

**11th Meeting of the Advisory Expert Group on National Accounts,
5-7 December 2017, New York, USA**

Agenda item: 10

Measuring Direct Economic Loss

Introduction

Direct economic loss is one of the core disaster-related indicators for monitoring progress in the UN Sustainable Development Goals and in the Sendai Framework for Disaster Risk Reductions. There are major conceptual and practical challenges with meeting the demands for producing internationally harmonized indicators for direct economic loss in alignment with requirements for the SDGs and Sendai Framework targets, especially in the context of the existing standards for economic statistics compilation and valuation (i.e. 2008 SNA). Recommendations for disaster related statistics are needed.

Main issues to be discussed

Paper on: Economic Impacts from Disasters in the System of National Accounts: Towards an Internationally-Harmonized Approach to Direct Economic Loss Measurement

Main issues to be discussed

The AEG is requested to:

- Express their views on the need for alignment of measurements of direct economic loss to the concepts and definitions of the 2008 SNA and
- provide further guidance on future work in this area

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**Economic Impacts from Disasters in the System of National Accounts:
Towards an Internationally-Harmonized Approach to Direct Economic Loss Measurement**

UNESCAP Statistics Division Discussion Paper¹²

Background and Terminology

1. According to the currently available statistics, economic impacts from disasters are on the rise in many countries, creating fundamental challenges to the achievement of sustainable development.
2. Increased exposure to economic impacts of disasters can best be monitored and addressed through policies aided by clear concepts for measuring economic loss from disasters that are harmonized, as much as possible, across countries and across disasters.
3. Direct economic loss is one of the core disaster-related indicators for monitoring progress in the UN Sustainable Development Goals (SDGS) and in the Sendai Framework for Disaster Risk Reductions. In that context, *Direct economic loss* is defined for the monitoring of Target C in the Sendai Framework for Disaster Risk Reduction as "the monetary value of total or partial destruction of physical assets existing in the affected area." Methodological guidance developed for monitoring international indicators for economic loss (target C) of the Sendai Framework (UNIDSR, 2017) acknowledged significant differences in current practices for economic loss measurement around the world and that, currently, "in many disaster loss databases and disaster situation reports, it is often difficult to determine which methodology, criteria and parameters have been used for estimation of the economic value of losses."
4. As a contribution to development of a framework for statistics on economic impacts from disasters, including for use in post disaster impact assessments and production of the international indicators, this paper reviews the concepts and related demands for direct economic loss from the perspective of relationships with existing statistical standards from the System of National Accounts (SNA).
5. Terminologies for assessing economic impacts of disasters have evolved over time and significant differences remain in the use of key terms like direct or indirect impacts, losses and

¹ This paper represents the views of the authors only and does not necessarily describe official positions of the United Nations organization.

² This paper was prepared by Daniel Clarke, UNESCAP Statistician, with Jean Louis Weber (International Consultant). The research benefitted greatly from many inputs and comments volunteered generously from several experts, particularly: Jeff Cope, Gary Dunnet, Mathew Page and Chase O'Brien (of Statistics New Zealand), Robert Smith (of Midsummer Analytics), and Herman Smith (of UN Statistics Division).

damages. The guidance for Sendai Framework monitoring developed by UNISDR puts emphasis on the distinction between direct and indirect impacts. According to the UNISDR descriptions, *indirect impacts* are not indiscriminately losses, as indirect effects could potentially include increases in certain productive activities (like construction), which contribute to production (GDP) and are income-earning activities. More conventionally, indirect impacts are composed of losses in the form of additional costs, reduced demand and reduced income for certain groups as a consequence of the damages to assets.

6. From the national accounts perspective, a difference between direct and indirect impacts is that the direct losses are explicitly recorded as changes in the stocks of assets whereas indirect losses are implicitly reflected in the transaction accounts and must be estimated based on analysis of statistics within the accounts.

7. Guidance on post disaster needs assessment (PDNA) studies make a conceptual distinction between *damages* (defined as physical impacts to infrastructure) and *losses* (defined as production losses and higher costs associated with selected services). There are close relationships but no perfect correspondence across these terminologies. So, there are multiple concepts for scope of measurement of economic impacts from disasters in use in the current international guidance on measurement.

8. We can combine the terms as follows: direct impacts include monetary valuation of damages (for all assets) and losses are the negative portion of the indirect impacts from a disaster, which includes a wide range of possible economic changes as indirect consequence of the damages to assets.

9. According to the System of National Accounts 2008 (2008 SNA), an **asset** is “a store of value representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time. It is a means of transferring value from one accounting period to another.” (2008 SNA, para 3.30).

10. Assets have an intrinsic value represented by benefits to owners. This value can be lost or reduced directly by a disaster. A simple example is a destroyed dwelling, which is a total loss in the asset that a household had been utilizing as shelter, and for which a value could be identified as the market value of the asset at the time of its destruction or by the costs of replacement or reconstruction following the disaster.

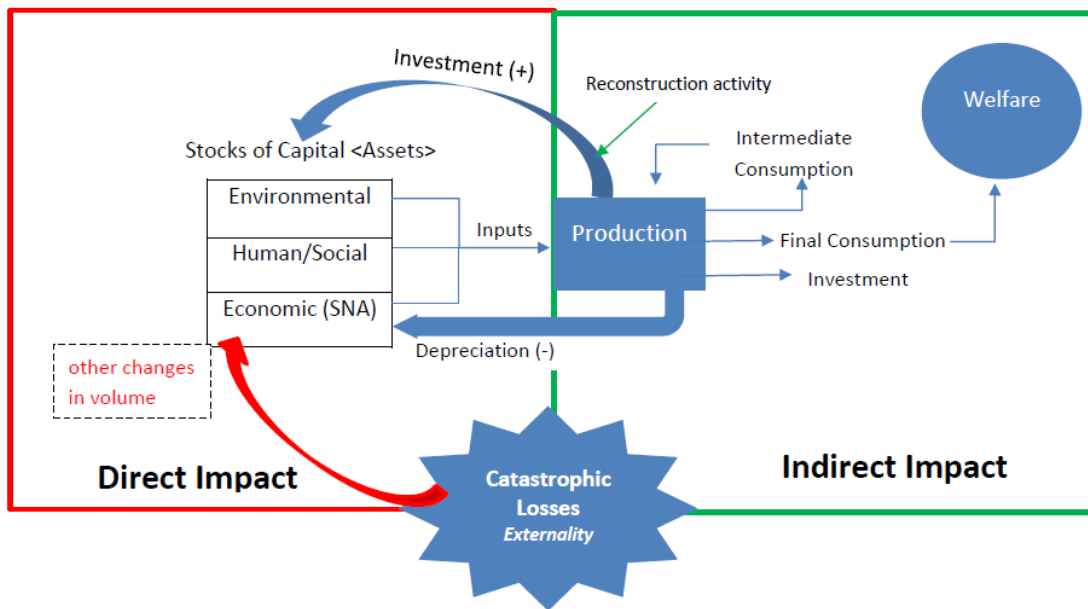
11. The scope of measurement for direct impacts, for practical reasons, should be aligned to economic assets as defined according to the 2008 SNA, as these are the items that can be valued in monetary terms consistently with current standards for economic statistics. There are other recognized forms of capital (e.g. natural capital), which are accounted for in other frameworks, in particular in the System of Environmental Economic Accounts (SEEA). The System of Environmental-Economic Accounting (SEEA) 2012 – Central Framework is an internationally agreed standard for producing comparable statistics on the environment and its relationship with the economy, following a similar accounting structure as the SNA. According to SEEA, environmental assets are “the naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.”

Some environmental assets are also economic assets (in the SNA sense), particularly: land and natural resources. In principle, other changes to stocks for land improvements and natural resources can be accounted for in monetary terms within the SNA.

12. It is not an objective in the SNA to measure economic impacts of disasters, but it addresses the general equilibrium of economic flows and the changes in assets and liabilities. Moreover, the Sendai Framework and SDGs indicators explicitly request that impacts from disasters be expressed in reference to GDP. Thus, valuation in monetary terms should seek the best consistency with the SNA.

13. In the SNA, **production** is an activity carried out under the responsibility, control and management of an institutional unit, that uses inputs of labour, capital, and goods and services to produce outputs of goods and services (SNA, 2008). The balancing item from production accounts is Value Added (VA), which summed at the country level is GDP. VA and GDP are firstly computed Gross, which means with no deduction of the regular consumption of fixed capital resulting from assets use and obsolescence. When deduction is done, VA and production are called “Net” (NVA, NDP).

Figure 1: Direct, Indirect Impacts, and the SNA Framework



14. According to the terminology, the direct economic impacts are reflected in measurement to changes to the stocks of assets, as shown on the left side of Figure 1. These changes to assets from a disaster are a kind of economic externality and are called catastrophic losses in the SNA terminology. They are accounted for as a special entry called “Other changes in volume” to assets. Impacts to flow accounts of production, expenditure, and income will be affected (implicitly) as indirect impacts of the disaster.

15. In the SNA, production depends on inputs of economic non-financial assets (Fixed capital and Inventories), which can be damaged or destroyed in the form of direct material impacts from

a disaster. Such sudden assets reduction is not recorded as a deduction to GDP, although its indirect consequences on Value Added may be observed, e.g. from time series analysis.³

16. Direct impacts are recorded in the Balance-sheet of non-financial and financial assets as catastrophic losses in the “The other changes in the volume of assets account”.⁴ So, in principle, these direct impacts from disasters are recorded by the SNA (in asset accounting) , at least for catastrophic losses from “large scale” events. For direct economic loss time series measurement, this national accounts entry should be supplemented with data from smaller scale disasters as their accumulation over time may yield major economic costs.

Asset Valuation

17. When it comes to estimating a monetary value for direct economic loss, the challenge is to put a value to the physical damages to assets observed by the disaster management agencies (and other relevant authorities). There are multiple options, as described below. In general, these options are not additive because summing different perspectives on the value of material changes to assets may result in double-counting (or mixing of concepts incoherently). Thus, for any given specific asset damaged or destroyed by a disaster, a decision needs to be made according to the following options based on appropriateness for the uses of the statistics and availability of data.

18. While there is a strong international demand for internationally comparable indicators of direct economic loss, there is also an interest to produce multiple related figures, where possible, in order to meet different purposes of economic analysis, including, subsequently, for assessments of the indirect impacts of disasters. Each option described below has advantages and disadvantages according to different purposes and some choices are more or less practical or appropriate depending on the type of the affected asset.

19. The purpose of the following descriptions is mainly to clarify the possibilities and give guidance towards practical measurement decisions for making the best use of existing data. The fact that there are multiple perspectives and multiple possible approaches to valuation shows the importance of clear use of terminologies and of documentation of valuation methodologies when reporting economic loss statistics.

Replacement Costs

20. For most cases, utilizing available data or estimates for replacement costs of assets is recommended as a first-tier approach for measuring the concept of direct economic loss, as defined

³ Note that these negative effects will be incorporated implicitly into GDP along with the restoration activities (as positive contributions to GDP, rather than as losses). So, aggregate indirect impacts (or ‘losses’) to economies are ambiguous from the national accounts and requires some assumptions and modelling

⁴ “*The volume changes recorded as catastrophic losses in the other changes in the volume of assets account are the result of large scale, discrete and recognizable events that may destroy a significantly large number of assets within any of the asset categories. Such events will generally be easy to identify. They include major earthquakes, volcanic eruptions, tidal waves, exceptionally severe hurricanes, drought and other natural disasters; acts of war, riots and other political events; and technological accidents such as major toxic spills or release of radioactive particles into the air. Included here are such major losses as deterioration in the quality of land caused by abnormal flooding or wind damage; destruction of cultivated assets by drought or outbreaks of disease; destruction of buildings, equipment or valuables in forest fires or earthquakes.*” [SNA 12.46]

for the Sendai Framework in the report of the working group to the UN General Assembly. Compilations of statistics on replacement (or reconstruction) costs for assets damaged by a disaster have immediate utility for calculating indicators for international reporting for SDGs and the Sendai Framework, among other purposes.

21. In general, the replacement cost values are expected to be calculated and reported relatively quickly after disaster occurrences by disaster management agencies (UNISDR, 2017). These are estimates of reconstruction and replacement cost for damages caused by a hazard (earthquake, storm, flood, etc.). They are calculated based on assessments of damages in physical terms (numbers of buildings, square meters, etc.) following a specific event, and therefore there is not yet an integration, at this stage, with the national accounts or other official statistics compilations. The national accounts can play a crucial role for a broader spectrum of uses for these statistics, including for the integration into the broader macroeconomic view, such as shares of expenditure on reconstruction as compared to total disaster risk reduction expenditures or as a share of GDP, over time.

22. Although, conceptually the replacement costs are value markers for changes to the stocks of assets, they are also actual expenditures (recorded whenever the reconstruction activity takes place) and therefore recorded as a contribution to overall national expenditure and GDP. In other words, information for valuing the changes to stock of assets is found in the transaction accounts for production and expenditure.

23. However, in practice, expenditures on disaster reconstruction and recovery may be difficult to identify and isolate from the current sources of national accounts statistics,. In principle all of these transactions are already a part of the accounts, but not explicitly as reconstruction after a disaster. For such cases, the SNA encompasses additional accounts, called satellite accounts for functional analyses. The purpose of satellite accounts is to present, in a systematic and comprehensive way, all economic information on a particular social domain such as education, health, research and development, environmental protection or on multidimensional activities such as tourism. A main aggregate of interest from the disaster risk reduction domain is national expenditure. Its magnitude can be compared with other activities and with the total GDP.

24. An advantage of replacement costs accounting, is these values are based on observed transactions and thus aligned with actual expenses and real costs to society for restoring the stock of infrastructure as the basic building blocks for economic activity. However, not all damaged or destroyed assets are recovered through reconstruction, or at least not precisely with a replacement of the assets that were there before. Some assets are replaced by qualitatively different new assets. In these cases it may be necessary to try to separate the portion of the costs attributable specifically to replacement of damaged or destroyed from the broader set of reconstruction expenses.

25. The Sendai Framework encourages member states to recover assets differently than in the pre-disaster situation, in order to make the overall stock of assets more resilient to future hazards. This basic concept is summarised by the phrase '*building back better*'. The costs of building back better are different from the losses to assets. These costs have different uses within the disaster-related statistics framework, which is to account for the broader scope of disaster risk reduction investment expenditure, like structural measures for disaster mitigation and monitoring progress towards disaster risk reduction (DRR) targets.

26. To support further investigation and testing for the proposal for DRR expenditure accounting, a draft classification for defining DRR characteristics activities, including the post-disaster reconstruction expenses has been developed, below.

Figure 2: Proposed Characteristic Activities for DRR Expenditure accounting

Activity expenditure account (current plus investment)	
1	Disaster Risk Prevention
1.1	Risk prevention in advance of hazardous event
1.2	Risk prevention in or after hazardous event
2	Disaster Risk Mitigation
2.1	Structural measures
2.2	Non-structural measures
2.3	Land-use planning
2.4	Early warning systems management
3	Disaster Management
3.1	Preparedness
3.2	Emergency management
3.3	Other disaster responses
3.4	Emergency supply of commodities
4	Disaster Recovery
4.1	Relocation
4.2	Rehabilitation
4.3	<i>Reconstruction</i>
5	General Government, Research & Development, Education Expenditure
5.1	General government expenditure for Disaster Risk Reduction
5.2	Research & Development, risk assessment, and information
5.3	Education to Disaster Risk Reduction

27. Actual observed recovery costs for damaged or destroyed assets will not be available in all cases, and in these circumstances estimations could be developed based on the average reconstruction costs (if known) for the different types of assets affected in the affected region. Essentially, the average cost based estimation of reconstruction costs from a disaster mirrors the statistical inputs that are used in pre-disaster economic risk assessments, which are location-specific assessments of exposure of economic assets to damages from potential future hazard.

28. In general, the reconstruction/replacement costs (observed or estimated) is the most practical and straight-forward approach for the public good infrastructure (such as roads, bridges and public buildings like government hospitals) and for dwellings. Replacement costs method is also the most practical in the case of damaged (rather than destroyed) assets, i.e. where there was only a marginal loss of value to the assets, which could be recovered through reconstruction.

Impacts to Privately Owned Assets & the Present Value of Future Benefits

29. Additional perspectives should be considered in the case of privately-owned assets used in production activities (i.e. all privately-owned assets besides dwellings, called “productive assets” in the Sendai Framework indicators). According to the SNA, asset values can be measured as observed market prices and, in principle, these prices represent the current value of assets to the owners, following the basic macroeconomic theory that underpins the SNA.

30. So, a related but different approach to asset valuation as compared to reconstruction expenses is to consider the asset value at the time of the disaster, from the perspective of the its owner, either in terms of the market price for the asset (if available) or estimated net present value (NPV) of future benefits. Where available, market prices are the first preference for estimating asset values. However, price markers are not always available, especially for immobile assets that are rarely put to the market. The market value for these assets, can then be estimated as the approximate the net present value (NPV) of future benefits from use of the asset by its owner. Although Net present value calculations are not commonly used in national accounts in practice, it is a basic principle for defining asset value in the SNA.

31. From this perspective, the direct economic impact of physical damages is the marginal reduction in the balance sheet value of total assets in the country. In other words, the change in value is equivalent to an observable changes in the value of the stock of assets before and after a disaster and that were a direct result of the disaster. At least in principle, this value should be equivalent to the losses of flows of expected future benefits from those assets to their owners.

32. Owners are the companies, households and investors in assets like buildings, factories, machinery and transport equipment, etc.

Loss of value to users/beneficiaries (social costs of impacts)

33. In so far as enterprises provide benefits to their owners (profit) as well as to their employees (compensation) and to the government (taxes), the ownership perspective for valuation damages to economic assets may be insufficient for fully describing the direct costs of material impacts from a disaster. Costs to other stakeholders, which includes perspectives of impacts to human and social capital are also significant. For example, the economic value for a destroyed factory is broader than just the costs to the owner of the building (or insurance) since the value of the asset, in principle, is the value of its future benefits. The loss of this value also leads directly to losses to its employees (reduced income) and to government (reduced tax revenue)

34. Thus, a third perspective is to consider direct economic impacts to users or beneficiaries of the assets. This perspective lies largely beyond the scope of the SNA because the SNA defines asset value from the perspective of owners . However, there also could be direct economic impacts (in addition to the myriad of indirect impacts) to the related communities and households that are worth considering as an additional optional when valuing economic impacts.

35. The beneficiaries’ perspective can help to incorporate a broader qualitative assessment of economic consequences of destroyed assets and help to indicate some of the likely indirect costs.

36. They are immediate and direct impacts to workers that depend upon the assets (for example a factory, agricultural assets, or other place of work) for their incomes. The human and

social costs of impacts to assets include a temporary loss of income to the employees. Indirect impacts, in this case, takes the form of decreased overall demand and perhaps structural changes to employment.

37. The value of the direct impacts from the broad perspective of users and beneficiaries could be estimated according to the value of temporary loss of income (e.g. number of days of loss work multiplied by the average salaries of those workers). These social impacts from damaged assets are direct impacts, which also have indirect consequences since the loss of wages will usually either lead to higher debt or reduced consumption for those affected. This perspective for valuing changes to capital from the point-of-view of the workers is beyond the scope of usual and standard compilations of official economic statistics, and therefore is recommended as an addition, optional approach and an area for future research.

Direct Impacts to Agriculture

38. A very important case for understanding the different types of direct impacts and their valuation for statistics on economic loss is the range of possible direct economic impacts of disasters on agriculture, forestry and fisheries.

39. Economic assets include machinery and equipment used in production and also land (or improvements to land, following the SNA definition) and other resources like livestock and plantations. Sometimes improvements (like irrigation) that were made to the land are undone as a direct impact of a disaster, making continued use of the land impractical without restoration and restarting the production process. Also, if crops, livestock or trees are killed by a disaster, the only option is to purchase replacements from the market and, effectively, restart the production process over again from scratch.

40. In cases of damaged or destroyed crops, there could also be costs for recovery or replacement (e.g. replanting). The recovery costs will most likely not be incurred immediately since these are the costs of production for a new cycle of outputs. The more immediate costs from the owner's perspective is the loss of crops that were expected to be sold. The market value of the finished product provides an estimate of the value of losses in foregone revenue from the owner's perspective. For practical reasons, this price should be the recommended, tier 1, value used to estimate the value of impacts from a disaster to crops, and also to livestock, and fisheries and to forest cover (cultivated and non-cultivated forests are recognized as assets in the SNA).

41. Thus, for the case of agriculture, there are at least 3 distinct types of direct impacts and valuation. These different values can be aggregated for direct impacts without double-counting: (i) estimated market price value of destroyed crops, livestock, and trees (as a proxy for the loss of value to owners of assets/inventories), (ii) replacement costs for damaged or destroyed buildings and equipment, and (iii) recovery costs for damages to restore improvements to the land.

Economic Loss and Poverty

42. The SDG Targets on direct economic loss from disasters indicate demands not only for measuring direct economic losses in aggregate, but also to provide for focused analyses and risk reduction for the poor and other people in vulnerable situations. This can be accomplished via the

linkages to affected population statistics, in particular households affected by damages to their dwellings or other assets. In the future, considering the social costs of damages to assets (i.e. costs from the users/beneficiaries perspective, see above) could also be useful for analysing economic impacts and vulnerable groups. Another important link for understanding this relationship is to review statistics on financial support during and after a disaster. The example below from Bangladesh shows numbers of household receiving financial support, according to different sources of support and by geographic regions within the country.

43. The summary statistics in this sample table were derived from a household survey (Impacts of Climate Change on Human Life Survey (2015)). In this example, the statistics are disaggregated by sources of financial support. Data from this survey could also be used to produce statistics disaggregated statistics according to recipients, including relevant population groups, such as the poor. In this way, economic impacts, and particularly the costs associated with economic recovery could be utilized for analyses of economic impacts to those groups. This same survey in Bangladesh was also used to produce statistics on losses of household income due to disruptions to employment.

Sample Table 1: Number of households received financial support from organizations during and after disaster by geographic region, 2009-2014

Divison	Total Household	Organisation				
		Government Office	NGO/ International Organisation	Local Elite Person/ Local social welfare and cooperatives	Business Organisation	Others
Number						
All	605319	446353	88361	43470	15923	11211
Barisal	189090	148257	24875	9401	4098	2459
Chittagong	63500	49058	3929	7067	2730	716
Dhaka	84601	60672	13797	6425	2307	1400
Khulna	104432	77726	15949	7663	2270	824
Rajshahi	51743	35158	9620	4237	1497	1231
Rangpur	79812	56134	16096	5074	1826	682
Sylhet	32140	19349	4095	3602	1195	3899
Percentage						
All	100.00%	73.74%	14.60%	7.18%	2.63%	1.85%
Barisal	31.24%	24.49%	4.11%	1.55%	0.68%	0.41%
Chittagong	10.49%	8.10%	0.65%	1.17%	0.45%	0.12%
Dhaka	13.98%	10.02%	2.28%	1.06%	0.38%	0.23%
Khulna	17.25%	12.84%	2.63%	1.27%	0.38%	0.14%
Rajshahi	8.55%	5.81%	1.59%	0.70%	0.25%	0.20%
Rangpur	13.19%	9.27%	2.66%	0.84%	0.30%	0.11%
Sylhet	5.31%	3.20%	0.68%	0.60%	0.20%	0.64%

Source: Bangladesh Bureau of Statistics (2016)

44. In conclusion, a number of values and perspectives on economic value are useful for compilation of statistics on direct and indirect economic impacts from disasters. Prioritizing measurement specifically to the direct impacts to economic assets, is a useful step for simplifying the scope of measurement. Direct impacts can be observed from statistics directly whereas indirect

impacts are mainly a matter of application of statistics for assessment via modelling or other applications. However, for the direct impacts measurement, there are still multiple considerations or possible approaches in terms of appropriate prices to use in quantifying the impacts in monetary terms and in terms of potentially considering the social perspective rather than focussing only on losses from the perspective of their owners. For some types of damages, especially to privately-owned assets, multiple measures are relevant, but usually not additive because they represent different concepts of value for the same object. Clear documentation is needed in reporting economic loss statistics, including by specifying the relationship with values recorded in the stock and flow accounts of the SNA.

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