Disaster Loss Data:
Raising the Standard

Overview

The UN Sendai Framework has four goals and seven targets covering global, national and local level disaster risk reduction. The UN General Assembly (Resolution A/71/644, 2 February, 2017) defined 38 indicators for monitoring the targets of the Sendai framework, on which participating countries are required to report. Risk knowledge is vital in developing robust, effective policies and practices for disaster risk management. Consequently the Sendai Framework adopted 'Understanding disaster risk' as its first priority for action. Disaster loss data is fundamental for accurate risk assessments and can be critical in providing a baseline for the calibration and validation of results using verifiable information. The UN endorsement of the Sendai framework for Disaster Risk Reduction 2015-2030 reinforces the amassing of disaster loss data in a useable format as increasingly vital.

National disaster loss databases are also crucial to producing and acting upon risk information that, in turn, advances appropriate policy making and risk governance. They also serve as basic mechanisms for reporting on the Sendai Framework targets. Data collection is pivotal to the comprehensive assessment of disaster impacts. Risk interpretation, with standardized loss data, can also provide loss forecasting data in referencing historical loss modelling.

This white paper describes standard framework and protocols for loss data collection systems that

Tonkin+Taylor

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offer enhanced and accurate risk assessments. The paper also discusses identification of indicators in disaster loss estimation, outlining standards, and designing data collection and assessment procedures.

Standardization of disaster loss estimation is important. However, the assessment process is challenging as it may require collaboration and participation across multiple sectors and establishing a central data clearing house. The 5th Global Platform for Disaster Risk Reduction (5th GP-DRR) working session on *"Risk Information and Loss Databases for Effective Disaster Risk Reduction"* (Mexico, 22-26 May 2017) highlighted the importance of standard methodologies and guidelines for the collection of data in creating and maintaining national loss databases and risk assessments. These activities should engage support from both the public and private sectors. Data should be collected and applied from the bottom up, beginning with local government and progressively elevated to regional, national and, ultimately, global level.

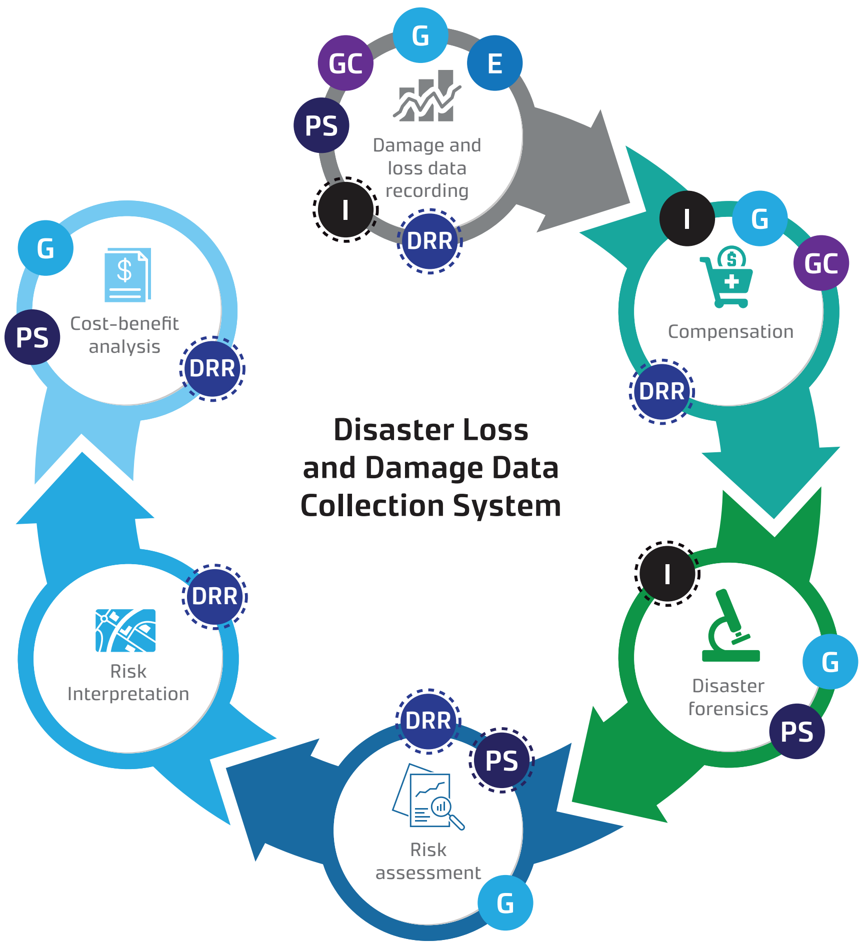
Many countries are now considering the development of standardized loss data collection systems. These would provide valuable opportunities to gain concise information about the economic and social cost of disasters, and to more rigorously collect data that can inform future policy, practice, and investment. To do this well a multi-agency, multi-sectoral approach is needed to capture prior experience and the full range of relevant data. For example, in New Zealand, Ministry of Civil Defence & Emergency Management (MCDEM) has initiated the Loss Database Project in conjunction with the National Disaster Resilience Strategy[1].

In New Zealand, a dollar invested in disaster risk reduction has been estimated to return as much as $60 via improved economic outcomes (Motu, 2017). An investment of $US6 billion can produce $US360 billion in benefits through improved resilience, competitiveness and sustainability. Each year, New Zealand's Earthquake Commission (EQC) spends around $NZ16 million on research, education, monitoring and managing hazards. This has significantly reduced natural hazards-induced infrastructure losses (EQC, 2016). A standardized format for data collection would further improve New Zealand's resilience standards, as well as disaster risk reduction accountability. The Canterbury Earthquake Sequence highlighted the need for a single-authority, transparent, efficient, viable and standardized database for loss data assessment in New Zealand. Multiple claims lodged on individual properties generated inaccurate loss data. The situation was further complicated by invalid and duplicate claims, lack of coordination between authorities, administrative challenges, and aftershock uncertainties. Ultimately, the New Zealand experience resulted in the creation of a new set of global standards, proof that standardizing disaster loss data estimation can lead to new discoveries and solutions.

Framework for Damage and Loss Data Collection System

Disaster loss data can be collected and recorded by multiple sectors - governments, technical experts, DRR researchers, the private sector, the general population, volunteers and insurance authorities. However it is vital to acquire data in a standardized format to enable effective data sharing. Although data sharing is subject to various factors such as data ownership, data restrictions, data use provisions and

1. First consultation workshop, planned on 28 September, 2017, Wellington.



acknowledgment of data sources, over all it reduces data acquisition costs and time (European Commission, 2015). It may also broaden scientific and social communities, thereby facilitating more integrated planning. The 5th GP-DRR encouraged countries to adopt an updated framework for damage and loss data collection systems (Fakhruddin, 2017). This framework is shown in Figure 1.

Figure 1: Disaster loss and damage data collection system (Fakhruddin, 2017, modified from De Groeve, 2015)

Legend

Read/Write data access	Read data access	
G	G	Government
E	E	Experts
DRR	DRR	DRR Researchers
PS	PS	Private Sector
GC	GC	General citizenship/ volunteers
I	I	Insurance agents

1. Damage and loss data recording

Accounting disaster loss records are the primary source of information when establishing a historical baseline for future monitoring. They also enhance risk investments and allow forecasting of the average investment needed for recovery per year.

Unfortunately, the organisations that are best positioned to record detailed losses see little benefit in doing so and this is a major barrier to establishing databases. Loss data collection should, in theory, take place at a local government level, but pure loss accounting is of little interest to local government. Ninety percent of New Zealand homes are insured against disasters with EQC or private insurers. Disaster loss data was amassed primarily through the claims settlement process. This systematic recording of data was performed by insurance authorities and Government, with each organisation using different approaches based on their own guidelines and policies. Much of the indirect, reversible and irreversible damage was not accounted for in loss data collection systems and, consequently, the total damages may not have been accurately reflected. Linking loss accounting to other applications with local benefits (such as forensics and risk modelling) may be a way to achieve this objective.

2. Compensation data

Insurers are the most organized agencies in recording loss data across their insured assets. In many countries the data belongs to the insurers and is retained for their own interests. However, sometimes it is published globally by reinsurance companies. Linking this same, standardized data with local government data could enhance our ability to understand total losses and future risk assessments. In New Zealand, EQC is the leading authority for assessing risk and loss, using innovative and cost-effective solutions. The Canterbury experience encouraged EQC to think about the need for advanced partnerships and a single-authority database system in loss data estimation (EQC, 2016). The Hurunui-Kaikoura earthquake (2016) damage and loss estimation process also emphasised the importance of a national standardized loss assessment system. Efficient partnerships between all levels of government, the public and insurance authorities would markedly improve the collection and maintenance of disaster loss data. An appropriate strategy, with proper standard guidelines, could be developed for multi-hazard loss data collection at central Government level.

3. Disaster forensics

Disaster forensics require more detailed loss information linking all possible sources of direct, indirect, reversible damage and loss to a central database. The losses need to be recorded with enough detail to understand the context of the disaster. For example, an analysis must show whether people were impacted because of an unforeseen complication (e.g. a dike break during a hurricane), foreseeable exposure (e.g. living in a 100-year storm surge area), or inadequate

disaster management (e.g. late or no evacuation) (JRC, 2013). Disaster loss data reveals the relationship between exposure, capacity, vulnerability and overall resilience. A systematic approach would also generate historical disaster data invaluable for future reference. Every year, New Zealand spends millions of dollars on risk assessment processes and risk investments (EQC, 2016). Disaster forensics identify the root cause of disasters and can make a significant contribution to evaluating the effectiveness of risk reduction measures, as well as more resilient rebuilds.

4. Risk assessment

Risk assessment requires damage and loss data to quantify risk. The impacts of hazards on infrastructure, people and society are typically complex to model accurately. Instead, we tend to rely on empirical models or probabilistic modelling using big data such as global, regional and local hydro-meteorological, geo and socio economic databases. These allow, for example, using the New Zealand Geotechnical Database to develop probabilistic assessment of liquefaction risk. To conduct such assessments requires calibration using historical losses. Standardizing disaster loss data quantification identifies gaps in risk assessment, simultaneously improving disaster risk information (Fakhruddin et al., 2016). The Canterbury Earthquake Sequence caused extensive land damage, including increased vulnerability to liquefaction and flood (EQC, 2016). Paradoxical catastrophes like this require standardized quantification measures to assist practical engineering measures and rebuild solutions supported by adequate legislation and policy. At local government level, understanding hazard is paramount in risk reduction, while at regional and national level, it is important to address the funding required. Proposed local government Risk Agency (LGRA)/MCDEM could provide common guidelines on methods of hazard and risk mapping, assessments and analysis, taking into account the work at national level and ensuring comparability between Regional and local government. Harmonised loss data are an essential element of this process.

5. Risk interpretation

A major conundrum in risk assessment is the issue of how to convey risk uncertainty and decision making. While opinions are mixed, there is nonetheless a degree of consensus that the level of certainty around risk should be communicated as part of risk information (Fakhruddin, 2017). How people make decisions based on risk information, including the important effects of past experience, has been the subject of significant research. This revealed that, before deciding to take a disruptive and often expensive action, people must understand the hazard in order to believe it and assist their decision making process. However, common practice has been to prepare and release risk information with inadequate understanding of how these messages are interpreted.

Comprehensive disaster loss data produces valuable risk information

for decision-making authorities. This can establish loss trends as well as spatial outlines and can be used for developing policies, rapid damage assessment and disaster recovery. Furthermore, scientific researchers, insurers and other entities will benefit from the risk interpretation process (Statistics NZ, 2017). However, the complexities and anomalies inherent in dealing with loss information may cause an entirely incorrect calibration system. This, in turn, can lead to uncertainty and frustration within affected communities, as was experienced in Canterbury (EQC, 2016). Assessing current disaster impacts is also significant when interpreting risk and mitigation measures.

6. Cost benefit analysis

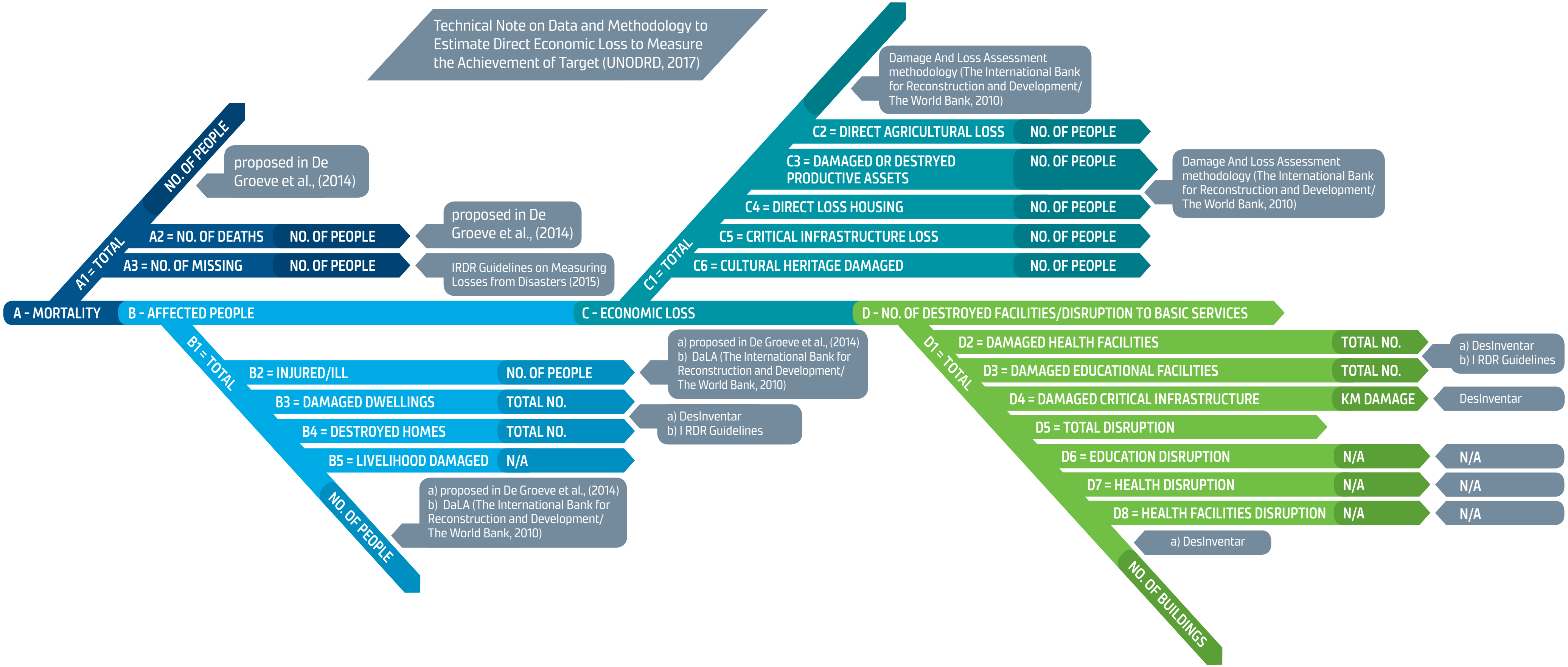
Cost components, together with financial and non-financial benefits in disaster loss data, are challenging to analyse. According to UNISDR data, the average estimated loss due to natural hazards globally is $US314 billion, perhaps 50% more in the case of recurring disasters such as hurricanes Irma, Jose, Katia and Maria, and the recent Mexico earthquakes. This reinforces the value of disaster risk investments and their considerable returns in terms of improving resilience, competitiveness, and sustainability. Following the widespread liquefaction and infrastructure damage caused by the Canterbury Earthquake Sequence, EQC analysed different repair strategies, overall costs and benefits to make decisions about the future of the affected land (EQC, 2016). Standardized loss data quantification of historical disaster loss and damage information was pivotal to making robust decisions as to where to rebuild and where not to rebuild. This was a crucial step in creating a safer, more resilient future for Cantabrians.

Data Standardization complying with the Sendai Framework

Disaster loss components can either be directly, or indirectly, quantified. A consistent approach to loss data evaluation requires a reliable procedure and adequate data availability to perform that quantification. The absence of a standard methodology for quantification of data quality remains a major challenge. Many developing nations have devised standards based on global, regional and existing in-country tools to enhance the data standard to measure Sendai Indicators (Figure: 2).

Data collected for damage and loss requires that intrinsic quality is maintained (data accuracy, reliability, objectivity and reputability of the source), along with accessibility (security access and cost in acquiring the data), contextual quality (data relevancy, value, timeliness, completeness and quantity) and representational quality (interoperability of data, comprehensibility, concise and consistent representation). A draft stocktake of New Zealand loss data collection activities in relation to the Sendai Framework, is shown in Appendix 1.

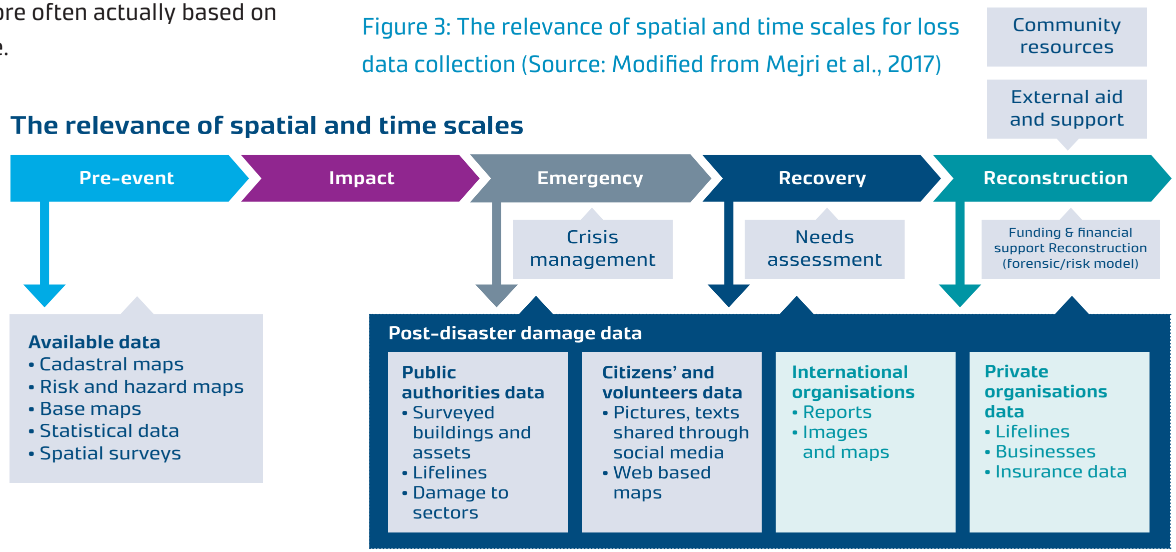
Figure: 2 Data Collection Protocol presented in the 5th GP-DRR, 2017



In order to respond to the Sendai indicators, there are several challenges countries could face. For example:

- Loss expressed as monetary costs is insufficient because Sendai Framework Target D (Indicators D1-8, which refer to the number of facilities destroyed/disruption to basic facilities and essential services) requires that assessments describe only significant physical damage and functional disruption (outages). The Sendai Framework indicators do not provide for the assessment of partial or minor damage; the cost of repairing or replacing which can be considerable. Meanwhile, in many countries, the assessment of physical damage does not fully correspond with the costs expressed in monetary terms, partly due to the costs of amelioration (e.g. taking steps to safeguard against short to medium-term failures). It is also because although these expressions of costs may directly reflect physical damage, they are more often actually based on compensation received from insurers or the state.
- Unit measures suggested by the Sendai indicators are not matched with collected data in many countries. There are some aspects that are not covered by the indicators and units of measure, but even so information is collected and could be used for monitoring progress.
- Some aspects of damages (e.g. indirect, reversible) will inevitably be missed in the data collection process.
- The spatial and temporal scale of information is especially important (Figure 3). With regard to the spatial scale, it is important to determine who the damage is being assessed for. This is more relevant for indirect damage, but can be equally relevant when one community's repair costs become gains for another that is providing material and personnel for the repairs. Mixing different time scales without any particular care, as is current practice in many countries, may result in significant, nonsensical inconsistencies, particularly when damage is related to the same category of items and assets. Sometimes only one type of datum is available, typically crisis datum, while more consolidated data are never produced. It is important to know the time when the data has been declared (inserted in the system), the time when the data has been produced (crisis/recovery; emergency/consolidated), the time when the data has become available, i.e. the damage can be detected (mould, health, indirect), and the damage duration (this is essential, particularly for functional damage).

Figure 3: The relevance of spatial and time scales for loss data collection (Source: Modified from Mejri et al., 2017)



Undoubtedly, establishing a comprehensive national standardized loss data collection and warehousing system is complex due to its multi-sectoral, multi-layered requirements across the public and private sectors. However, the value of such systems is now well proven.

New Zealand would be well served by the framework proposed. Its "bottom up" progression is designed to enhance standard loss data collection and recording processes, while offering a robust risk governance culture. In addition to the Sendai global targets, attention should be given to developing nationally-defined targets and indicators.

The evolution of the technological, stakeholder, quality assurance, and governance aspects of data processing would be linked to reporting over time. Once a framework has been adopted, a set of "step-by-step" protocols could developed for organisations to follow.

A key consideration will be resource mobilisation for improvement of data collection, recording and reporting at all levels. This will require an appropriate level of investment in building local and regional data collection capacity and, consequently, supporting IT infrastructure.

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Corresponding author: Bapon Fakhruddin, bfakhruddin@tonkintaylor.co.nz
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Appendix 1. A draft stocktake of New Zealand loss data collection activities in relation to the Sendai Framework

Goals		Target		Indicators	New Zealand Status						Reference
					Overall	MCDEM	National Organisations (e.g. Statistics NZ)	Local Councils	Local Organisations (e.g. Councils)	EQC and other Insurers	
Goal 1	A	Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared with 2005-2015	A1	Number of deaths and missing persons attributed to disasters, per 100,000 population.	Yes	CDEM groups do search and rescue and collect number of deaths, missing people.	"DHBs also join in death and injury reporting. Statistics NZ derives report with their tools on population data, datasets by subject and theme, business data geographic maps, data, and files, metadata and classifications."*	Collect number of deaths and missing persons attributed to disasters		Collect data on claim reporting	New Zealand, to report against the indicators recommended to measure the global targets of the Sendai Framework, and identify current gaps., http://www.preventionweb.net/files/53164_newzealandnzl.pdf
			A2	Number of deaths attributed to disasters, per 100,000 population.	Yes, but no specific data collection			Collects data		Collect data on claim reporting	
			A3	Number of missing persons attributed to disasters, per 100,000 population.	Yes, but no specific data collection			Collects data		Collect data on claim reporting	
Goal 2	B	Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared with 2005-2015.	B1	Number of directly affected people attributed to disasters, per 100,000 population.	Yes	Collect number of affected population		Supports CDEM		Collect total number of deaths	**The Story So Far. Report*** http://www.civildefence.govt.nz/assets/guide-to-the-national-cdem-plan/Guide-to-the-National-CDEM-Plan-2015.pdf
			B2	Number of injured or ill people attributed to disasters, per 100,000 population.	Yes, but no specific data collection	General Interpretation	DHBs record data of injured seeking medical help				http://www.stats.govt.nz/tools_and_services.aspx
			B3	Number of people whose damaged dwellings were attributed to disasters.	Yes, but no specific data collection		Statistics NZ hold household data which are usually used to give interpretations	Council collect data of damaged dwellings		For Insurance claim settlements EQC acquire these data but for no specific reason.	
			B4	Number of people whose destroyed dwellings were attributed to disasters.	Yes, but no specific data collection			Council collect data of destroyed dwellings		For Insurance claim settlements EQC acquire these data but for no specific reason.	
			B5	Number of people whose livelihoods were disrupted or destroyed, attributed to disasters.	Yes, but no specific data collection			Council collect data of destroyed livelihood		For Insurance claim settlements EQC acquire these data but for no specific reason.	
Goal 3	C	Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030	C1	Direct economic loss attributed to disasters in relation to global gross domestic product.	Yes	General loss intrepretation	Statistics NZ collects data in relation to GDP	Council collect loss data	Rearchers working on DM derive interpretations	EQC assess economic loss with reference to claims.	
			C2	Direct agricultural loss attributed to disasters.	no specific data collection					For Insurance claim settlements EQC acquire total agriculture loss data but for no specific reason.	NZ collects data on forest loss, biodiversity loss etc.
			C3	Direct economic loss to all other damaged or destroyed productive assets attributed to disasters	Yes					EQC assess economic loss with reference to claims.	
			C4	Direct economic loss in the housing sector attributed to disasters.	Yes					EQC assess economic loss with reference to claims	
			C5	Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters.	Yes					EQC assess economic loss with reference to claims	"NZ collects loss data on critical infrastructure elements such as Energy (Oil, Gas, Electricity), Roads, Airports, Ports, Rail, Telecommunications, Broadcasting, Fast-Moving Consumer Goods, 3 Waters"*
			C6	Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.	Yes			Council acquire these data	Researchers working on DM derive interpretations	EQC assesses value	
Goal 4	D	Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.	D1	Damage to critical infrastructure attributed to disasters	Yes	General loss intrepretation	"Statistics NZ derives report with their tools on population data, datasets by subject and theme, business data geographic maps, data, and files, metadata and classifications. "*	Council collect loss data		For Insurance claim settlements EQC acquire total loss data but for no specific reason.	"NZ collects loss data on critical infrastructure elements such as Energy (Oil, Gas, Electricity), Roads, Airports, Ports, Rail, Telecommunications, Broadcasting, Fast-Moving Consumer Goods, 3 Waters"*
			D2	Number of destroyed or damaged health facilities attributed to disasters.	Yes						
			D3	Number of destroyed or damaged educational facilities attributed to disasters.	Yes						
			D4	Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters.	Yes						
			D5	Number of disruptions to basic services attributed to disasters.	no specific data collection						
			D6	Number of disruptions to educational services attributed to disasters.	no specific data collection						***The Story So Far. Report** Earthquake Commission, New Zealand: The Story So Far. Report, October 2016, https://www.eqc.govt.nz/sites/public_files/documents/Research/Planning-for-loss.pdf
			D7	Number of disruptions to health services attributed to disasters.	no specific data collection						
			D8	Number of disruptions to other basic services attributed to disasters.	Yes						