Competencies	Institutionalization	Governance	Alignment with DRR
Bottom 33%	1.93	1.40	1.75	1.23	1.93	1.40	1.31
Middle 33%	2.87	2.24	2.59	2.45	3.42	3.29	3.01
Top 33%	3.50	3.59	3.15	3.59	3.50	4.20	3.94

Figure 2. Radar chart showing average DDRRMM scores by maturity cluster

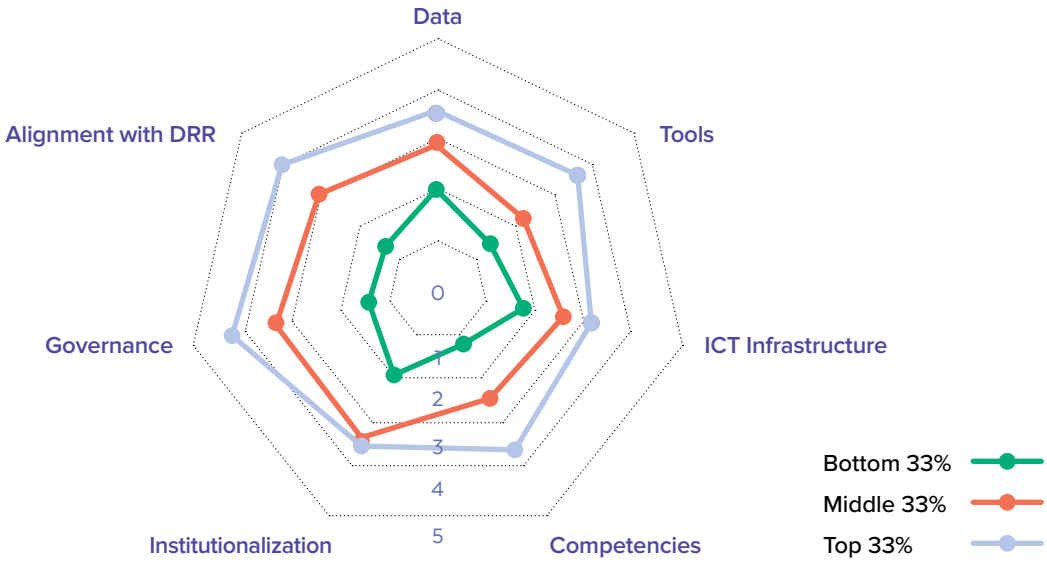


Figure 3. ANOVA in DDRRMM maturity scores calculated for the three maturity clusters

Summary			
Groups	Cluster 1 (bottom 33%)	Cluster 2 (middle 33%)	Cluster 3 (top 33%)
Variance	0.087865	0.323167	0.114479

ANOVA						
Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between clusters	15.51815	2	7.759077	44.29452	1.11697E-07	3.554557
Within clusters	3.153063	18	0.17517			

The major takeaways from the scores and analysis shown in Table 1 and Figures 2 and 3 are as follows.

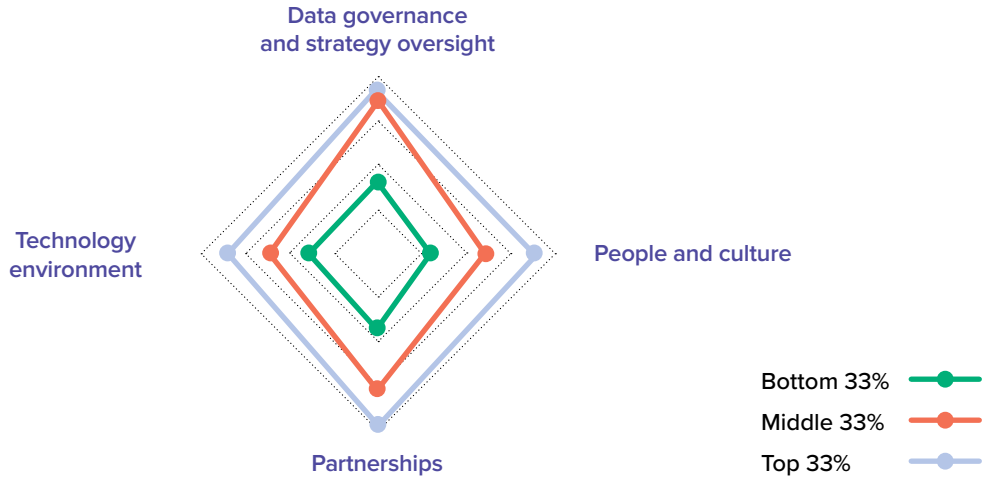
- The average scores assigned to DDRRMM components in each cluster tend to mostly fall under the same percentile group as their corresponding maturity cluster. The scores show that countries that are doing well with their national disaster loss databases or equivalent (hence scoring high in maturity) tend to do so by balancing progress in all aspects of digital transformation (i.e. the seven DDRRMM components). The opposite is also true.
- Calculated variance (a measure of variability) for the three clusters reveals how institutions and countries progress along the data maturity path. Cluster 1 exhibits the smallest variance in maturity scores calculated for the DDRRMM components. This is because Cluster 1 represents countries at the very early stage of setting up a disaster data system, which are expected to have made little progress on any DDRRMM component yet. On the other hand, Cluster 2 has the highest variance, reflecting different degrees of progress on the components. Cluster 2 represents institutions in transition.
- This transition state leads to unbalanced progress in digital transformation, where maturity proceeds in some areas faster than others. In the countries sampled in this study, institutions in Cluster 2 emphasize the institutionalization and governance of data systems more than data, tools or capacity-building. Managing transition in a balanced way is key for such countries to progress; otherwise, they risk potential setbacks in progress. Finally, the variance in Cluster 3 shows a value between those of Clusters 1 and 2, though leaning more towards little variability. This cluster represents countries that have reached reasonable maturity across all DDRRMM components and tend to focus on maintaining and improving the overall data ecosystem.
- Overall, the scores in Table 1 show that to truly capture the status of a national disaster loss database in a given country, a holistic look at all aspects of digital transformation (i.e. data, tools, ICT infrastructure, competencies, institutionalization, governance and alignment with DRR activities) is needed. Focusing only on one or two aspects of digital transformation may yield a false interpretation of progress and possibly lead to the incorrect prioritization of the kinds of investments needed to improve disaster data solutions.

Table 2 and Figure 4 show the scores calculated for the four enablers of the United Nations Secretary-General's Data Strategy. The patterns of scores are similar to those outlined above.

Table 2. Average maturity scores calculated for the four enablers of the United Nations Secretary-General's Data Strategy for each cluster

Average normalized scores (1–5) per undata strategy enablers				
Cluster	Data governance and strategy oversight	People and culture	Partnerships	Technology environment
Bottom 33%	1.62	1.23	1.66	1.58
Middle 33%	3.47	2.45	3.08	2.42
Top 33%	3.72	3.59	3.85	3.37

Figure 4. Radar chart showing average DDRRMM scores for each United Nations Secretary-General's Data Strategy enabler



3.2 Results of consultations

This section presents consolidated challenges, lessons learned and good practices on the use and operation of national disaster loss databases derived from the interviews with government officials in selected countries. Specific issues raised during individual interview sessions conducted with government officials in the countries are provided in Appendix F in this report.

3.2.1 Challenges associated with disaster data systems

Challenges faced by the countries in using and operating disaster data systems are outlined below. The list was generated from countries mostly with early to mid-level maturity (Clusters 1 and 2, with an overall maturity score of less than 60 percent).

Data access and sharing

- The lack of exhaustively compiled and disaggregated, in-depth data has implications for overall disaster risk management.
- The lack of support for local languages in disaster loss databases is mentioned by some countries as a challenge in operating data solutions.
- Some countries (especially those in the early or medium stages of digital maturity) are having difficulties with data authentication/vetting issues.
- Some countries continue to use spreadsheets for data collection and management, which poses significant challenges in extracting, integrating and incorporating data into disaster databases.
- A few countries mentioned that while disaster databases capture the details of casualties caused by disasters, they seldom incorporate such details as economic impacts/losses, which, in turn, has implications for future disaster management and planning.

Digital applications and services

- Limited common understanding of processes (e.g. tabulation of data) and the capabilities of tools between different agencies involved in data collection leads to suboptimal results.
- Some countries also struggle with data analytics and do not have the required support to build on this area of work.
- Limited resources to support and operate disaster databases emerged as a common challenge in many countries.
- Capturing indirect disaster losses for incorporation in the databases has been challenging for some countries due to limited competencies, skills or information needed.

ICT infrastructure

- Limited ICT infrastructure, especially Internet connection, poses a challenge in rural and remote areas.
- Data back-up and protection emerged as a common challenge in many countries.
- Limited resources and budget to upgrade the computing infrastructure adds to the challenges and constrains smooth operations.

Staff competencies

- Many countries highlighted the lack of adequate and regular training to build capacities of personnel involved in disaster data collection and operating the software.
- Countries (especially in the early or medium stages of maturity) shared concerns about the lack of understanding of the importance and value of disaster databases in the community, among personnel involved in disaster data collection and, at times, in the government.
- Countries across all maturity levels face the challenge of turnover of trained staff.

Institutionalization and partnership programmes

- Data collection at the local level and real-time data-sharing among agencies continue to be a major challenge impacting the timeliness of data-sharing.
- In countries where different agencies are involved in disaster data collection, there is often a lack of consistency in the ways data are collected, which presents challenges for incorporating the data into formal databases. Further, many variations in the extent of data collected/available with different agencies further complicate the process of harmonizing data for entry into databases.

Data governance

- The absence of clearly articulated technical or training manuals, standard operating procedures, guidelines and practices contributed to process ambiguities and system asynchrony, impacting the smooth operation of DLAS and related systems. It is here that the need for handholding, training and orientation was felt the most.

3.2.2 Lessons learned

The following list is a compilation of lessons learned from the countries in using and operating disaster data systems. The list was generated from countries mostly at the medium to advanced level of maturity (Clusters 2 and 3, with an overall maturity score of more than 60 percent).

Data access and sharing

- A common framework is critical to bringing all data into the system with maximum accuracy. Here, it is important to note that while this is the vision for most countries at early to mid-level maturity, the advanced countries with data in one system seek the best ways to manage the data. This reiterates the importance of tailor-made solutions based on countries' digital maturity.
- Effective coordination of disaster data collection and sharing via disaster loss databases plays an important role in improved reporting to the SFM.
- As data are collected differently and in varying formats in different countries, future databases need to accommodate such tools as Extract, Transform, Load (ETL) to synchronize data and ease integration.
- Adopting a formal database schema eases the incorporation and uploading of data into databases, and optimal support should be provided in this regard.

Digital application and services

- With technological advancement at so many levels, many countries are seeking automation of processes at different levels. Therefore, maintaining a portfolio of desired applications and services allows for incremental progress towards full automation.
- Data solutions should leverage the full spectrum of resources available, with globally available digital solutions and resources effectively complemented by domestically available resources for greater sustainability.

ICT infrastructure

- The functioning of systems (tools, hardware,

software) varies by country, which in turn impacts the overall disaster data systems. Priority should be given to integrating existing systems through application programming interfaces, rather than developing new solutions afresh every time.

Staff competencies

- One of the major lessons from the analyses is that mere initial orientation or technical training on using disaster databases is insufficient. Regular capacity development and refresher training (especially in the initial stages, when limited clarity on systems and processes is expected) needs to be extended until personnel become fluent in the use of the solutions.
- In cases where competencies exist but are underutilized, the training modules need to be contextualised accordingly. Countries that have received such support make better progress in terms of DLAS applications.
- A training-of-trainers programme is very effective in developing capacities because trained personnel tend to be a useful resource for their peers on managing data related to disasters and handling DLAS tools.

Institutionalization and partnership programmes

- The existence of an overarching national body that is functional, well oriented for hosting and managing databases, and committed to further improvements provides strategic advantage for the smooth operation of disaster data systems.
- Some countries mentioned collaboration with academia/research institutions as an advantageous proposition, especially in terms of the digital application of disaster data.

Data governance

- In countries with explicit legislation frameworks or regulatory provisions for disaster risk management, DLAS operation processes tend to be better streamlined and coordinated.
- Many countries know what they want in terms of DLAS operations and utilization but are unsure how to achieve it. The existence of specific mechanisms (such as standard workflows or operational procedures and specific protocols) is useful for maintaining good DLAS performance. These, however, need to be regularly audited and, if necessary, updated, to accommodate pitfalls and changes in technology.

3.2.3 Good practices

The following list is a compilation of good practices derived from consultations with countries at medium and advanced maturity. These countries tend to have well-functioning disaster data systems but are working to improve their performance and take it to the next level.

- A thorough understanding of disaster-related risks, both generic and specific to a particular country, helps strengthen system databases.
- While it is important to institutionalize a disaster database, it is equally important to strengthen institutions that support it, from the national to the local level.
- Technically sound and trained human resources (especially at the local level) are critical. This should then lead to peer-to-peer learning so that trained personnel are continuously available, and the process does not suffer due to a lack of available trained personnel.
- Instil a collective spirit of disaster risk management for all stakeholders, ensuring their involvement to contribute at the local level for effective data collection and analyses, such as non-governmental organizations, academics and even the media.
- There needs to be a defined system of data collection, verification and sharing at the local level. It should involve all volunteers/informants engaged in verifying data and sharing them with national-level agencies.
- The role of disaster data systems is critical for effective reporting on SFM and related SDG indicators. However, this should not be approached from a compliance point of view. Both the data collated in the databases, and the officially reported data, should be consistently used to inform planning, preparedness and assessment, by aligning different systems/platforms and linking them to disaster databases.

A systematic application of such data plays a significant role in the sustainability of data systems.

- Capitalize on the rich information provided by a disaster database. For example, some countries have set up a simulation calendar to track the progress of disaster response, which is a great practice and can be replicated by other countries to aid disaster management processes.
- Countries at an advanced stage of digital disaster maturity view the entire disaster risk management sector as built on knowledge, risk reduction and management. It may be worth considering for countries to identify key parameters in their context and design their systems accordingly.

3.2.4 Outlook

This section provides a consolidated list of 'wish lists' provided by country representatives during the consultations. The study created a single list of demands (corresponding to the seven DDRRMM components) for all 13 countries.[8] The list was then used in the ranking workshops, conducted by grouping the countries based on convenient time zones.

It is worth noting that the interviews resulted in a series of demands and recommendations (Appendix F). These have been consolidated into the following demands (or wish list items) categorised by the DDRRMM components.

Data access and sharing

- Data specifications/formal database framework for standardized data collection and with complete coverage of all types of disasters
- Data quality standards, metadata documentation, and quality assurance/quality control and data auditing tools
- Support for local languages
- Decentralization: apps and solutions for data collection by local communities at the local level
- Streamlining data access and sharing: integration and support for interoperability
- Big data and real-time capability: dashboards for monitoring indicators and trends
- Guidelines for sharing good practices and user experiences of data handling and collection.

Digital applications and services

- Enhanced analytics (e.g. visualization, comparative statistics, etc.)
- Tools for producing actionable information and supporting risk-informed decision-making
- Geographic information system (GIS) and mapping tools to support risk analysis and capacity assessments
- Big data tools for real-time processing and incorporation of a multi-hazard early warning system
- Resources (e.g. dedicated budget, personnel, etc.)
- Tutorials and detailed user technical manuals (including video tutorials).

ICT infrastructure

- Mobile devices to support local-level data collection and reporting
- Improved ICT infrastructure, especially in rural and remote areas
- Resources/investment in computing infrastructure: support for big data processing for better risk management.

Staff competencies

- Personnel trained in data collection and analysis, and in information management
- Specialists in coordinating with agencies/ministries and other local authorities

8 The original plan was to collate consolidated action items by maturity cluster and conduct ranking workshops for countries in each cluster. However, that was not possible, due to the vast difference in time zones.

- Training and capacity-building for the efficient running of DLAS at all levels: a dedicated training-of-trainers programme
- Workshop and training for decision makers to understand the capability and value of DLAS, as well as limitations
- Budget and resource allocation for training and capacity-building
- Define the capability of the software/tool/instrument and then align human resource development accordingly.

Institutionalization

- Institutionalization of DLAS within a national agency for DRR
- Awareness and information dissemination programmes on how DLAS can be used for disaster risk management
- Stakeholder agreements and collaboration: a community of interest/practice around DLAS
- Dedicated resources/budget: incentivization policies.

Governance

- Investment in an 'enabling ecosystem' for the system to survive, with some defined funding in the future for this kind of work
- Legislative framework and aligning technology with the government's mission to ensure government buy-in
- Formal standard operating procedures cover all aspects (governance, asset management, training, etc.)
- Documentation of good practices from countries with advanced system databases on dealing with coastal hazards.

Alignment with DRR

- Application of DLAS-based analysis to support pre-disaster preparations and risk assessments
- Streamlining data to inform recovery, post-disaster events and long-term planning
- Mainstreaming data in risk-informed development, and tracking of performance of mitigation measures.

3.3 Summary findings

Overall findings of the present study are summarised below and are used as a basis for framing the recommendations for guiding the next generation of DLAS.

3.3.1 Broad takeaways

- A common message emerging from the surveyed countries is that **DLAS solutions and databases have considerable potential for diverse applications, besides official reporting on losses and damages.** All countries aspire to make their systems support an integrative and holistic approach to DRR. DLAS solutions are sought to effectively aid integrated disaster risk management (prevention, mitigation, preparedness, response, and recovery) or avert, minimise, and address losses and damages, while serving as a reason to tap funding for future interventions. DLAS solutions for assessing systemic, multidimensional-vulnerability, simultaneous crises from compound risks and for informing cost-benefit analyses will provide the evidence base for risk-informed decisions of the public and private sectors. While some countries (at advanced maturity) are progressing well to achieve this vision with their current DLAS solutions, others are a work in progress.
- Countries are at varying degrees of maturity with respect to disaster database management. Future systems need to be built on this realization and follow country context-specific requirements. Well-performing DLAS solutions **cater and respond better to a country's internal needs**.
- DLAS solutions with **formal attachments to government departments or a national coordinating entity are more likely to operate smoothly and effectively**.
- By serving as an important tool for disaster preparedness, risk assessment and planning, future DLAS solutions need to consider **account for countries' situational context** and be tailored to local requirements to meet the country-specific needs for disaster preparedness and planning.
- DLAS solutions should decentralize **disaster data collection and management**. **Rooting**

the process in local communities is critical to support national agencies.

- Countries are demonstrating a growing realization that DLAS solutions are embedded in a larger digital ecosystem that extends well beyond data and technology, and includes people, procedures, governance and financial resources. These issues (data and technology included) are equally important to ensure an 'enabling' digital ecosystem. Therefore, **a balanced, agile approach to tackle challenges and barriers and progress along all components of the digital ecosystem will likely yield better progress** in digital transformation and maturation of DLAS solutions.
- Many countries welcome the idea of learning from the practical experiences of others, especially those that have institutionalized DLAS, are successfully operating them and have good practice models. Therefore, mutual learning and sharing platforms are needed to **facilitate knowledge-sharing across countries and provide an outlet for active interaction**, including online sharing of resources, training materials and other forms of support.
- Data standards are critical to ensure coherent collection and analysis of disaster data, and enable comparison across time and space.

3.3.2 Inferences by cluster

The study of the demand ranks, and the weights assigned to these demands by each cluster of maturity, confirms the above-listed takeaways of this study. Below are some observations regarding the inputs from each of these clusters. These observations have been aligned with the Steps 1–3 from the Framework for Data Actions adopted in the United Nations Secretary-General's Data Strategy[9].

Cluster 1 (maturity scores 0–33 percent)

- Most of the challenges outlined earlier stem from issues reported by countries and institutions in Cluster 1. Consequently, the ranking of demands by this cluster mirrored to a large extent the challenges reported.
- Cluster 1's top three demands under 'data access and sharing' are: support for local languages; decentralization of data collection; and guidelines for good practices. Together these three demands account for over 57 percent of assigned weights. Therefore, **interventions targeting stakeholders in this cluster should focus on critical priority issues before addressing core technical data challenges,** such as setting up a formal database scheme, applying quality assurance procedures or considering big data applications.
- For 'digital applications and services', the top-priority issues ranked by this cluster and accounting for 56 percent of the weights were: developing tools to support disaster forecasting and simulation; producing actionable information; supporting decision makers; GIS mapping; and analysis. The higher-ranked demands mirror challenges reported about the lack of common understanding of the available tools, capability and data analytics. Interventions proposed to meet such demands should begin with use cases piloted to demonstrate and evaluate the use of these tools so that stakeholders can make risk-informed decisions on their utility. In addition, interventions related to tools and applications should be synchronized with those applied to improve data access and sharing, so that decisions concerning the scale-up of specific tools can be timed with the presence of sufficient data resources that these tools need to use.
- This cluster assigned equal weights to all demands under 'ICT infrastructure' and 'alignment with DRR'. Stakeholders tend to 'play it safe' and weigh items equally when the items

9 The United Nations Secretary-Genera's Data Strategy suggests a six-step framework for data actions for identifying and delivering data-focused products, projects or programmes. The steps are: (1) clarify priorities; (2) drill down to outcome; (3) identify use cases; (4) evaluate use cases; (5) evaluate the use case portfolio; and (6) deliver the portfolio. Steps 1–3 are intended to build value propositions, while step 4 is intended to assess the net value of proposed products, and steps 5 and 6 are to build an optimal use case portfolio.

in question do not present an urgent need for consideration or they lack technical information about the items. Interventions to address these components of digital transformation should be preceded by further discussions with relevant stakeholders to **reveal the context-specific challenges of these areas**.

- Under 'competencies', the top-priority items ranked by Cluster 1 related to the presence of trained personnel in data collection, and aligning training profiles with technologies, which counted for over 43 percent of the weights. **Thus, related interventions for this cluster should aim to build a competent cadre of human resources in data acquisition, analysis and modelling.**
- Finally, under 'institutionalization' and 'governance', the demand for increased awareness of disaster data solutions among stakeholders and the development of legislative frameworks each contributed 40 percent of the weights. Related interventions should provide guidance and recommendations to countries at the early stage of data system development to **establish a community of practice and shared interest among stakeholders and develop legislation that aligns DLAS with the government's mission**.

Cluster 2 (maturity scores 34–66 percent)

- This cluster comprised countries with considerably diverse maturity scores across individual components. It represents countries 'in transition' towards the large-scale operation of disaster data solutions. Accordingly, the priority demands of countries in this cluster are of a more technical nature than those of Cluster 1.
- The demands that stand out for this cluster include:
  - data specification, formal database schema, and standardization of data collected (for the data component);
  - real-time processing of data, forecasting and modelling, and GIS mapping (for the digital applications and services component);
  - dedicated training-of-trainers programmes, training of personnel for data collection and ICT, and workshops to inform decision makers (for competencies);
  - increased awareness and incentivization policies (for institutionalization); and
  - creation of a legislative framework and the adoption of standard operating procedures (for governance).
- The top-ranked demand is a mix of technical issues similar to those mentioned by Cluster 1 and others ranked high by Cluster 3. When countries are in transition, they maintain equal chances of setbacks and acceleration. Therefore, **interventions designed to address countries in this cluster should be carefully planned and extremely sensitive to each country's context.**

Cluster 3 (maturity scores 67–100 percent)

- This cluster represents countries that have progressed towards a mature status in disaster data solutions on a national scale. Most of the lessons learned and good practices captured in this report are collected from the interviews with stakeholders in this cluster.
- The weights assigned to demands by this cluster have the lowest variance, reflecting the importance of a 'package' of efforts needed to ensure the development and sustainability of a productive digital ecosystem.
- Top-ranked demands for various components focus on improving current conditions and keeping pace with technological development and state-of-the-art practices.
- Interventions designed to address the demands of this cluster need to focus on innovation, optimization and harmonization.

04 Recommendations

The following recommendations build on the findings of this report and offer insights into future disaster data models and solutions.

- **Embrace a holistic view of digital ecosystem transformation to underlie the vision, mission and implementation roadmap for the next generation of DLAS.** The core definition of holistic systems thinking is that the whole is much greater than the sum of the parts. All digital transformation frameworks acknowledge that the digital ecosystem is much bigger than data and technology. It includes operators, finances, policies, practices, governance, procedures, studies, internal staff, beneficiaries, etc. All these components represent either potential enablers or barriers to the successful roll-out and operation of DLAS solutions. Therefore, they should be emphasized equally and without bias, recognizing that the lack of progress in one area ultimately impacts progress in all others, as evidenced by the variance results presented in Section 3.1. Practical steps to be taken in this direction include the following.
  - Develop and pilot a national data ecosystem prototype (with data visualization and applications), and in a few countries build a system with participation from government, the private sector, international organizations and others as producers, suppliers and users of data, to identify risks and help develop analogue and digital solutions.
  - Brand the next generation of DLAS to demonstrate its varied applications for comprehensive disaster and climate risk management.
  - Adopt the model of successful software platforms in devising a programme for the next generation of DLAS that would provide practical action to adopt such a holistic view. Whether open source or commercial, successful platforms have an ultimate mission to keep operating by offering their user base some value addition, to ensure that they continue to use their systems. This value covers the technology but extends to technical support, tutorials, know-how

advisories, case studies, training programmes, a user community, annual user meetings, white papers, etc. That is, they create a value chain for everyone who is engaged with their platforms. Likewise, the programme for the next generation of DLAS should be devised with operational lines (technical support, technical development, educational centre, data advisers, etc.) that address all areas of digital transformation (data, technology, ICT, etc.).

- DLAS should be guided by a common data architecture, contextualised to national development priorities. This will ensure ownership and sustainability of DLAS by the government and other stakeholders, and will continue to incorporate changes based on changing risk profiles and emerging development priorities.

- **Adopt a value chain model for digital transformation as the way forward to develop the DLAS.** Promotion of digital transformation in countries across key sectors and improving understanding of systemic risks will accelerate digitalization to better understand exposure, vulnerabilities and risks. This will improve understanding of various dimensions of systemic risks and their manifestation in society, particularly for the most vulnerable and the larger well-being of humans and ecosystems. Practical action in this regard could possibly include the following.

  - Create an information value chain model for disaster risk information products provided by DLAS. An information value chain depicts the value of each data item stored in the DLAS and shows stakeholders how it is used to support decision-making, risk management and risk-informed development (i.e. value added by turning data into information, information into decision, and decision into action). An information value chain model is key for digital transformation and would help show each stakeholder group the value of the next generation of DLAS.
  - Engage end-users (stakeholders from government agencies, non-governmental organizations, consultants, United Nations organizations, etc.) and build their capacities in shaping and managing DLAS product delivery (technology features and capabilities, supported data, training modules, etc.) via an agile methodology. This agile, user-centric product roll-out methodology will give DLAS users a sense of ownership and accelerate the adaptation and scale-up of DLAS product releases because they speak directly to their needs. User needs and corresponding actions to meet them should be documented. There is a need to roll out DLAS products corresponding to the user stories and demands (whether technology, data packages, training modules, uses cases, white papers, etc.) in small releases and 'listen' to user feedback on their experience to revise and fix 'bugs' in a responsive manner.
  - Use analytics and key performance indicators to unleash the value and measure the degree to which stakeholders and users understand the importance of information products provided by the DLAS. These indicators will complement the assessment done by the DDRRMM framework, which measures digital maturity but does not focus on assessing the value of the system or its appreciation by stakeholders.

- **Develop product editions that speak to different contexts and stakeholders at various maturity levels.** It has been repeatedly emphasized throughout this report that context matters. Each country has its unique context and unique path to maturity in the development and application of DLAS. Certainly, there are observed patterns and good practices that help transfer knowledge and experiences. However, contexts differ over space and time. The 'one-size-fits-all' model implies that the solution seldom matches the expectation. At the same time, it is impractical to develop a unique customized solution for every country, as it would neither be efficient nor permit cross-country comparisons of data outputs. Further, improvement and adaptation of the digital diagnostics and maturity assessments can help a country and/or entity build a baseline and use it to identify areas that require further

strengthening. Here, maturity clusters or tiers are useful to offer common data architecture and standards, but contextualised to national and local needs.

- Develop multiple solution offerings that speak to each level of maturity. We have already seen that the ranking of demands varies by cluster. The solution offering can cater to the top demands of each maturity cluster across all components of the DLAS digital ecosystem. Many software products come in different versions with different capabilities (beginner, professional and enterprise editions); so should DLAS and its solution offerings.
- Maintain an online portal to capture case studies, user experiences, know-how tips, etc., and build a community of interest and practice covering all aspects of DLAS, from technology and data to governance and institutions.
- Allow for third-party integration via application programming interfaces and services. Third-party developers and users are typically faster to create solutions to very specific problems. These have to be envisaged in compliance with the framework for United Nations information security norms.
- **Develop awareness campaigns for governments on the value of DLAS.** One concrete lesson learned from this study is the crucial role that government agencies play in promoting DLAS solutions. Some governments primarily used DesInventar for their multilateral reporting requirements and may not have been able to make use of the system's full potential. An evidence-based awareness campaign that explains the return on investment and provides a cost-benefit analysis, along with case studies and success stories, may help countries gain maximum benefit from the system. The awareness campaign can take several forms, from promotional videos and monthly newsletters featuring best practices, user feedback and use cases, to organizing periodic conferences and webinars. Evidence-based knowledge products leveraging local knowledge and lessons learned can inform the design of the awareness campaign and effective messages.

Appendix

Appendix A: Definitions

The following key disaster terms are based on the DRR terminology adopted by the United Nations General Assembly in 2016. For the complete list, please see https://www.undrr.org/terminology.

Term	Definition
Capacity	The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience
Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts
Disaster damage	Damage occurs during and immediately after the disaster. This is usually measured in physical units (e.g. square metres of housing, kilometres of roads, etc.) and describes the total or partial destruction of physical assets, the disruption of basic services and damages to sources of livelihood in the affected area.
Disaster impact	The total effect, including negative effects (e.g. economic losses) and positive effects (e.g. economic gains), of a hazardous event or a disaster. The term includes economic, human and environmental impacts, and may include death, injuries, disease and other negative effects on human physical, mental and social well-being.
Disaster management	The organization, planning and application of measures preparing for, responding to and recovering from disasters
Disaster risk	The potential loss of life, injury or destroyed or damaged assets which could occur to a system, society or community in a specific period, determined probabilistically as a function of hazard, exposure, vulnerability and capacity
Exposure	The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas
Hazard	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation
Mitigation	The lessening or minimizing of the adverse impacts of a hazardous event

Term	Definition
Preparedness	The knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters
Prevention	Activities and measures to avoid existing and new disaster risks
Recovery	The restoration or improvement 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
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management
Response	Actions taken directly before, during or immediately after a disaster to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief.
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, community, assets or system to the impacts of hazards.

Appendix B: Guiding frameworks for the assessment

B.1 Digital Disaster Risk Reduction Maturity Model (DDRRMM)

A maturity model is essentially a classification scheme that places patterns in developing organizational capabilities under a certain capability stage, assuming linear progression from one maturity level to the next. In line with this, the DDRRMM provides a systematic way to capture the maturity status in using digital resources and technologies (DR&T) to enhance DRR operations and improve disaster resilience and liveability in a given context. The DDRRMM framework revolves around seven main core components/enablers:

- **Shared data resources and access**: A maturation path leading to streamlined access to timely and quality datasets. It covers a range of subcomponents and underlying elements concerning compliance with international and national standards of data specifications, management, quality, meta data, etc. and the transition towards the full adoption of big data supporting the DRR practice areas.
- **Digital applications and services**: A maturation path a DRR institute would take in adopting and harnessing the benefits of software applications, tools, analytics, services, etc. to increase productivity, automate and integrate workflows and operations, optimize performance and inform decision-making.
- **ICT infrastructure**: A maturation path to build, operate and maintain a robust technology infrastructure that can support business continuity, high-level performance, speedy access and timely decision-making, and is scalable to accommodate the increased computation requirements of technology applications and protect the DRR institution's assets and operations.
- **Institutionalization and partnership programmes**: The maturation path a DRR institution takes to create an enabling environment and culture for promoting DR&T innovation such as investment, partnership, management of technology resources, etc.
- **User competencies**: The maturation of the skills and knowledge of human capital and talents needed to operate and use DR&T effectively.
- **Governance (policies, standards, guidelines and best practices)**: A maturation path covering various legal and operational regulations and practices impacting access to DR&T, availability, data ownership, stewardship, privacy, etc.
- **DRR coordination and collaboration**: This component looks for evidence to assess the return on investment and social benefits of DR&T utilization in DRR in terms of enhanced operations and improved performance (e.g. increased response, reduced fatalities, increased resilience, improved risk-informed decisions, etc.).

Each of the seven components represents an area of digital technology that influences the performance of DRR practices. The components are further split into subcomponents, which are deemed equally critical for the maturation of DLAS. These components and subcomponents are presented in Table 3.

Table 3. DDRRMM components and subcomponents used in the assessment

DDRRMM component	Subcomponents
Data access and sharing	◆ Data framework ◆ Data availability and quality ◆ Data management ◆ Data governance ◆ Big data capability
Digital applications and services	◆ Application portfolio ◆ Software ◆ Tools for workflow optimization ◆ Analytics
ICT infrastructure	◆ Computing infrastructure ◆ Network infrastructure ◆ Risk management ◆ Computing infrastructure for big data processing
Staff competencies	◆ Competency framework ◆ Training portfolio ◆ Decision-making support
Institutionalization	◆ Stakeholder management and collaboration ◆ Communication
Governance	◆ Governance frameworks ◆ Governance best practices
Alignment with DRR	◆ Pre-disaster ◆ Disaster ◆ Post-disaster

Table 4 provides a mapping of the DDRRMM components against United Nations Data Strategy enablers, while Table 5 maps these components against UNDP digital transformation pathways.

Table 4. DDRRMM components mapped against United Nations Secretary-General's Data Strategy enablers

United nations data strategy enablers	DDRRMM components
People and culture	◆ Staff competencies
Data governance and strategy oversight	◆ Institutionalization ◆ Governance ◆ Alignment with DRR
Partnerships	◆ Data access and sharing
Technology environment	◆ Digital applications and services ◆ IC Infrastructure

Table 5. DDRRMM components mapped against UNDP digital transformation pathways

DDRRMM component	UNDP digital transformation pathways	
	Digital technologies to improve partner experience and solve development challenges	Digital technologies to improve the quality, relevance and impact of UNDP's work
Data access and sharing	✓	✓
Digital applications and services	✓	✓
ICT infrastructure		✓
Staff competencies		✓
Institutionalization	✓	
Governance	✓	
Alignment with DRR	✓	

B.2 Stakeholder-centric co-creation

As the world today is increasingly challenged by 'wicked' and 'multidimensional' problems such as climate change, pandemics, etc., the exposure to existing risks and the threat of newly emergent ones is increasing daily. This complexity is compounded by the fact that such threats, challenges and risks present themselves in varied dimensions in varied contexts, depending on the situational reality of a particular place. As a result, different countries worldwide face varying levels of challenges based on their local realities and the presence or absence of resources/competencies. In such a scenario, it is paramount that a crucial intervention such as building a DLAS is reflexive and responsive to such challenges, threats and risks to serve as a meaningful basis for future policy and action.

This reality requires the move from a one-size-fits-all solution (based on universal interventions) to a more ecological one (based on locally devised and owned solutions that align with the particularities of the context (materially, historically and culturally).[10] One approach that has been increasingly gaining currency and enables the adoption of such an ecological perspective is known as **'co-creation'** or **'co-production'**. Co-creation processes emphasize participatory and collaborative 'value creation' processes between stakeholders to develop a common understanding of issues, create innovations, deliver better performance and agree on desired outcomes/solutions. Issues of shared concern drive such participatory/co-creation-based approaches. They account for the experiences and insights of all stakeholders and their lived realities while deliberating on an issue and devising a solution to ensure its ownership in local contexts and sustainability in the long run.

10 O.A. Alrwais, 'Towards a New GIS Maturity Model: An Organizational Usage Perspective', PhD thesis, CGU Theses & Dissertations, 100, http://scholarship.claremont.edu/cgu_etd/100.

Therefore, against this background and in the context of the current assessment of national disaster databases and the development of the next generation of DLAS with the maximum local utility**, a co-creation approach was adopted to facilitate collaboration for innovation and co-creation of solutions**. This involved direct interactions (through key informant interviews and ranking webinars, detailed earlier in the report) with government stakeholders in all selected countries. These interactions and conversations (hinging on the DDRRMM framework) paved the way for understanding their local context and building on their experiences and insights to develop the next generation of DLAS that is adaptable to the country-specific needs for disaster databases so that the DLAS are tailored to local requirements and owned by national governments/institutions. Adoption of the co-creation approach also ensured that the entire process was participatory and collaborative and gave equal importance to insights emerging from all stakeholders, rather than focusing on the experiences of only one group of stakeholders.

Appendix C: Methodology

1. Data collection

Sample selection

For the current assessment, UNDRR/UNDP project advisers selected 15 agencies/institutions in 13 countries in different regions to be interviewed, ensuring diversity in the maturity status and DLAS in place. Full details are provided in Table 6.

Table 6. List of countries, agencies and their respective software covered in the assessment

Country	Agency/institution interviewed	DLAS software
1. Armenia	Ministry of Emergency Situations (MoES)	In transition towards DesInventar
2. Colombia	National Unit for Disaster Risk Management (UNGRD)	UNGRD (self-developed)
3. Costa Rica	National Emergency Commission (CNE)	CNE (self-developed)
4. Indonesia	National Disaster Management Authority (BNPB)	Disaster Data and Information of Indonesia (DIBI) (self-developed, integrated with DesInventar)
5. Jordan	Civil Defense Department (CDD)	DesInventar
6. Lebanon	Disaster Risk Management Centre (DRMC) and Central Administration of Statistics (CAS)	DesInventar
7. Malawi	Department of Disaster Management Affairs (DoDMA)	DesInventar
8. Mauritius	National Disaster Risk Management Council (NDRMC)	Mauritius Disaster Information Management System (MAUDIMS) (customized DesInventar)
9. Nepal	National Disaster Risk Reduction and Management Authority (NDRRMA)	BIPAD portal
	National Society for Earthquake Technology (NSET)	DesInventar
10. Niger	Cell for Early Warning Systems	DesInventar
11. Philippines	National Economic and Development Authority (NEDA)	N/A
	Office of Civil Defense (OCD)	National Loss and Damage Registry (DesInventar derivative)
12. Portugal	National Authority for Civil Protection (NACP)	DesInventar
13. Sudan	Red Crescent	DesInventar (not in use since 2017)

Data collection tool

Data collection in the current assessment was done primarily through semi-structured interviews with key informants. Over 35 stakeholders, often representing leadership in their respective institutions, attended one-to-one interview sessions. The interviews were conducted over three weeks. Each of them lasted between 90 and 120 minutes. Each interview comprised the following three parts:

- **Country-specific overview of disaster data systems**: This was done to capture a broad overview of the stakeholder agency and the history of usage of disaster data in the country. This overview was key to understanding each country's historical and current situational context concerning the operations and functioning of disaster databases, the enablers, the challenges, and the scope for further improvement.
- **Country scoring based on the DDRRMM**: The second part of the interview involved a qualitative assessment of the digital ecosystem underlying the disaster database implementation in each country (a template of the assessment tool is provided in Appendix C). The government stakeholders interviewed in the respective agencies/institutions assigned a score of 0–5 for each of the subcomponents listed under the seven components of the DDRRMM framework. The rationale for each score was discussed with the interviewees before agreeing on it. The qualitative description of the maturity level and the scores assigned are detailed in Table 7.

Table 7. Qualitative description of maturity levels and assigned scores*

Maturity level	Description	Score
N/A	Not applicable (explanation required)	0
Ad hoc	Desired, but not planned	1
Recognized	Planned but with no resources available to achieve the capability	2
Defined	Planned and with resources available to achieve the capability	3
Managed	In progress/partially implemented OR fully implemented but lacking performance assessment and compliance with international standards	4
Optimized	Fully implemented AND performance is in full compliance with standards; continuous improvement is done on an ongoing basis based on quantified performance goals	5

* Only one score assigned to each element

- **Demands and requirements 'wish list'**: The third and the final part of the interview focused on the potential wish list items, as the government stakeholders were requested to share their ultimate requirements for the use of DLAS and digital disaster databases and/or best practices or recommendations for potential action items that demanded urgent attention to ensure smooth operation of the databases. The wish list items were also woven around the seven components of the DDRRMM to make it easier to synchronize recommendations and frame them around specific action areas at the end of the assessment.

2. Maturity assessment

Calculation of a normalized DDRRMM score per country

The aggregate of scores assigned to the 23 DDRRMM subcomponents was calculated for each country. All subcomponents were considered equally important in the operationalization of a disaster loss database. Therefore, the score given for each component was normalized as an average score of respective subcomponents (0–5 for each of the seven components). The total maturity score was then computed by calculating the percentage of the summed normalized scores to the total possible score of 35. The final maturity score was represented as a percentage value (0–100) that reflected a holistic, balanced view of the digital maturity of each country's use of a disaster loss database.

Categorization of countries into maturity clusters

After calculating the final maturity score for each country, the countries were grouped into three maturity clusters based on the criteria shown in Table 8.

Table 8. Criteria used to cluster sample countries based on their overall maturity score

Maturity cluster	Criteria used for clustering
Maturity cluster 1	Countries in the top 33rd percentile
Maturity cluster 2	Countries in the middle 33rd percentile
Maturity cluster 3	Countries in the bottom 33rd percentile

Consolidation of wish list items per maturity cluster

The wish lists emerging from the interviews were processed using thematic data analysis, involving identifying, analysing and documenting the patterns or themes that emerged within the data. In line with this, the wish lists were first compiled for all three maturity groups according to the seven DDRRMM components. This compiled wish list was then analysed for patterns and repetitions, and key aspects/emerging themes were noted. This was then used to consolidate the list into unique and exclusive pointers spread over the seven DDRRMM components for further processing and prioritization in the ranking workshops (detailed in the upcoming section).

3. Ranking and weights assignments

As a follow-up to the interview process, the assessment conducted ranking workshops with government stakeholders in the selected countries. The ideal scenario was to run each ranking workshop with countries in the same maturity cluster. Unfortunately, this could not be done due to the vast time zone differences and language barriers (i.e. Spanish- vs. English-speaking stakeholders). As a result, four separate ranking workshops were conducted with countries with similar time zones, to ensure that each one had a proportionate number of participating countries (see Table 9).

Table 9. Ranking workshops

Workshop	Participating countries
1	Armenia, Jordan, Lebanon, Mauritius and Sudan
2	Philippines, Indonesia and Nepal
3	Malawi, Niger and Portugal
4	Costa Rica and Colombia

The ranking workshops were meant to serve as a tool to co-create and prioritize action agendas for guiding the next generation of DesInventar or other existing or potential DLAS solutions. To achieve this objective, the workshops applied the analytical hierarchy process (AHP).[11] The AHP allows the relative weight of multiple criteria to be

11 T.L. Saaty, *The Analytic Hierarchy Process*, McGraw-Hill, New York, 1980.

assessed intuitively. The fundamental input to the AHP is the decision maker's answers to a series of questions of the general form: 'How important is criterion A relative to criterion B?'. These are termed pairwise comparisons. The AHP was used in this study because it combines mathematics and psychology to compare several options via 'pairwise comparison', where two criteria are compared at a time, which is easier and more convenient than comparing several criteria at once. Responses are gathered in verbal form and subsequently codified on a nine-point intensity scale. The AHP's basic method to identify the value of the weights depends on matrix algebra and calculates the weights as the elements in the eigenvector associated with the maximum eigenvalue of the matrix. Final results include the weight of each element and a measure of inconsistency, which informs us whether or not the preference assignment needs to be revised.

As mentioned earlier, four webinars were organized, bringing together countries in the same time zone. The vote for ranking was done through the 'Poll' feature of the Zoom videoconferencing platform. Unfortunately, due to a limitation of this feature (allowing only 10 comparisons per poll), a total of 12 polls were created, breaking out the comparison of DDRRMM components with extended wish list items to several polls. Table 10 lists the number of polls and comparisons for each DDRRMM component. Before voting, stakeholders received an explanation of the process and the rationale for using the AHP. Each poll lasted about 2.5 minutes on average.

Figure 5. Screenshot from the AHP polls run on Zoom

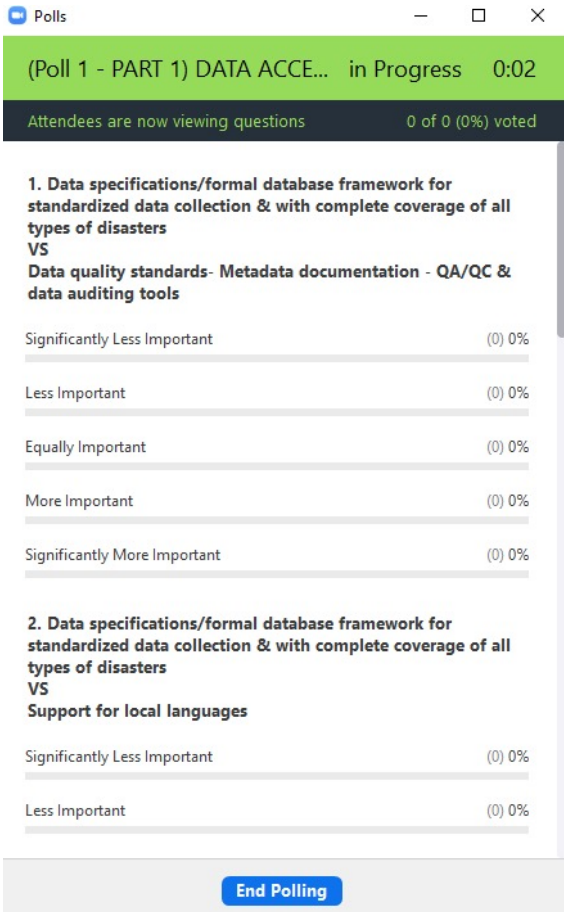


Table 10. Number of polls and AHP pairwise comparisons for the ranking webinars

DDRRMM component	Total number of actions items	Number of pairwise comparisons	Number of polls
Data access and sharing	7	21	3
Digital applications and services	7	21	3
ICT infrastructure	3	3	1
Staff competencies	6	16	2
Institutionalization	4	6	1
Governance	4	6	1
Alignment with DRR	3	3	1
Total	**34**	**76**	**12**

Appendix D: Template of the ddrrmm maturity scoring sheet used in the interviews

DDRRMM V1.0 Draft

Component 1: Data access and sharing								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
1.1 Data framework							0	
1.2 Data availability and quality							0	
1.3 Data management							0	
1.4 Data governance							0	
1.5 Big data capability							0	
Component 2: Digital applications and services								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
2.1 Application portfolio							0	
2.2 Software							0	
2.3 Tools for workflow optimization							0	
2.4 Analytics							0	
Component 3: ICT infrastructure								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
3.1 Computing infrastructure							0	
3.2 Network infrastructure							0	
3.3 Risk management							0	
3.4 Computing infrastructure for big data processing							0	
Component 4: Staff competencies: element-level specifications								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
4.1 Competency framework							0	
4.2 Training portfolio							0	
4.3 Decision-making support							0	

Component 5: Institutionalization and partnership programmes								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
5.1 Stakeholder management and collaboration							0	
5.2 Communication							0	
Component 6: Governance (policies, standards, guidelines and best practices)								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
6.1 Governance frameworks							0	
6.2 Governance best practices							0	
Component 7: Alignment with DRR coordination and collaboration								
Subcomponent	N/A	Ad Hoc	Recognized	Defined	Managed	Optimized	Score	Notes:
7.1 Pre-disaster phase							0	
7.2 Disaster phase							0	
7.3 Post-disaster phase							0	

Appendix E: Status of national disaster databases by country: A brief overview

Asia and the pacific

Indonesia

- DesInventar was introduced in 2006 and handed over to the National Disaster Management Authority (BNPB) in 2007.
- The BNPB works with the National Statistical Agency on database system management.
- DesInventar has been integrated into Disaster Data and Information of Indonesia (DIBI), developed using the DesInventar structure.
- DIBI also facilitates the publication of information over the Internet.
- Indonesia has also developed InaRisk.

Philippines

- Currently using a derivative of DisInventar, called the National Loss and Damage Registry (at the research and development stage, but ready to be rolled out)
- Limited data now, with no analytics capability (hoping to have it in the second stage of disaster registry)
- Information is gathered through CEDRA and PDNA. However, both have deficiencies. For example, while PDNA is strictly geographically focused (and does not cover all affected areas), CEDRA provides the bigger picture, but not all details or disaggregation (e.g. it identifies structures affected and gives numbers (figures), but not cost and value, which can be done with PDNA). So both systems need to be complemented to obtain a better picture of disaster loss data.
- The big difference between the previous system and the current registry is that previously it was all tables; now, all data are digitized and transferred into computers; data are also being disaggregated.
- They use developed computer systems and may get data as separated values or CSVs, which will probably be converted into a structured database (SQL) in the future.

Nepal

- The National Disaster Risk Reduction and Management Authority (NDRRMA) is the national lead agency for the Sendai Framework. It uses BIPAD portal data.
- There are efforts to integrate DesInventar data into the portal, but the major focus has been on developing its portal.
- Currently, the system does not capture economic losses or anything apart from point data; also, all hazards listed in the new Disaster Risk Management Act (2017) fall outside the framework.
-
- They face gaps in data collection, such as which data to generate, what information to calculate, visualizing data, etc.
- However, the BIPAD portal visualizes those data from the DRR portal and other risk/hazard information.
- Currently, the data framework is much older, as it is based on the previous ways of doing things, so now the officials are reviewing the current methods of capturing data.
- The broad idea is to take data capture down to the local level from the District Disaster Management Committees.
- They want to graduate from being only a district-centric system into a more coherent system, allowing for the participation of four levels of governance (local, district, provincial and national).
- Presently, they are developing a common framework so that data entered at the local level through the BIPAD portal can be verified at higher levels and then published.
- They have the vision to bring all data into the system with accuracy.

Africa

Niger

- The use of DesInventar started in 2014.
- There is a cell for coordination of the early warning system, hosting the DesInventar software.
- It is linked to the Prime Minister's Cabinet.
- Free online access is available.

Mauritius

- DesInventar is now customized into the Mauritius Disaster Information Management System (MAUDIMS).
- The MAUDIMS is hosted on the government cloud.
- Data for the system are collected from various specified and designated ministries/agencies, and collated for use in SFM and SDGs.
- Data have been used to identify impacted regions and decide on disaster-oriented methods for planning and management.
- The Ministry of Finance allocates generous funds.
- Currently in the first phase of DesInventar; planning for a second phase with more advanced features such as big data capability, automatic data collection, and forecast modelling.

Malawi

- The Department of Disaster Management Affairs (DoDMA) has the mandate to coordinate implementation of the disaster risk management programme, activities and efforts.
- DesInventar is hosted by the DoDMA, the coordinating agency for DRR mitigation, response and recovery.
- The DoDMA is a department within the Office of the Presidential Cabinet.
- The DoDMA has a national task team, which collects and disseminates data related to DesInventar and SFM.
- There are also bits and pieces of digital platforms on different elements (floods, droughts, etc.).
- DesInventar is restricted to only loss and damage.
- Malawi is developing a disaster risk management information system, which will be broad—more than just disaster loss reports and damage—and will include other elements such as risk reduction, interventions, etc.

Sudan

- Up until 2016, Sudan had a fully functional DesInventar database. In 2016, it was handed over to the National Council for Civil Defense (NCCD). However, it is not currently functional.
- At present, two bodies oversee DRR affairs: the NCCD and the Civil Defense Department. The NCCD is the body formulated by different ministries and stakeholders to deal with DRR (with a command-and-control mentality), whereas the Civil Defense Department is affiliated with the Police Department or Ministry of Interior to combat or face emergencies (from a police perspective only).

Europe And Central Asia

Armenia

- The Ministry of Emergency Situations is the nodal ministry responsible for consolidating data relating to disaster loss and damage.
- Under the Ministry, the database specialists are the Department of Civil Protection and Disaster Risk Reduction.
- Presently, they have an old database, which is too informative and inflexible, and has information written in data fields (in text or stories) which are not numbered. As a result, on conversion to an Excel file, it is impossible to extract numbers or disaggregated data for households, agriculture, animal husbandry, etc.
- Therefore, this database needs to be reinterpreted and populated, which requires segregation and additional columns, such as household, animals (numbers).
- Currently, two parallel databases are being used (old and new).
- DesInventar is in the transition phase (work is almost complete on shapefiles, and it is being translated into the Armenian language).

Portugal

- The National Authority for Civil Protection (NACP) is the DesInventar authority in Portugal.
- Implementation of DesInventar started only two years ago (in 2019).
- In 2010, a National Platform for Disaster Risk Reduction was created (hosted and coordinated by the NACP), which gathers several country agencies and defines goals for DRR.

- The country is in the initial phase of DesInventar implementation, taking baby steps.
- The goal of the NACP is not only to respond to emergencies but also to engage in prevention, reduction, etc.

Arab States

Jordan

- DesInventar is used to report disaster loss data and SFM indicators and for historical information.
- It is not currently used for any other purposes.
- Jordan has had this system since 2010. However, it was not used between 2011 and 2018.
- The latest update on the system is from 2019.
- The main challenges include the lack of Arabic support, lack of clarity of what constitutes disaster events, need for auditing and validating data, and use of the system beyond the reporting to UNDRR.

Lebanon

- DesInventar is hosted within the Disaster Risk Management Centre (DRMC), a government entity (supported by UNDP) with a mandate to coordinate all government entities.
- The DRMC works closely with the National Council for Scientific Research (CNRS) and the Statistical Authority, and other government entities such as the Civil Defense; it also reports to the Prime Minister's office.
- The Statistical Authority focuses on supporting the census, market prices, and the impacts of disasters on sectoral areas.
- CNRS is the scientific arm for disaster management, especially those who work in the Remote Sensing Department.
- Lebanon has been selected to showcase the best practices in working with disaster loss data at Global Standards in Disaster Related Statistics 2021.
- Their goal is to bring together indicators for the Sendai Framework, climate change and the SDGs in one platform.

Latin America and the Caribbean

Costa Rica

- The National Emergency Commission (CNE) is the institutional system in the country responsible for DRR.
- The CNE is also the national focal point for the Sendai Framework and coordinates monitoring and reporting of reported indicators.
- DesInventar is hosted and used by academics, not by the government.
- The CNE (run by the government) does not rely on DesInventar for SFM; however, it provides information about academics managing DesInventar.
- The CNE is supported by law, and so different sectors and different levels of intervention report to it, and this is what they use for SFM.
- The CNE has been developing a more robust, updated and user-friendly system (compared to DesInventar and with funding from the World Bank) that better reflects the country's needs.
- The new system responds to national reporting needs (for the Sendai Framework) and responds to their internal needs, such as improving decision-making in the country.

Colombia

- The National Unit for Disaster Risk Management (UNGRD) is the government's coordinating organization in Colombia; everything is done at the national level.
- Colombia has a law that regulates disaster risk management, and the UNGRD oversees execution of this law.
- As a coordinating organization, it receives information from territorial authorities (local level) or government officials at agencies.
- They do not use DesInventar. However, they have all the data they need to collect and manage.
- DesInventar is hosted by a non-governmental organization, but the data are unofficial.

Appendix F: Mapping of the consolidated wish list (demands)

DDRRMM component 1: Data access and sharing

Consolidated list for ranking	
1	Data specifications/formal database framework for standardized data collection and with complete coverage of all types of disasters
2	Data quality standards, meta data documentation, quality assurance/quality control and data auditing tools
3	Support for local languages
4	Decentralization: Apps and solutions for data collection by local communities at the local level
5	Streamlining data access and sharing: Integration and support of interoperability
6	Big data and real-time capability: Dashboards for monitoring indicators and trends
7	Guidelines for sharing best practices and user experience of data handling and collection

Compiled wish list items
Detailed, disaggregated data framework and more structured database, with detailed specifications
Language for feeding in data into the system needs to be contextualized or be bilingual, and should preferably be available in local language (in addition to English).
Robust stakeholder engagement from the national government to ensure not only the quantity, but also quality, of data through official vetting and validation
Need guidelines on how to put information about 'slow-onset disasters' (such as drought) into DesInventar
Data collection should involve gathering information on systemic risks such as COVID-19.
Next generation of DesInventar should have more options for inclusion of local users; should be more decentralized; local communities need to play a role in developing the system, as this can enrich the data for reporting.
Need to improve streamlining of data, in terms of interoperability between sectors
Incorporation of meta data and enhancing/incorporating big data capability; need support/resources for this
Need solid data on impacts, vulnerability and potential threats from potential disaster events in the future
Data need to be well managed, aggregated, defined, classified and digitalized.
Need to have a fully interpreted system of dashboards and a complete channel for data collection up to dashboards for decision makers (with specific visualizations and updates)
Need to integrate the database with other national systems (such as CNRS and the Statistical Authority in Lebanon)

Compiled wish list items
Need to have a single system/platform, for better management and utilization of data
Need to have a system where people can download from Play Store/Google for feeding of data, to ease the data collection process
Need to devise a system which enables people to share data which are compatible with the system
Need for ways to harmonize the methods of data collection and entry into the DesInventar software, and how the data can be populated in the software
There needs to be a way to directly import data from Excel files into the software, to avoid manual entry of data.
Along with data quality, also need to quantify the data coming in, to ease the data processing load
Need for a single platform to integrate all data and sources
Need to strengthen data-sharing
Need to enhance capacities for data collection and gathering at the local levels, to move from data capture at the district level to the municipal level
Need to focus on the establishment of better data architecture infrastructure/methods/tools for data collection
Reference pointers/best practice examples from other countries/contexts on operationalization (data collection and management)
Need to collect real-time disaggregated data on damage and loss
For future DesInventar, tools such as Caspio (a tool to create databases) can be used, which can add to the capability of the next generation of DesInventar.

DDRRMM component 2: Digital application and service

Consolidated list for ranking	
1	Analytics that extend beyond reporting tools (e.g. visualization, indicators and comparative statistics, predictive analytics, analytics, etc.)
2	Forecasting, modelling and simulation tools
3	Tools for producing actionable information and supporting risk-informed decision-making
4	GIS and mapping tools to support vulnerability capacity assessment
5	Big data tools for real-time processing and incorporation of a multi-hazard early warning system
6	Resources (e.g. dedicated budget, personnel, etc.)
7	Tutorials and detailed user technical manuals (including video tutorials)

Compiled wish list items
There needs to be a well-defined system for when and how to use DesInventar.
Need for a standard system for reporting disasters and their impacts (including calculation of estimates from disasters and other economic impacts)
Use of mobile devices for simple analytics, planning and monitoring of risks and vulnerability
Next generation of DesInventar should have some tools/guidelines on calculation/estimation of indirect losses, such as economic losses.
Need to enable decision makers to take risk-informed decisions
Hardware needs to be improved, and there needs to be dedicated budget allocation for this.
A dedicated budget is needed to support operations.
Need to harmonize resources for better software
Use of statistical measurement tools
Integration of forecast modelling
Desire to improve and learn more about applications such as mapping risk zones
Need resources and training to be able to do better and advanced analytics
Need resources (financial and material) on how to use the software
Need to strengthen the role of data information for use in statistics
Desire to foray into data modelling as next feature
Need to invest more in evidence/data-based decision-making; disaster risk management should be central to development and decision-making

Compiled wish list items
Investment into making future projections
Need to invest in doing actual risk reduction, guided by risk information and datasets
Need to use datasets for loss modelling and disaster risk financing
Incorporation of a multi-hazard early warning system
Need a free flow of information from information source to the decision maker
Need to have vulnerability capacity assessment
Need for use/incorporation of more data graphics (such as tables, etc.) and a user-friendly graphic user interface
Need for investment in protocols (sharing of data) and analytical tools (for simulation and modelling exercises), for prediction purposes

DDRRMM component 3: ICT infrastructure

Consolidated list for ranking	
1	Mobile devices to support local-level reporting
2	Improved ICT infrastructure, especially in rural and remote areas
3	Resources/investment in computing infrastructure: support for big data processing for better risk management

Compiled wish list items
Development of simple mobile/tablet-based application for improved data collection and easy operability
Need to upgrade technology of DesInventar with built-in information layers
Network needs to be improved, especially in rural areas
Need for resources/investment in computing infrastructure and for better risk management
Need to have good resources and Internet connection for smooth operation of the DesInventar software
Need to improve computing infrastructure and network, especially at the local level

DDRRMM component 4: Staff competencies

Consolidated list for ranking	
1	Personnel trained in data capture, collection and information management (who are well versed in ICT and technicalities)
2	Specialists in coordinating with agencies/ministries and other local management authorities
3	Training and capacity-building for the efficient running of DLAS at all levels: a dedicated training-of-trainers programme
4	Workshop training for decision makers to understand capability and value of DesInventar and similar systems, as well as limitations
5	Budget and resource allocation for training and capacity-building
6	Define the capability of the software/tool/instrument and then align human resource development accordingly

Compiled wish list items
Need for personnel trained in data capture, collection and information management (who are well versed in ICT and technicalities)
Preparation of specialists for coordinating agencies/ministries and other local management authorities
Need for training and capacity-building for efficient and successful running of the DesInventar system
Workshop training for decision makers is required; need to support decision makers and their understanding of the difference between Sendai and DesInventar.
Better and more frequent formal training programmes are needed, including for interns, on how to make the DesInventar tool more user-friendly, and to train people on how to use its features; the preliminary training given needs to be followed up, to check on the performance of users, and whether they are facing any issues with respect to the use of DesInventar.
Need for behavioural training for users (at local level and decision makers) to understand the importance and value of DesInventar and other loss databases
Need to dedicate resources for the development of human resource capability.
There also needs to be a training-of-trainers programme to prepare master trainers, who can teach the local people engaged in data collection how to do it.
Capacity-building/training is needed at local level, for efficient use of tools and software.
Need to define the scope/capability of the software/tool/instrument and then align human resource development accordingly
Need to build the capacity of local government, especially the local disaster management authority, to understand DesInventar and to use the tool/instrument for good data management

DDRRMM component 5: Institutionalization

Consolidated list for ranking	
1	Institutionalization of DesInventar or similar systems within a national agency for DRR
2	Awareness and information dissemination programme on how DesInventar and similar systems can be used for DRR capacity-building and management
3	Stakeholder agreements and collaboration: a community of interest/practice around DesInventar and similar systems
4	Dedicated resources/budget: incentivization policies

Compiled wish list items
Availability of resources and opportunities for exposure and learning
Need to come up with information dissemination on what a national DLAS or DesInventar may provide in terms of data that can be used for DRR capacity-building and management
Need to have internally driven initiatives; push in the right direction
Stakeholder collaboration for data acquisitioncan be improved.
Need for institutionalization of DRR and disaster risk management, and formation of a national agency for DRR; need to set up a concrete and solid government body on DRR
Need to inculcate a civilian mentality which can lead and take responsibility
Need to build a community of disaster practitioners (local communities, civil society organizations), and equip them with necessary tools
Need to bring stakeholders onto a common platform and make them think along the same lines as the government coordinating agency (such as the NDRMC in Mauritius) to organize, process and use the data.
Institutional collaboration needs to be strengthened, especially for data-sharing.
Mainstream linkages with the education sector/academia.

DDRRMM component 6: governance

Consolidated list for ranking	
1	Investment in an 'enabling ecosystem' for the system to survive; needs to be some defined funding in the future for this kind of work
2	Legislative framework and alignment of technology with government missions to ensure government buy-in
3	Formal standard operational procedures that cover all aspects (governance, asset management, training, etc.)
4	Documentation of best practices from countries with advanced system databases on dealing with coastal hazards

Compiled wish list items
Definition of 'disasters' needs to be clearly defined, to avoid ambiguities in understanding and in data collection processes.
The system needs to be integrated with other existing systems, and made better suited to support emergency operations.
Need for greater investment to build an 'enabling ecosystem' for the system to survive. There needs to be some defined funding in the future for this kind of work.
There needs to be a buy-in from the government for successful functioning of the system.
Need for interoperability of DesInventar with other systems
There needs to be well-defined standard operating procedures, with better indicators on how data should be treated.
Need for a robust disaster risk management system
Desire to learn from countries with advanced system databases on dealing with coastal hazards

DDRRMM component 7: Alignment with DRR

Consolidated list for ranking	
1	Extrapolate disaster loss data to support pre- disaster preparations and risk assessments
2	Streamline data to inform recovery, post-disaster events and long-term planning
3	Mainstream data in risk-informed development and track performance of mitigation measures

Compiled wish list items
In addition to responding to disasters, efforts also need to be taken for pre-disaster preparations and risk assessments.
Need for robust investment in DRR and better funding in terms of recovery, post-disaster events and long-term planning
Need to mainstream disaster risk management as part of risk-informed development, so it is not seen as a siloed activity but, rather, part of day-to-day development decisions
Need to invest in risk-sensitive management planning
As part of reconstruction and recovery, need to track the progress of municipalities in terms of lowering the risks over time
Need to come up with financial incentives for municipalities, so that they are able to progress in terms of achieving the targets under the Sendai Framework

Appendix G: Ranking results per maturity tier, per DDDRRMM component

1. Ranking results of action items for **data access and sharing**

Ranks for MATURITY CLUSTER 1: Bottom 33%

Rank	Item	Weight
1	Support for local languages	28.2%
2	Decentralization: apps and solutions for data collection by local communities at the local level	15.6%
3	Guidelines for sharing best practices and user experiences of data handling and collection	13.4%
4	Streamlining data access and sharing: integration and support for interoperability	12.6%
5	Data specifications/formal database framework for standardized data collection and with complete coverage of all types of disasters	10.9%
5	Data quality standards, meta data documentation, quality assurance/quality control and data auditing tools	10.9%
7	Big data and real-time capability: dashboards for monitoring indicators and trends	8.4%
	Number of comparisons	21
	Consistency ratio	5.7%
	Principal eigenvalue	7.462

Ranks for MATURITY CLUSTER 2: Middle 33%

Rank	Item	Weight
1	Data specifications/formal database framework for standardized data collection and with complete coverage of all types of disasters	27.6%
2	Data quality standards, meta data documentation, quality assurance/quality control and data auditing tools	18.9%
3	Decentralization: apps and solutions for data collection by local communities at the local level	17.2%
4	Guidelines for sharing best practices and user experiences of data handling and collection	15.2%
5	Support for local languages	10.5%
6	Streamlining data access and sharing: integration and support for interoperability	5.5%
7	Big data and real-time capability: dashboards for monitoring indicators and trends	5.0%
	Number of comparisons	21
	Consistency ratio	7.9%
	Principal eigenvalue	7.633

Ranks for MATURITY CLUSTER 3: Top 33%

Rank	Item	Weight
1	Data specifications/formal database framework for standardized data collection and with complete coverage of all types of disasters	24.1%
2	Streamlining data access and sharing: integration and support for interoperability	18.1%
3	Data quality standards, meta data documentation, quality assurance/quality control and data auditing tools	14.4%
4	Decentralization: apps and solutions for data collection by local communities at the local level	13.9%
5	Big data and real-time capability: dashboards for monitoring indicators and trends	11.1%
6	Support for local languages	9.4%
7	Guidelines for sharing best practices and user experiences of data handling and collection	9.1%
	Number of comparisons	21
	Consistency ratio	9.1%
	Principal eigenvalue	7.508

2. Ranking results of action items for **digital application and service**

Ranks for MATURITY CLUSTER 1: Bottom 33%

Rank	Item	Weight
1	Forecasting, modelling and simulation tools	26.1%
2	Tools for producing actionable information and supporting risk-informed decision-making	16.4%
3	Analytics that extend beyond reporting tools (e.g. visualization, indicators and comparative statistics, predictive analytics, analytics, etc.)	13.5%
3	GIS and mapping tools to support vulnerability capacity assessment	13.5%
5	Big data tools for real-time processing and incorporation of a multi- hazard early warning system	11.1%
6	Tutorials and detailed user technical manuals (including video tutorials)	9.7%
6	Resources (e.g. dedicated budget, personnel, etc.)	9.7%
	Number of comparisons	21
	Consistency ratio	5.1%
	Principal eigenvalue	7.408

Ranks for MATURITY CLUSTER 2: Middle 33%

Rank	Item	Weight
1	Big data tools for real-time processing and incorporation of a multi- hazard early warning system	20.9%
2	Forecasting, modelling and simulation tools	18.9%
3	GIS and mapping tools to support vulnerability capacity assessment	17.3%
4	Analytics that extend beyond reporting tools (e.g. visualization, indicators and comparative statistics, predictive analytics, analytics, etc.)	14.9%
5	Tools for producing actionable information and supporting risk-informed decision-making	13.7%
6	Resources (e.g. dedicated budget, personnel, etc.)	8.7%
7	Tutorials and detailed user technical manuals (including video tutorials)	5.8%
	Number of comparisons	21
	Consistency ratio	5.8%
	Principal eigenvalue	7.47

Ranks for MATURITY CLUSTER 3: Top 33%

Rank	Item	Weight
1	Analytics that extend beyond reporting tools (e.g. visualization, indicators and comparative statistics, predictive analytics, analytics, etc.)	17.4%
2	Forecasting, modelling and simulation tools	15.6%
3	Tools for producing actionable information and supporting risk-informed decision-making	15.2%
4	GIS and mapping tools to support vulnerability capacity assessment	15.2%
5	Big data tools for real-time processing and incorporation of a multi- hazard early warning system	13.7%
6	Tutorials and detailed user technical manuals (including video tutorials)	11.9%
7	Resources (e.g. dedicated budget, personnel, etc.)	11.0%
	Number of comparisons	21
	Consistency ratio	3.7%
	Principal eigenvalue	7.296

3. Ranking results of action items for **ICT infrastructure**

Ranks for MATURITY CLUSTER 1: Bottom 33%		
Rank	Item	Weight
1	Mobile devices to support local-level reporting	33.3%
1	Improved ICT infrastructure, especially in rural and remote areas	33.3%
1	Resources/investment in computing infrastructure: support for big data processing for better risk management	33.3%
	Number of comparisons	3
	Consistency ratio	0.0%
	Principal eigenvalue	3

Ranks for MATURITY CLUSTER 2: Middle 33%		
Rank	Item	Weight
1	Mobile devices to support local-level reporting	33.3%
1	Improved ICT infrastructure, especially in rural and remote areas	33.3%
1	Resources/investment in computing infrastructure: support for big data processing for better risk management	33.3%
	Number of comparisons	3
	Consistency ratio	0.0%
	Principal eigenvalue	3

Ranks for MATURITY CLUSTER 3: Top 33%		
Rank	Item	Weight
1	Mobile devices to support local-level reporting	41.3%
2	Improved ICT infrastructure, especially in rural and remote areas	32.7%
3	Resources/investment in computing infrastructure: support for big data processing for better risk management	26.0%
	Number of comparisons	3
	Consistency ratio	5.6%
	Principal eigenvalue	3.054

4. Ranking results of action items for **staff competencies**

Ranks for MATURITY CLUSTER 1: Bottom 33%

Rank	Item	Weight
1	Personnel trained in data capture, collection and information management (who are well versed in ICT and technicalities)	23.8%
2	Define the capability of the software/tool/ instrument and then align human resource development accordingly	19.6%
3	Specialists in coordinating with agencies/ ministries and also other local management authorities	15.9%
3	Training and capacity-building for the efficient running of DLAS at all levels: a dedicated training-of-trainers programme	15.9%
5	Training workshop for decision makers to understand capability and value of DesInventar and similar systems, as well as limitations	13.4%
6	Budget and resource allocation for training and capacity-building	11.3%
	Number of comparisons	15
	Consistency ratio	4.4%
	Principal eigenvalue	6.273

Ranks for MATURITY CLUSTER 2: Middle 33%

Rank	Item	Weight
1	Training and capacity-building for the efficient running of DLAS at all levels: a dedicated training-of-trainers programme	20.1%
2	Personnel trained in data capture, collection and information management (who are well versed in ICT and technicalities)	19.4%
2	Training workshop for decision makers to understand capability and value of DesInventar and similar systems, as well as limitations	19.4%
4	Specialists in coordinating with agencies/ ministries and also other local management authorities	15.8%
5	Define the capability of the software/tool/ instrument and then align human resource development accordingly	13.6%
6	Budget and resource allocation for training and capacity-building	11.7%
	Number of comparisons	15
	Consistency ratio	5.5%
	Principal eigenvalue	6.347

Ranks for MATURITY CLUSTER 3: Top 33%

Rank	Item	Weight
1	Training workshop for decision makers to understand capability and value of DesInventar and similar systems, as well as limitations	22.2%
2	Specialists in coordinating with agencies/ ministries and also other local management authorities	20.2%
3	Personnel trained in data capture, collection and information management (who are well versed in ICT and technicalities)	20.0%
4	Budget and resource allocation for training and capacity-building	12.7%
4	Define the capability of the software/tool/ instrument and then align human resource development accordingly	12.7%
6	Training and capacity-building for the efficient running of DLAS at all levels: a dedicated training-of-trainers programme	12.2%
	Number of comparisons	15
	Consistency ratio	3.3%
	Principal eigenvalue	6.205

5. Ranking results of action items for **institutionalization**

Ranks for MATURITY CLUSTER 1: Bottom 33%

Rank	Item	Weight
1	Awareness and information dissemination programme on how DesInventar and similar systems can be used for DRR capacity-building and management	40.0%
2	Institutionalization of DesInventar or similar systems within a national agency for DRR	20.0%
2	Stakeholder agreements and collaboration: a community of interest/practice around DesInventar and similar systems	20.0%
2	Dedicated resources/budget; incentivization policies	20.0%
	Number of comparisons	6
	Consistency ratio	2.2%
	Principal eigenvalue	4.061

Ranks for MATURITY CLUSTER 2: Middle 33%

Rank	Item	Weight
1	Awareness and information dissemination programme on how DesInventar and similar systems can be used for DRR capacity-building and management	39.4%
2	Dedicated resources/budget; incentivization policies	39.4%
3	Stakeholder agreements and collaboration: a community of interest/practice around DesInventar and similar systems	13.7%
4	Institutionalization of DesInventar or similar systems within a national agency for DRR	7.5%
	Number of comparisons	6
	Consistency ratio	2.0%
	Principal eigenvalue	4.004

Ranks for MATURITY CLUSTER 3: Top 33%

Rank	Item	Weight
1	Institutionalization of DesInventar or similar systems within a national agency for DRR	29.8%
2	Awareness and information dissemination programme on how DesInventar and similar systems can be used for DRR capacity-building and management	24.6%
2	Stakeholder agreements and collaboration: a community of interest/practice around DesInventar and similar systems	24.6%
4	Dedicated resources/budget; incentivization policies	21.0%
	Number of comparisons	6
	Consistency ratio	2.2%
	Principal eigenvalue	4.061

6. Ranking results of action items for **governance**

Ranks for MATURITY CLUSTER 1: Bottom 33%

Rank	Item	Weight
1	Legislative framework and alignment of technology with government missions to ensure government buy-in	39.5%
2	Investment in an 'enabling ecosystem' for the system to survive; needs to be some defined funding in the future for this kind of work	23.9%
2	Formal standard operational procedures that cover all aspects (governance, asset management, training, etc.)	19.8%
4	Documentation of best practices from countries with advanced system databases on dealing with coastal hazards	16.8%
	Number of comparisons	6
	Consistency ratio	2.2%
	Principal eigenvalue	4.061

Ranks for MATURITY CLUSTER 2: Middle 33%

Rank	Item	Weight
1	Legislative framework and alignment of technology with government missions to ensure government buy-in	28.9%
1	Formal standard operational procedures that cover all aspects (governance, asset management, training, etc.)	28.9%
3	Documentation of best practices from countries with advanced system databases on dealing with coastal hazards	24.6%
4	Investment in an 'enabling ecosystem' for the system to survive; needs to be some defined funding in the future for this kind of work	17.5%
	Number of comparisons	6
	Consistency ratio	2.2%
	Principal eigenvalue	4.061

Ranks for MATURITY CLUSTER 3: Top 33%

Rank	Item	Weight
1	Formal standard operational procedures that cover all aspects (governance, asset management, training, etc.)	35.1%
2	Legislative framework and alignment of technology with government missions to ensure government buy-in	31.2%
3	Investment in an 'enabling ecosystem' for the system to survive; needs to be some defined funding in the future for this kind of work	24.7%
4	Documentation of best practices from countries with advanced system databases on dealing with coastal hazards	9.0%
	Number of comparisons	6
	Consistency ratio	2.6%
	Principal eigenvalue	4.071

7. Ranking results of action items for **alignment with DRR**

Ranks for MATURITY CLUSTER 1: Bottom 33%		
Rank	Item	Weight
1	Extrapolating disaster loss data to support pre-disaster preparations and risk assessments	33.3%
1	Streamlining data to inform recovery, post-disaster events and long-term planning	33.3%
1	Mainstreaming data in risk-informed development and tracking performance of mitigation measures	33.3%
	Number of comparisons	3
	Consistency ratio	0.0%
	Principal eigenvalue	3

Ranks for MATURITY CLUSTER 2: Middle 33%		
Rank	Item	Weight
1	Extrapolating disaster loss data to support pre-disaster preparations and risk assessments	33.3%
1	Streamlining data to inform recovery, post-disaster events and long-term planning	33.3%
1	Mainstreaming data in risk-informed development and tracking performance of mitigation measures	33.3%
	Number of comparisons	3
	Consistency ratio	0.0%
	Principal eigenvalue	3

Ranks for MATURITY CLUSTER 3: Top 33%		
Rank	Item	Weight
1	Extrapolating disaster loss data to support pre-disaster preparations and risk assessments	41.3%
2	Streamlining data to inform recovery, post-disaster events and long-term planning	32.7%
3	Mainstreaming data in risk-informed development and tracking performance of mitigation measures	26.0%
	Number of comparisons	3
	Consistency ratio	5.6%
	Principal eigenvalue	3.054

Appendix H: Demand ranking webinars

H.1 Results from screening participants' input

As mentioned earlier, four webinars were organized to engage with the stakeholders in an exercise to rank the demands listed in Section 3.2.4. The webinars had to accommodate the time zone differences and language preferences of the participating countries. A total of 42 stakeholders participated in the voting across the four webinars. Participants covered 11 countries (stakeholders from Jordan and Sudan did not participate).

The votes of every single user were screened based on whether they participated in all the ranking polls (some users dropped out or just voted in one poll then stopped voting), were government stakeholders or UNDP/UNDRR observers, and their consistency ratio[12] was 15 percent or less. As a result of this screening, 19 entries were excluded for not meeting one or both screening criteria, rendering a total of 23 valid votes with good ranking. The users' votes were then grouped by maturity cluster, with a fourth group comprising UNDRR/UNDP experts. Table 11 provides the number of users per group whose input was used to derive the final ranking of the action items.

Table 11. Users with consistent ranking votes by group

Voting group	Number of users with valid (consistent) votes
Maturity Cluster 1	5
Maturity Cluster 2	9
Maturity Cluster 3	9

H.2 Results of demand ranking

Since the demands (wish list items) were segregated according to the DDRRMM components (see Section 3.2.4), only those belonging to the same DDRRMM component were ranked against each other. The results of the demand ranking by maturity cluster are provided in Appendix G, where ranked demands are provided along with the derived weights of each item, the number of pairwise comparisons held, and the overall consistency ratio per cluster.

To gain insights into the implications of the ranked demands, the following results emerging from the ranking exercise were considered:

- To what extent does the ranking of demands in each DDRRMM component agree or differ across the three clusters? What does this mean?
- What is the variance of calculated weights of the demands? What do they inform us about required interventions?

H.2.1 Comparison of ranked demands

The Spearman correlation[13] was used to answer the first question concerning how the ranking of demands among various clusters agrees or differs. The Spearman correlation coefficient, r_s, ranges from +1 to -1. The value of +1 indicates a perfect association of ranks; zero means no association between ranks; and -1 indicates a perfect negative association of ranks. Thus, the closer r_s is to zero, the weaker the association between the ranks.[14]

Table 12 shows the calculated Spearman correlation coefficient values calculated to compare the ranking of demands between clusters for each DDRRMM component.

12 The consistency ratio is a statistic calculated via the AHP and measures the 'inconsistency' of votes (i.e. a consistency ratio of 0 percent implies fully consistent, and a consistency ratio of 100 percent suggests random selection and totally inconsistent voting). The consistency ratio provides a measure of user selection accuracy during the pairwise comparison.

13 The Spearman correlation is the nonparametric statistic that measures the degree of association between two variables based on their ranks.

14 No statistical significance tests were calculated in this exercise, since statistical significance testing of the Spearman correlation does not provide information about the strength of the relationship; rather, it is used to test any hypothesis of whether a ranking of demands in one cluster changes with the ranking of another. We already know that is not the case.

Table 12. Spearman correlation values comparing ranking agreements among maturity clusters

Ddrrmm component	Cluster 1 VS cluster 2	Cluster 1 VS cluster 3	Cluster 2 VS cluster 3
Data sharing and access	0.01802	0.13245	0.42857
Digital applications and services	0.50918	0.81655	0.46849
ICT infrastructure	1	0.89443	0.89443
Competencies	0.45588	-0.08824	-0.13235
Institutionalization	0.54433	0	-0.83333
Governance	0.5	0.5	0.5
Alignment with DRR	1	0.89443	0.89443

The demands listed in Section 3.2.4 reflect a unique set of 34 items that government officials from 13 countries deem necessary for DLAS. However, the results in Table 12 show that clusters of different maturity levels tend to differ in their view of the importance of these demands more often than they tend to agree. **UNDRR and UNDP can build on this fact to strategize solution offerings to cater to target institutions' specific needs and maturity levels.** In aspects of digital transformation where there is a general agreement on the priority of demands across all groups, as in the action items belonging to 'ICT infrastructure' and 'alignment with DDR', a unified approach can be justified—for example, establishing common technical specifications for the underlying ICT that need to support the operation and scalability of DLAS solutions, and setting common targets for how the DLAS solution serves all DRR practices.

However, for many other components where the priority of demands differs significantly by maturity level, tailored approaches are needed. For example, Cluster 1 (early stage of DLAS adaptation) stands out in prioritizing its demands related to data access and sharing, whereas Clusters 2 and 3 share moderate agreement in their ranking of demands. The demands that Cluster 1 ranks as a top priority (support for local language, decentralization of data collection, and guidelines for best practices and user experiences) represent barriers associated with gathering and collecting disaster-related data, typical at this stage of maturity. On the other hand, the demands ranked highest by Clusters 2 and 3 are assumed to have already addressed these barriers and are more focused on how data are stored, manipulated and managed by the DLAS solution, and the quality of the information collected (standardization, meta data, etc.). We learn from the difference in prioritization of demands that institutions have their own unique performance and aspirations for handling disaster data, depending on their maturity status. Therefore, **programmes designed to set institutions on the path to improving their data access and sharing should be context-specific and cater to the specific barriers and implementation priorities associated with the maturity of DRR institutions**. The same logic applies to several other aspects of digital maturity, such as applications and services, people competencies and institutionalization. Each cluster of maturity seems to rank the demands related to these areas differently according to the goals they deem important to achieve in each area.

H.2.2 Variance in assigned weights

More insight can be gained by studying the variance of the weights assigned to the demands by the different maturity clusters. The results of calculating variance measures are shown in Table 13. We should expect that all variance measures are generally small because the values of weights need to sum to 100 percent; therefore, the room for variability among weights is kept tight. Yet when a cluster shows relatively higher variance, it indicates a stronger desire to meet some specific demands more than others. For example, the relatively higher variance

in weights assigned to demands by Cluster 2 under 'institutionalization' suggests that institutions with a medium maturity level favour certain interventions (in this case, increasing awareness of the features of DLAS solutions among users, and incentivization policies to engage in the DLAS programme) more strongly than others. **These biases towards certain demands over others need to be studied carefully, as they could result either from an actual challenge faced by an institution and, therefore, need to be addressed immediately, or from a misconception that can be revisited through further discussion of the rationale behind the demand ranking.**

Table 13. Variance calculated for weights of demands per cluster per DDRRMM component

	Cluster 1	Cluster 2	Cluster 3
Data access and sharing	0.0043	0.0064	0.0029
Digital applications and services	0.0033	0.0029	0.0005
ICT infrastructure	0.0000	0.0000	0.0006
Competencies	0.0020	0.0012	0.0021
Institutionalization	0.0100	0.0283	0.0013
Governance	0.0102	0.0029	0.0132
Alignment with DRR	0.0000	0.0000	0.0006

Appendix I: Disaster Loss Databases (2021)

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
1	**Americas and Caribbean**	Antigua and Barbuda				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp	DesInventar	
2	Americas and Caribbean	Argentina	Academic	University of Buenos Aires	Jesica Viand, Docente e Investigadora de la Universidad de Buenos Aires y consultora independiente, Email: jesicaviand@gmail.com; Teléfono: (54) (11) 5736-9459	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=arg&continue=y	DesInventar	9/2/2010
3	**Americas and Caribbean**	Barbados	Government	Coastal Zone Management Unit	Ramón Roach, Coastal Zone Management Unit, Email: rroach@coastal.gov.bb	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=brb&continue=y	DesInventar	3/3/2015
4	Americas and Caribbean	Belize	Government	National Emergency Management Organization	National Emergency Management Organization	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=blz&continue=y	DesInventar	11/10/2010
5	**Americas and Caribbean**	Bolivia	Government	VIDECI	Carlos Mariaca, VIDECI: c_mariaca@hotmail.com	DesInventar	Public	https://www.desinventar.net/DesInventar/country_profile.jsp?countrycode=bol&lang=EN	DesInventar	11/25/2009
6	Europe and Central Asia	Bosnia and Herzegovina	Government	CIMA FOUNDATION	Laura Rosselo	DesInventar Sendai	Not finished and public		DesInventar Sendai	2019
7	**Americas and Caribbean**	Brazil	Government	CENAD	CENAD / SEDEC: S2ID - https://s2id.mi.gov.br/	SOBRE	Public	https://s2id.mi.gov.br/paginas/sobre.xhtml	Self	
8	Americas and Caribbean	Chile	Academic	University of Chile	Alejandro León, Profesor Asociado, Depto. Cs. Ambientales y RNR, Facultad de Cs. Agronómicas, Universidad de Chile, Email: aleon@renare.uchile.cl	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=chl&continue=y	DesInventar	11/25/2009
9	**Americas and Caribbean**	Colombia	NGO	OSSO	Corporación OSSO, Nayibe Jimenez, Email: nayibe.jimenez@osso.org.co	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=col&continue=y	DesInventar	11/11/2009
10	**Americas and Caribbean**	Costa Rica	Academic	National University of Costa Rica	Licda. Alice Brenes Maykall, Coordinadora Programa Institucional de Gestión del Riesgo de Desastres (PIGRD), Universidad Nacional de Costa Rica (UNA), Email: alice.brenes.maykall@una.cr, Teléfono 22773740	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=cri&continue=y	DesInventar	11/25/2009
11	**Americas and Caribbean**	Dominica				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=dma&continue=y	DesInventar	
12	**Americas and Caribbean**	Dominican Republic				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=dom&continue=y	DesInventar	11/12/2010

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1974	2014							
1970	2015		Newspapers					
1980	2017		Newspapers					
1931	2011		Newspapers & Offical					
1970	2015		Initially newspapers and Official since 2010					
2019	2021	Municipality	Municipal damage and loss assessment committees	All		Ministry of Interior, Statistics	Entity civil protection coordinators (2)	DesInventar Sendai Sectors
1970	2014		Newspapers					
1970	2018		Newspapers & Offical					
1970	2013		Newspapers & Offical					
1970	2000		Newspapers					

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
13	**Americas and Caribbean**	Ecuador	Government	National Service for Risk and Emergency Management	Servicio Nacional de Gestión de Riesgos y Emergencias - Ecuador, Virgilio Benavides Hilgert, Director de monitoreo. mail: director.monitoreo@gestionderiesgos.gob.ec. Ing. Stalin Jiménez Martínez. Analista - Dirección de Monitoreo de Eventos Adversos - Secretaría de Gestión de Riesgos - Ecuador. Email: stalin.jimenez@gestionderiesgos.gob.ec, Ma. Angélica Larrea Moreano, Analista de Monitoreo de eventos adversos, Email: maria.larrea@gestionderiesgos.gob.ec	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=ecu&continue=y	DesInventar	11/25/2009
14	**Americas and Caribbean**	El Salvador	Academic	University of El Salvador	Universidad de El Salvador, Profesores Luis Rodolfo Nosiglia Durán, Email: rnosiglia@gmail.com	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=slv&continue=y	DesInventar	11/25/2009
15	**Americas and Caribbean**	Grenada				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=grd&continue=y	DesInventar	
16	**Americas and Caribbean**	Guatemala	News	La Red	Geóg. Gisela Gellert, Miembro promotor de La Red, Email: gg@cadejo.com	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=gtm&continue=y	DesInventar	11/25/2009
17	**Americas and Caribbean**	Guyana	Government	Civil Defence Commission of Guyana (CDC)	Civil Defence Commission of Guyana (CDC), Evaluación de Riesgos Naturales (ERN)	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=guy&continue=y	DesInventar	7/27/2010
18	**Americas and Caribbean**	Honduras	Academic	UNAH	Nabil Kawas, Decano de la Factultad de Ciencias, UNAH, email: nkawask@gmail.com, Oscar Elvir Ferman, Docente, IHCIT-UNAH, Email: elvirferman@yahoo.com.mx	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=hnd&continue=y	DesInventar	5/13/2010
19	**Americas and Caribbean**	Jamaica				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=jam&continue=y	DesInventar	11/12/2010
20	**Arab States**	Jordan	Military	public security / Civil Defense	Focal Point/Disaster Dept	DesInventar or {Name of other databases} Desinventar	Public/ closed/ public		(DesInventar/ Self-developed/ ?Desinventar	
21	**Europe and Central Asia**	Kosovo	Government	AME		DesInventarKosova	closed	http://desinventarkosova.rks-gov.net	DesInventar	
22	**Arab States**	Kuwait	Government	Kuwait Environment Public Authority		System of environmental monitoring information eMISK	Closed		self developed	
23	**Europe and Central Asia**	Kyrgyzstan	Government	Crisis Management Center of the Ministry of Emergency Situations through UNDP in the Kyrgyz Republic	Mr.Erjan Namyrtagaev, Senior operational officer of the Crisi Management Center of MES KR, erjan_nd@mail.ru	Automated Information Management System, IAMS 0.9.15	Closed	http://ais.mes.gov.kg:12321/	Self-developed	2017

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1970	2019		Initially newspapers and Official since 2008					
1970	2013		Newspapers					
1988	2015		Newspaper and official in some cases					
1972	2013		Newspapers					
1970	2015		Newspaper and official in some cases					
1973	2014		Newspapers					
2009	2020/ not all years		civil defense	Multi		Other departments	No	Locations and nature of hazard
2015	2019		Central and Local authorities	Multi harzard profile		Yes	Yes	
2017	2021	N\A	Territorial divisions of the Ministry of Emergency Situations; Subscribers-users of the mobile application 112 Kyrgyzstan	All 5 types of emergency sitiations; Various types of incidents	N\A	Emergency Response Coordination Group (SCRF), The Agency of Hydrometeorology	Yes	Emergency situations; incidents; natural disasters

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
24	**Arab States**	Lebanon	Government	DRM/PCM	DRM	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=lbn	Desinventar	2011
25	**Americas and Caribbean**	Mexico	News	La Red	Elizabeth Mansilla.(La Red), Email: elisa_mansilla@yahoo.com	buscaindex	Public	http://www.cenapred.gob.mx/PublicacionesWebGobMX/buscaindex (https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=mex&continue=y)	Self	11/25/2009
26	**Americas and Caribbean**	Nicaragua				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=nic&continue=y	DesInventar	11/12/2010
27	**Americas and Caribbean**	Panama	Government	National Agency for Civil Protection	Yitsuen Jipsion, Proyectos, Cooperación Internacional. Sistema Nacional de Protección Civil -(SINAPROC). Teléfono:520-4462. Email: yjipsion@sinaproc.gob.pa	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pan&continue=y	DesInventar	11/25/2009
28	**Americas and Caribbean**	Paraguay	Government	Directora General de Planificación y Sistematización de la SEN	Ofelia Insaurralde, Directora General de Planificación y Sistematización de la SEN, Email: ofeliainsaurralde@yahoo.com.	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pry&continue=y	DesInventar	11/25/2009
29	**Americas and Caribbean**	Peru	Academic	Center for Disaster Studies and Prevention	Centro de Estudios y Prevención de Desastres - PREDES. Martín de Porres 161 – San Isidro – Lima – Perú, Teléfonos: (051-1) 2210251 - 4423410, Email: postmast@predes.org.pe, Web: http://www.predes.org.pe	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=per&continue=y	DesInventar	11/24/2009
30	**Americas and Caribbean**	Saint Kitts and Nevis				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=lca&continue=y	DesInventar	
31	**Americas and Caribbean**	Saint Lucia				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=kna&continue=y	DesInventar	
32	**Americas and Caribbean**	St. Vincent & Grenadines				DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=vct&continue=y	DesInventar	
33	**Americas and Caribbean**	Uruguay	Government	istema Nacional de Emergencias	Sistema Nacional de Emergencias, SINAE	DesInventar	Public	https://www.gub.uy/sistema-nacional-emergencias/mira (www.desinventar.net/DesInventar/profiletab.jsp?countrycode=ury&continue=y)	DesInventar	6/4/2012
34	**Americas and Caribbean**	Venezuela	Government	DNPCAD	Dirección Nacional de Protección Civil y Administración de Desastres (DNPCAD).		Closed			11/25/2009

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1980	2020		Media, CNRS,	All Natural Hazards		CNRS, CAS	Yes	Health, education, transportation, agriculture
1970	2013		Newspapers					
1922	2013		Newspapers					
1986	2019		Oficial					
1981	2016		Newspapers					
1970	2013		Newspaper and official in some cases					
1983	2014		Newspapers					
1970	2015		Newspapers					

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
35	**Asia - Pacific**	Samoa	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
36	**Asia - Pacific**	Solomon Islands	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
37	**Asia - Pacific**	Sri Lanka	Government	Disaster Management Centre	Anoja Senevirathne seneviratne.anoja@gmail.com	Desinventar	Public	http://www.desinventar.lk:8081/DesInventar/main.jsp?countrycode=sl&lang=EN http://www.desinventar.lk/	DesInventar (non Sendai version)	2007
38	**Asia - Pacific**	Timor Leste	Government Regional organisation/ UN-Government	National Disaster Risk Management Directorate-National Disaster Operation centre National Disaster Operation Centre-National Disaster Risk Management Directorate (NDRMD) of The Secretary State for Civil Protection (SSCP)	Agostinho Cosme Belo-Martinho Fatima	BDDTL	Public (indvidual level details not public)	bddtl.mss.gov.tl (server is temporarily unable) http://tldd.mss.gov.tl/DesInventar/main.jsp?countrycode=tl&lang=EN	Desinventar (non Sendai version)	2008
39	**Asia - Pacific**	Tokelau	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
40	**Asia - Pacific**	Tonga	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
41	**Asia - Pacific**	Tuvalu	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
42	Asia - Pacific	Vietnam	Regional organisation/ UN	Vietnam Disaster Management Authority (VNDMA) Ministry of Agriculture and Rural Development, Vietnam (MARD)	(hungaq@vndma.gov.vn). Technology Application and Database Management Division Disaster Management Policy and Technology Center under VNDMA	National database of Science and Technology on disaster prevention and control and Desinventar	Public	dmptc.gov.vn http://dmptc.gov.vn/disaster-infomation-pt32.html?lang=en-US https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=vnm&continue=y	National database of Science and Technology on disaster prevention and control	2017 1989

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1868	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1567	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	Education, health, infrastructure, protection, IDPs, livelihoods.
1974	2021	Divisional Secretariat Division	Organisations have been identified as sources for obtaining information in respect of disasters. They are print media, government and non-governmental organisations and other research organisations	Accident, animal attack, boat capsize, chemical, coastal erosion, coastline, collapse of building, collapse of mine, cutting failur, cyclone, cyclone & flood, drought, drowning, earth slip, electrocution, epidemic, explosion, fire, flash flood, forest fire, frost, gale, ground vibration, hailstorm, heavy rains, land subsidence, landslide, leak or spill, lightning , plague, retaining wf, rock fall, sedimentation, snake bite, storm, strong wind, structure, subsidence, surge, tidal wave, tornado, tree fallen, tsunami, urban flood, wall collapse	Project designing, Project planning and implementation, damage and loss assessment, policy formulation and analysis	Yes, epidemiology unit of the ministry of health, department of social services, department of wildlife conservation, department of fire services of the colombo municipal council, national building research organization, department of meteorology, disaster relief service centre, department of agriculture, department of census and statistics	Yes	Water supply, housing, agriculture, transportation, health, industries, communication, power & energy, education
1992	2021	Department level (NDOC)	DRR & DRM Portal	Landslide; Flood; Thunderbolt; Fire; Drowning; Others (Non-Natural); Heavy Rainfall;Wind Storm; Earthquake; Pandemics/epidemic;Soil Erosion;Inundation;Drought;Storm;Rainfall;Mud volcanic erruption.Other (Natural);Forest Fire;Epidemic;Bridge Collapse;Avalanche;	Preparedness plans Strategic Action Plan Disaster profiles Maps/Charts/Visualizations Reports	District Administration One time entry of data from: ◆ MDMC (Municipal Disaster Management Committee)	Yes (not fully operational)	Agriculture, infrastructure, disaster management ◆ People loss ◆ Family loss ◆ Agriculture loss ◆ Livestock loss ◆ Infrastructure loss
1966	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1853	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1883	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
2018 2010		Province	VNDMA, Govement	All hazard Cold wave, cylcone, flash floods, floods, hailstorm, landslide, rain, storm, surge, typhoon	For reference the program, project... related to disaster that implimented in Viet Nam	VNDMA, govement: Institude of Geophysic	yes	Disaster management, housing, infrastructures, agricultrue

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Estab-lishment
			Type	Name	Focal Point					
43	Asia - Pacific	Wallis and Futuna	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
44	Asia - Pacific	New Zealand								
45	Asia - Pacific	Afghanistan	Independent Authority (Government)	Afghanistan National Disaster Management Authority (ANDMA)	On hold due to the political situation	Data Management System (MIS)	Public	https://ndmis.andma.gov.af/en/reports	NDMIS is open source web based application	2014
46	Asia - Pacific	American Samoa	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
47	Asia - Pacific	Bhutan	Government	DDM, GDC, Thimphu	Lotoey Pem-Dy. ICTO Dorji Wangchuk- Sr. ICTA	Disaster Management Information System	Closed (user based)	http://43.230.208.53:8080/dmis/login	Out sourced (Fund: WB)	2019
48	Asia - Pacific	Cambodia	Government	MPTC	NCDM Official Incharge: +855 12777183	CamDi	Public	http://camdi.ncdm.gov.kh	DesInventar Customized	2012
49	**Asia - Pacific**	China	Government	Beijing Normal University	wangwenzhuo@bnu.edu.cn: yangsaini@bnu.edu.cn School of National Safety and Emergency Management of BNU	Global Disaster Data Platform	Public	www.gddat.cn; https://www.gddat.cn/newGlobalWeb/#/chinaDisasterDatabase	Self-developed	
50	**Asia - Pacific**	Cook Islands	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1986	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1/1/2014	6/9/2021	-	ANDMA Provincial Directorates through joint Government and Humanitarian Agencies Survey teams	Natural Disasters, Man made disasters and technological, chemical disasters	The database is used for different purposes as follows: 1 For recording initial statistics, 2 For Conducting Rapid Assessment through joint teams, 3 Aid Distribution, 4 Warehousing, 5 Disaster Mitigation	Yes mutual collaboration is established between members of National Disaster Management Commission International partners - IOM	Yes, a specific technical team is stationed in ANDMA central office to monitor and cross check the data entered.	Health, Water, Shelter, Food, NFI, Transport, Agriculture, Meteorology, public awarenss, Reconstruction
1866		Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
?	?		Official (government)	All hazards in the Country	Disaster prepardness	Data shared by NSB, input by Dzongkhag Disaster Officer	Unknown	Hazards in the country
2012	2021	Commune	Provincial Administration	◆ Flood ◆ Drought ◆ Storm/Strong Windy ◆ Lightning ◆ Fire ◆ River Bank Collapse ◆ Epidamic	◆ NCDM Project ◆ Government Project ◆ Development Partner Project ◆ NGO ◆ Researcher	Key line Ministries in Cambodia including MPWT, MRD, MAFF, MoWRAM, MoH, MoE, PCDM	Yes	◆ Road Infrastructure ◆ Agriculture ◆ Irrigation System ◆ Rural Infrastrucutre ◆ School and Health
2009	2021	Province	WorldPop project, National Institute for Environmental Stuties (Japan), NASA, FAO, University of California, EM-DAT, UNDRR, IFRC, SwissRe, Natcat, World Bank, NDRCC (China), National Bureau of Statistics (China), IIEM&CCII (China), CENC, National Climate Center (China), National Earthquake Response Support Service (China), GDACS For China - National Bureau of Statistics and National Disaster Reduction Center	All hazard	1) Real-time release of global disaster data: 2) Sharing global disaster assessment products; 3) Providing decision support for global disaster risk management.	The Global Disaster Data Platform is organized by the Ministry of Emergency Management - Institute of Disaster Reduction and Emergency Management of the Ministry of Education, China Disaster Co-founded by the National Defense Association and the National Disaster Reduction Center of the Ministry of Emergency Management. Institute of Disaster Reduction and Emergency Management	No	Disaster management
1831	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
51	**Asia - Pacific**	Democratic People's Republic of Korea	Government			Desinvnetar	Closed		Desinventar	
52	**Asia - Pacific**	Fiji	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
53	**Asia - Pacific**	French Polynesia	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
54	**Asia - Pacific**	Guam	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
55	**Asia - Pacific**	India	Government	MHA	Ministry of Home Affairs	NDMIS	Closed	ndmis.mha.gov.in	Self-developed (national informatics center NIC)	2020
56	**Asia - Pacific**	Indonesia	Government	National Disaster Management Authority (BNPB)	Agus Wibowo.Head of Data, Information and Communication National Disaster Management Authority (BNPB) radityajati@gmail.com Ridwan Yunus - Ridwan.yunus@undp.org	DesInventar (customized and hosted in own server - mirror in Desinventar.net on a regular basis.	Public	https://dibi.bnpb.go.id https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=idn&continue=y	DesInventar	2008
57	**Asia - Pacific**	I.R. of Iran	Government	International Institute of Earthquake Engineering and Seismology in collaboration with National Disaster Management Organization Of Iran	Dr. Kambod Amini Hosseini (kamini@iiees.ac.ir)	Web Based National PDNA	Government related authority	http://pdadmin.iieesdevl.ir/app/sector (This address will be changed soon) https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=irn&continue=y	WEB-PDNA (Self-Developed)	2020
58	**Asia - Pacific**	Kiribati	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
59	**Asia - Pacific**	Malaysia	Government	JPS Malaysia	Hydrological Disaster	Program Ramalan Awal Banjir Negara (PRABN)	Limited	publicinfobanjir.water.gov.my	Self Developed	2014

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1840	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	Agriculture, forestry, fisheries, commerce, infrastructure(roads, jetties, bridges, water, electricity, sanitation)
1844	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1767	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
2020	2021	District	NERC- MHA, NCRB, State Govt, IMD	33 Hazards/ Disasters	DDMP-SDMP HVR Analysis, Possible use in preperation of memorandum, date for PDNA, SFM Monitoring, SDG Monitoring, Global Climate Risk Index (GCRI)	6 Central Ministries, Central Statistical Office, NDMA/ SDMA.	Yes	Social, productive and all cross cutting issues including environment and cultural heritage.
2008 1815	2021 2019	District	Government of Indonesia	CONFLICT	National-level Ministries and Agencies	All National-level Ministries and Agencies	Yes	Infrastructure
2021	2021	County	All relevant governmental and non-governmental institutions through relevant links provide necessary databases	Various Natural Disasters: Floods, Wildfires, Earthquakes, Drought, Storms, landslides	Post Disaster Needs Assessment, Recovery, Risk Reduction, Planning, Budject Allocation	National Disaster Management Organization of Iran, Planning and Budget Organization, International Institute of Earthquake Engineering and Seismology	Yes	Agriculture, commerce, community infrastructure, culture, disaster risk reduction, education, environment, gender, governance, health, housing, livelihood, macroeconomic impact, manufacturing, telecommunication, tourism, transportation, wash, energy
1899	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
-	-	-	Flood Monitoring and Forecast + GIS	Hydrological	Flood Monitoring Flood Forecasting Damage Estimation	JUPEM, MySA	No	Agriculture and irrigation others upon request

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
60	**Asia - Pacific**	Maldives	Government	Natioal Disaster Management Authority	Faroosha Ali; Umar Fikry (umar.fikry@ndma.gov.mv)	DesInventar Maldives	Closed	N/A	DesInventar	2006
61	**Asia - Pacific**	Marshall Islands	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
62	**Asia - Pacific**	Micronesia (Federated States of)	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
63	**Asia - Pacific**	Mongolia	Regional organisation/ UN - Government	National Emergency Management authority	Bazarragchaa Duudgai bazaraasg1@gmail.com riskmanagement@nema.gov.mn; ariunaach@nema.gov.mn	Desinventar	Public and close	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=mng&continue=y		
64	**Asia - Pacific**	Myanmar	Government	Ministry of Social Welfare, Relief and Resettlement	Department of Disaster Management (DDM)	Myanmar Disaster Loss and Damage Database (MDLD)	Public	Online (Currently the server has down and not been working since February 2021)	DesInventar	2014
65	**Asia - Pacific**	Nauru	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
66	**Asia - Pacific**	Nepal	Government	National Disaster Risk Reduction and Management Authority (NDRRMA)	Sushil Bhandari (a.pokhrel@outlook.com) Anil Pokhrel (a.pokhrel@outlook.com)	BIPAD-Portal	Public (indvidual level details not public)	bipadportal.gov.np	Self-developed	2019

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
2006	2019	Island level	Island councils; City councils; Atoll Councils; NDMA assessments; Sectoral agencies; Red Crescent National Society	Flood (Sea Swells and Rain); Heavy Rain; Tsunami; Thunderstorms; Earthquake; Fire; Cyclones; Maritime Incidents; Airtraffic Incidents;	Disaster profiles; to build visuals for reports or presentations; to gather info for SFDRR; shown interest in using DLD data for damage and loss discussions under UNFCCC	Initiated discussions with Ministry of Health after joint collaboration on the COVID-19 task force. International partners - UNDP and UNDRR	Not yet	Damage at household level; damage due to maritime and airtraffice incidents;
1905	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1894	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SP+S27:V33C, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
2006	2019	District (Soum)	Official	All	Disaster prepardness	Statistics office		
2014	2020	N/A	Sectorial Departments	Earthquake, Tsunami, Cyclone, Storm Surge, Floods, Landslides, Drought, Forest Fires, Urban Fires	N/A	Central Statistical Organization under Ministry of Planning, Finance and Industry; General Administration Department under Ministry of Home Affairs and UN Agencies & Financial Institutions (World Bank & ADB)	Yearly updated until 2020.	Sectorwide coverage, especially productive sectors, social sectors, housing, education, transport, health
1941	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
2019	2021	Ward level	DRR Portal	Landslide; high altitude; flood;boat capsize; thunderbolt; snake bite; fire;drowning; others (non-natural); heavy rainfall;wind storm; cold wave; earthquake; response accident; water accident; microorganism attack; leakage (toxic gas); leakage (radiation); leakage (chemical); gas explosion; food poisoning; famine; environmental pollution; deforestation; animal flu; road accident; pandemics; mine disaster; industrial disaster; volcanic eruption; soil erosion; inundation; heat wave; glacial lake outburst; drought; storm; snow storm; rainfall; other (natural); helicopter crash; hailstorm; forest fire; epidemic; bridge collapse; avalanche; animal incidents; aircraft accident	Preparedness plans Strategic Action Plan Disaster profiles Maps/Charts/Visualizations Reports EW - vulnerability assessments Sendai Framework Monitoring	Real time link: ◆ Meterological Department ◆ Seismological Department ◆ Pollution data One time entry of data from: ◆ Statistics (demographics ◆ Administrative boundaries ◆ Various resources (health/education institutions) ◆ Flood return maps	Yes (not fully operational)	◆ People loss ◆ Family loss ◆ Agriculture loss ◆ Livestock loss ◆ Infrastructure loss

No.	Region	National Disaster Loss Database (sub-national or regional database as relevent)	Hosting institution			Database system	Accessibility	URL (if online)	Software	Year Establishment
			Type	Name	Focal Point					
67	**Asia - Pacific**	New Caledonia	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
68	**Asia - Pacific**	Niue	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
69	**Asia - Pacific**	Northern Mariana Islands	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
70	**Asia - Pacific**	Pakistan	Regional organisation/ UN	UNDRR	NA	DesInventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pak&continue=y		
71	**Asia - Pacific**	Palau	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
72	**Asia - Pacific**	Papua New Guinea	Regional organisation/ UN	SPC/UNDRR Pacific Office	Litea Biukoto <liteab@spc.int>, Zarin Khan <zarink@spc.int>, Yo Kunieda (yo.kunieda@un.org)	DesInventar Pacific	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=pac&continue=y		2013
73	**Asia - Pacific**	Philippines	Government	OCD	Chief, ICTD KELVIN ART T. OFRECIO ictd@ocd.gov.ph lorelei.bendijo@ocd.gov.ph	DesInventar	Public / subject for approval	ONLINE but not open; PUBLIC: http://202.90.136.170:8081/DesInventar ADMIN: http://202.90.136.170:8081/DesInventar/inv/	DesInventar - developed by DLSU for DOST and OCD	Started 2018 as R&D Project; subject for transfer to OCD
74	**Asia - Pacific**	Uttarakhand (India)	Regional organisation/ UN-Goverment	State Comissioner. Disaster Mitigation and Management Centre (Uttarakhand Secretariat) https://dmmc.uk.gov.in/	rautelapiyoosh@gmail.com	Desinventar	Public	https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=005&continue=y	Desinventar	

Year First Entry	Year Last Entry	Lowest admin unit coverage	Data source	Hazard Types covered	List usage of the database	Formal collaboration with other agencies (Statistics/ housing/ roads, etc.	Quality control/ validation mechanism in place (Yes/ No)	Main Sectors covered
1875	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1959	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1819	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1980	2014	Tehsil	Government	All (including contamination)				Housing, agriculture, infrastructure, disaster management
1850	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1768	2021	Country	Governments, UN	All	Reporting for Sendai Framework Monitor	SPC, UNDRR Pacific Office	Data reviewed in 2013 and 2021	
1968	2016	User accounts listed below	◆ CalamidatPH ◆ Disaster Data Files (e.g. SitRep, Incidents Monitored) ◆ PDNA	Multi-Hazard Type	PNLDR	As to date re NLDR: none but data comes from agencies and OCDROs	Yes (Manual Validation)	Social; Productive, Infrastructure
1984	2020		Official State government	All	Prepardness,	NIDM	Unknown	Infrastructure; agriculture; disaster management