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BRIEFING NOTE: Technical guidance on choosing targets for reducing natural disaster risk*

Key messages

- Reducing disaster losses is a fundamental component of the Sustainable Development Goals (SDGs), demonstrated by the presence of targets relating to disaster risk management (DRM) under six goals in the 'zero draft' (2 June 2014). However, few of the proposed DRM targets are concise or easily measurable; they do not build on existing international datasets or focus on whether disaster losses are actually being reduced.
- This briefing assesses trends in disaster deaths, economic losses and the impact of disasters on poverty to help Open Working Group (OWG) members to formulate targets that are both politically acceptable and technically robust. Accordingly we recommend returning to a DRM target under Goal 1 as follows: 'By 2030, strengthen disaster risk management systems, reduce disaster deaths by x% and reduce economic, physical and social disaster impacts by y%'.
- Disaster deaths and economic losses are among the most widely collected information about disaster impacts. Existing international datasets highlight considerable variations between countries depending on their level of economic development and hazard exposure, although progress regionally and globally can be assessed. Targets differentiated around these determinants may indeed be desirable. Experience shows that it is possible to achieve much larger reductions in disaster mortality than in economic losses.
- Data challenges include deciding which events should be counted (for example, does a flood killing one person and destroying one house count?) and how to measure progress in disaster resilience when large-scale events, like big earthquakes, happen so irregularly. To deal with the latter, proxies (such as the proportion of people covered by an evacuation plan) and the audited use of probabilistic catastrophe models (for example to monitor the impact of changing building construction on earthquake losses) are suggested to ensure a consistent measure for a particular country.

1. Introduction

Disasters, climate change and development are inextricably linked. Not only are the poorest and most marginalised people disproportionately affected by disasters, but disasters also exacerbate vulnerabilities and social inequalities and harm economic growth. Disasters can reverse years of development gains, and threaten to derail efforts to eliminate poverty by 2030. While weather-related hazards are increasing in scope, frequency and intensity, exposure to hazards is also increasing quickly, as more people, infrastructure, assets and livelihoods are located in hazard prone areas. Targets for reducing disaster risk and tackling disaster losses are rightly included in the 'zero draft of proposed goals and targets on sustainable development for the post-2015 development agenda' (see Box 1). The authors of this briefing have discussed potential SDG targets on DRM at length in previous publications[1] and have shown why a target on reducing disaster losses is crucial for ending poverty by 2030[2].

This briefing note is designed to support OWG members in their consideration of targets related to DRM. It presents a technical assessment of potential targets and explores global trends in disaster losses in the past, along with comments on possibilities for the future. This information should reassure OWG members that DRM targets are measurable. It concludes by reiterating the importance of linking SDG DRM targets with the process of developing targets and indicators for the successor to the Hyogo Framework for Action (HFA), the international agreement on reducing disaster risk. This briefing is part of a wider project assessing the measurement, data and calibration aspects of SDG targets on DRM. A more comprehensive report will be released in July 2014 that will consider potential estimates for the targeted percentage reduction in losses.

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Box 1: Proposed DRR targets in zero draft goals and targets on sustainable development for the Post-2015 Development Agenda (as of 2 June 2014)[3]

Proposed goal 1. End poverty in all its forms everywhere
1.6 by 2030 strengthen early warning and disaster risk reduction systems and related capacities with the aim of building resilience and protecting the poor and those in vulnerable situations from disasters and shocks, including climate-related extreme events

Proposed goal 2. End hunger, achieve food security and adequate nutrition for all, and promote sustainable agriculture
2.8 by 2030, fully implement agricultural practices that strengthen resilience and adaptation to extreme weather, drought, climate change and natural disasters, in particular for small-scale farmers

Proposed goal 6. Secure water and sanitation for all for a sustainable world
6.7 by 2030 decrease by x% mortality, and decrease by y% economic losses caused by natural and human-induced water-related disasters
6.8 provide adequate facilities and infrastructure, both built and natural, for safe drinking water and sanitation systems, for productive uses of water resources and for mitigating the impacts of water-related disasters

Proposed goal 11. Build inclusive, safe and sustainable cities and human settlements
11.6 by 2020, increase by x% the number of human settlements adopting and implementing policies and plans towards resilience and adaptation to climate change and natural disasters

Proposed goal 13. Promote actions at all levels to address climate change
/ Build a climate change goal based on the outcome of COP21 of the UNFCCC
13.2 build resilience and adaptive capacity to climate induced hazards in all vulnerable countries
13.5 improve education, awareness raising and human and institutional capacity on climate change impact reduction and early warning

Proposed goal 17. Strengthen and enhance the means of implementation and global partnership for sustainable development
17.14 increase the capacity for early warning, risk reduction, and management of national and global health risks

2. Trends in disaster losses

In 2013, there were 334 natural disasters worldwide, similar to the four previous years and close to the average of the previous decade. In the period from 2000-2009, the number of natural disasters was three times as many as in the 1980s, and the reported number of victims of disasters (deaths and number of people affected) rose rapidly over this period. Globally, the number of people killed by disasters in the period from 1999-2013 increased by 18% compared to the period 1980-1994[4]. Economic losses increased by an average of 236% over the same period[5].

Currently, most data collection on global disaster trends focuses on human deaths and affected populations. Data on economic losses, while increasingly recognised as crucial, are still only reported for a minority of events worldwide, and are largely driven by losses in wealthier countries where asset values are high and insurance penetration is widespread. The occurrence of disasters unquestionably varies by region according to levels of hazard exposure combined with vulnerability and levels of economic development. Setting targets for disaster losses should therefore play close attention to these factors. To illustrate this, we have examined patterns of economic losses and mortality across four groups of countries: low, lower-middle, upper-middle, and high income (see Table 1).

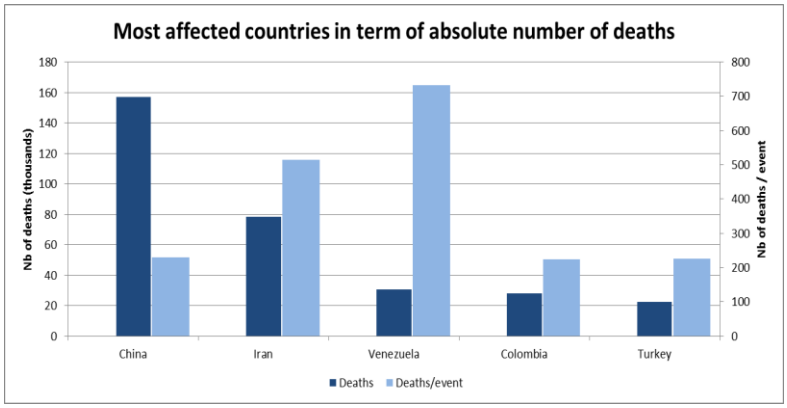
Table 1: Trends in mortality rates and economic losses as share of GDP between 1980-1995 vs 1995-2013

Economic income group	Commentary	Mortality trends (% change in deaths per million people)		Economic loss trends (% change in economic losses as share of GDP)	
		Most significant reduction in deaths	Most significant increases in deaths	Most significant reduction in economic losses (% reduction)	Most significant increase in economic losses (% increase)
Low	Performance tends to be shaped by weak infrastructure (especially housing), poor emergency care and livelihood breakdown.	Mozambique (750) Ethiopia (424) Chad (75) Tajikistan (47) Bangladesh (16)	Haiti (391) Myanmar (118) Zimbabwe (1.4) Togo (1.4) Uganda (1)	DPR Korea (22.5) Tajikistan (3.1) Kyrgyzstan (2.5) Madagascar (2.3) Cambodia (1.9)	Haiti (0.9) Myanmar (0.5) Somalia (0.2) Burkina Faso (0.1) Zimbabwe (0.02)
Lower Middle	Disaster preparedness/ early warning and central government support to affected regions may be improving, but significant changes are result of severe disasters in period.	Sudan (564) Yemen (32) Cameroon (25) El Salvador (19) Moldova (6)	Honduras (61) Sri Lanka (47) Nicaragua (10) P. N. Guinea (7) Pakistan (4)	Yemen (16.4) Moldova (7.7) Nicaragua (3.2) El Salvador (2.8) Bolivia (2.1)	Mongolia (7.3) Honduras (0.8) Georgia (0.5) Pakistan (0.1) Morocco (0.1)

Upper Middle	This group tends to be the most volatile with respect to disaster impact, as asset values rise in this economic category, losses will also increase.	Ecuador (25) Colombia (15) Iran (9) Lebanon (5) Albania (5)	Venezuela (41) Hungary (3) Dom Rep (3) Libya (3) Turkmenistan (2)	Turkmenistan (3.1) Jordan (1.8) Lebanon (1.3) Hungary (1.0) Tunisia (0.8)	Cuba (0.6) Thailand (0.2) Dom. Republic (0.1) Venezuela (0.1) Taiwan (0.1)
High	Specific events are important in this set. The 2003 and 2006 heat waves raised the death tolls of western Europe but had little effect on economic loss.	Puerto Rico (20) Oman (10) Greece (4) Chile (1) Korea P. Rep (1)	Portugal (11) Spain (9) Belgium (8) Netherlands (7) Switzerland (6)	Israel (0.2) Spain (0.2) Saudi Arabia (0.1) Italy (0.1) Greece (0.1)	Oman (2.3) New Zealand (1.0) Chile (0.2) Puerto Rico (0.2) Sweden (0.2)

Disaster death tolls typically record the deaths of those who have died as an immediate consequence of the disaster event. They exclude all those who may have succumbed to injuries later or died due to complete destitution, and take into partial account the death tolls related to drought. Disaster-related deaths also occur among the many victims of disasters who have to migrate to seek safety and livelihoods elsewhere. The trends considered here do not include any of these deaths and are therefore certainly underestimates, especially for poorer countries and those subject to drought. Patterns and trends in mortality, especially for global exercises, are however useful if they are standardised over the national population or number of people exposed and then converted into disaster related mortality rates instead of using the absolute or raw death tolls (see Figure 1 for an illustration). This transformation then allows for comparisons to be made between countries with large populations and those with smaller ones, or across time for countries with high fertility rates, by carefully adjusting the denominator by year. For example, over half the total death toll in upper middle income countries was from earthquakes (64%) but earthquakes accounted for just 4% of those affected by disasters. Most of those affected[6] by disasters in this income group were affected by floods. Although China registered very high absolute death tolls, Venezuela, Turkey, Iran and Colombia ranked as high or higher in terms of deaths per event. Countries in this income bracket are better placed, compared to lower income countries, to enact and enforce construction quality regulations and could conceivably reduce their death tolls from earthquakes, as well as from other disaster types.

Figure 1: Most affected countries in terms of absolute number of deaths and deaths per event



Finally, death tolls, especially over time, are a sensitive reflection of the severity of disasters and importantly a measurable one. In general, national reporting of deaths is improving globally, both in quality and accuracy, especially in countries that are at highest disaster risk. Multi-country efforts for better data and evidence are already underway in several regions. These countries should be supported with realistic tools to help them monitor disaster impact effectively. A small added investment to develop sound monitoring mechanisms that could follow trends and feed the results into development planning is achievable. Trends in the global data show that floods and droughts have the highest costs in terms of human lives, assets and economic livelihoods. Admittedly, some of the impact of these disasters is not fully captured by the reported data and supplementary data from sub-national sources is required to provide a more accurate and complete picture.

3. The impact of disasters on poverty and human development

Countries with some of the highest disaster risk in 2030 will be those with large numbers of people living in poverty on less than $1.25 a day.[7] Without effective disaster risk management systems these natural hazards will keep people in poverty or worsen their situation, as well as push other individuals below the poverty line. The impact of a natural disaster on poverty and human development will vary according to the characteristic of that hazard (whether it is rapid-onset or slow-onset and the recurrence time between events, for instance). However, the balance of evidence suggests that disasters, in combination with other shocks, can push more and more people into poverty, and keep those already poor in poverty.[8] In Mexico, for example, between 2000 and 2005 natural hazards (particularly floods

and droughts) had significant impacts on poverty incidence and the Human Development Index (HDI). Disasters increased food poverty by 3.7% and set back HDI progress by two years over that period.[9]

Disasters can also result in long-term poverty. A relatively mild drought in Zimbabwe in 1994/95 lowered the annual growth rates of children aged 12-24 months by between 1.5 and 2 cm. Four years after the drought these children remained shorter on average than those who were not affected by drought at the same age,[10] though children in relatively well-off households had recovered some of this lost growth when compared to those in poor families.[11] Lost growth in childhood is then correlated with lower productivity and lifetime earnings as an adult.[12] Impacts on labour markets, in terms of substantially lower wages, can also persist several years after a natural hazard. The 1998 flood in Bangladesh was a one-in-a-hundred-year event and five years later agricultural and non-agricultural wages remained 4-7% lower for each one-foot deviation from the normal flood level.[13]

While the evidence shows how disasters can affect poverty, different approaches to investigating this, and different sources of data, can lead to markedly different results. Panel data is necessary to investigate poverty dynamics over time, to show who escapes poverty, who slips into it and who remains in it. The collection of nationally and sub-nationally representative panel data can provide an important baseline from which to examine the impacts of natural disasters on poverty and human development. Investigating the role of natural disasters in poverty dynamics requires panel data to be analysed alongside comprehensive information on the extent and nature of the disaster. Here self-reported information on environmental hazards would seem to have limitations, though it may be that shock modules in household surveys, alongside community level shocks data, can be improved to collect this information more reliably.

4. Progress in reducing disaster risks

The potential reduction in disaster losses and disaster risk by 2030 depends on the strength of systems to manage disaster risk, including efforts to reduce vulnerability and exposure to hazards. It depends on how developed and successful these systems are: for example, if strong progress has already been made, it will be difficult to achieve the same magnitude of progress as a country which does not have any systems in place, and where there is great potential. The type of hazard which is being considered will also affect how much of reduction is realistic. Perils can be divided into those that are 'well forecasted', allowing evacuations (such as cyclones, floods and tsunamis), and those that cannot easily be forecasted (principally earthquakes). Many disasters, such as significant floods and storm surges, that 50 years ago were poorly predicted, are now well forecasted. In order to reduce losses, forecasts need to be delivered to the people at risk, who themselves need to know where to go to be safe. Further improvements in forecasting may be possible for rapid onset hazards, such as flash flooding, tornadoes and near-field tsunamis. The experience in Bangladesh since 1970 highlights what can be achieved around organised evacuations, elevated storm surge shelters and evacuation drills, with these factors, among others, contributing to reducing life loss in comparable cyclones a hundredfold between 1970 and 2007.[14] In Japan since the 1950s the focus has been both on organising evacuations and on building flood defences and improved river management. Between the 1950s and 1990s, annual mortality from typhoons was reduced fiftyfold[15] (and for other flooding by around 20 times.)[16] Whereas improvements in death rates tend to be related to early warning, education and improved infrastructure, higher death rates are often linked to changes in population exposure, and the type, severity and timing of hazards.

A country with low or improving disaster risk management capacity and with severe disaster impacts over the last few decades has considerable potential to radically reduce deaths and economic, social and physical losses over the next 15 years. Examples include Haiti, Honduras or Madagascar. Countries that have made significant improvements already, particularly on disaster deaths, such as Chile or Ethiopia, have less potential for considerable reductions.

We should expect to achieve much larger reductions in disaster mortality than in economic losses. It is easier to organise effective evacuations, for instance, than to prevent physical damage from flooding. In Japan between 1960 and 1989, while typhoon casualties were reduced fiftyfold, the number of properties flooded due to typhoons was only reduced eightfold.[17] In Bangladesh or Orissa, India, where improvements have been made in early warning, evacuations and infrastructure, there is no evidence to suggest material reductions in the numbers of properties flooded or in direct economic losses. From the use of catastrophe models, designed to capture both direct building damages and mortality rates, we find that in a particular high earthquake hazard zone, the replacement of all unreinforced masonry wall construction by the latest building code-compliant, steel frame (or wood) construction could reduce deaths around 300 times, while the consequent reductions in economic loss would only fall sixfold for the same rebuild cost. This highlights the way that building codes are intended to achieve life safety rather than to prevent damage. For well-forecasted hazards, reductions in economic damages can be expensive, requiring for example intensive flood defence construction.

5. Setting a baseline and monitoring progress

To have effective targets for reducing disaster deaths and economic, physical and social impacts, it is necessary to define how a baseline should be set as well as how to measure progress. The challenge is that large-scale events, like big earthquakes, happen so irregularly. To deal with this, both in setting baselines and measuring progress, proxies (such as the proportion of buildings constructed to design codes for earthquakes, the number of people covered by an evacuation plan for well-forecasted hazards) and the audited use of probabilistic catastrophe models (for events such as earthquakes, for monitoring impacts of construction changes) are suggested to ensure a consistent measure for a particular country. In terms of using observation data, larger regions are in principle likely to produce less volatile measures of risk than smaller areas, in particular for more frequent hazards such as wind and flood. However, we must be careful because even the statistics for a high frequency hazard measured across a large region, such as tornadoes in the US, are capable of showing outliers (since 1970 they have been normally distributed, ranging from a minimum of 10 and a maximum of 120, except in 2011 when more than 500 people were killed). Other hazards, such as earthquakes or volcanic eruptions display a skewed distribution of outcomes. Therefore, the use of proxies and probabilistic catastrophe models (rather than loss data from disasters over the 15-year time period) are suggested to ensure a valid and consistent comparison.

6. Data challenges and opportunities

Monitoring progress in reducing disaster mortality and other impacts is essential to ensuring the effectiveness of investments in DRM. Reliable monitoring indicators will be needed that are realistic and adaptable for all types of economic settings and disaster risks. Additionally, baseline estimates of human and economic disaster losses against which to monitor progress will be required that have reasonable data requirements and can be used in diverse settings.

One of the main challenges to be overcome is how to systematically measure the small-scale disasters that happen every day across the world while at the same time considering events that might happen once every 100 years or more. The incidence of events at both ends of spectrum, and the associated losses, will be relevant for assessing progress toward the SDGs. Other challenges include drawing boundaries around disasters: for example, the sudden nature of some disasters makes the measurement of impact much easier than slow-onset disasters, since it provides clearer starts and finishes for the measurement process. Another consideration is the appropriate low-end threshold for including a disaster in international databases. All these challenges are surmountable, particularly because the quality of disasters data will be a key feature of the successor to the HFA, the post-2015 agreement on reducing disaster risk, and progress is already being made in some areas, such as on national disaster loss databases, counting of small scale events, the use of catastrophe risk models and open source platforms.

Data collection will also need to separate out disaster categories, as well as the socio-economic profile of those impacted, as progress in reducing losses for some hazards and some socio-economic groups may be easier than for others. Additionally, as the resolution of datasets changes from global to regional to national, methods are required to ensure the quality and accuracy of the data in order to allow meaningful interpretation for impact and policy analyses at local levels. As we have assessed past progress, it has been noted that few countries currently have a dataset which is complete enough for investigating trends over time (in terms of a frequently experienced hazard, a large enough region and data collection over a long time period). As we move forward, the gathering of new data, the use of proxies and models, and data collection for these, will ensure more consistent monitoring.

Economic losses are reported for less than a third of the disasters globally, and trends from these data can therefore only be considered indicative. Missing data is most common among poorer countries and for most disasters, except geophysical events such as earthquakes, volcanoes and certain landslides. That said, the economic loss data does provide insights despite its paucity, when large numbers of records are considered and are corrected for inflation and standardised by the national Gross Domestic Product (GDP). The best data on economic losses are held by reinsurance companies who obtain this information from their client insurance companies based mainly on pay-outs. Countries with low life or asset insurance coverage are underrepresented in this case. For events of equal severity, comparative global trends overcompensate for disasters that occur in countries such as USA, Japan or western Europe compared to those that occur in poorer countries, such as Haiti or the Philippines.

Analyses of data for trends and patterns are most likely to be used for policy and monitoring if they are generated independently and close to the field. Regional banks as well national technical institutions that have the expertise and the independence should be tasked with developing and monitoring impact indicators and designing regionally appropriate methodologies.

7. Conclusion

The ultimate measure of improving disaster resilience and strengthening disaster risk management systems is the experience of disaster impacts and losses. Consequently, any SDG targets for natural disasters should include components that set targets for reducing disaster losses. While measurement and data challenges around disaster losses are significant but surmountable, international and national datasets for disaster losses do exist and provide a useful starting point when combined with proxies and models. Accordingly, we recommend returning to a DRM target under Goal 1 as follows: 'By 2030, strengthen disaster risk management systems, reduce disaster deaths by x% and reduce economic, physical and social disaster impacts by y%'. We are working on estimates for the percentages in this formulation and will release results in July 2014, along with suggestions on how to build and implement a monitoring system. Such a monitoring system would need to span the SDGs and the targets and indicators included in successor to the HFA, though ideally both SDG and HFA2 targets and indicators would dovetail seamlessly.

Evidence suggests that more rapid progress can be made on reducing disaster deaths than economic losses, for which global trends in asset exposure may mean that even keeping economic losses at a similar level to the baseline period would be a considerable achievement. Evidence also shows that there is considerable variation between countries depending on their level of economic development, exposure to and experience of hazards, and the strength of their DRM systems. Further work on how countries can be supported to set nationally appropriate targets and how these targets can be aggregated at the global level are a feature of our current project and will be elaborated in our forthcoming July publication.

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[1] Mitchell, T., Jones, L., Lovell, E., Comba, E. eds (2013) Disaster Risk Management in post-2015 Development Goals: Potential Targets and Indicators. ODI.

[2] Shepherd, A., Mitchell, T., Lewis, K., Lenhardt, A., Jones, L., Scott, L. and Muir-Wood, R. (2013) *The geography of poverty, disasters and climate extremes in 2030*. London: Overseas Development Institute.

[3] http://sustainabledevelopment.un.org/content/documents/4044140602workingdocument.pdf

[4] This is not normalised for increases in population over this period. The forthcoming report will include such data.

[5] This is not normalised for GDP growth or inflation. Again the forthcoming report will include such data.

[6] Affected people meaning people requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people.

[7] Shepherd, A., Mitchell, T., Lewis, K., Lenhardt, A., Jones, L., Scott, L. and Muir-Wood, R. (2013) *The geography of poverty, disasters and climate extremes in 2030*. London: Overseas Development Institute.

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[13] Mueller, V. and A. Quisumbing (2011) 'How resilient are labour markets to natural disasters? The case of the 1998 Bangladesh flood', *Journal of Development Studies* 47(12): 1954-1971.

[14] For each of the analyses the number of deaths has been normalised by either population or number of houses to allow for comparison across time periods. The number of houses has been used as a proxy to population where this data is unavailable, as long as defences have not been built to reduce the area impacted. In Bangladesh, the number of mortalities reduced from 300,000 to 3,447, which is normalised by the number of houses destroyed, resulting in a change from 0.75 in 1970 to 0.006 in 2007.

[15] The mortality rate (normalised by population) decreased from an average of 1.13x10-3 % in 1950s to 0.020x10-3 % in 1990s.

[16] The mortality rate (normalised by population) decreased from an average of 0.44 x10-3 % in 1950s to 0.022 x10-3 % in 1990s.

[17] Looking at five-year averages, the number of houses flooded decreased from 300,686 in 1960 to 37,327 in 1989. See endnote 13 for reduction in typhoon casualties.

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