Background Document

for

Working Session

Economic Aspects of DRR

February 2015

UNISDR
I. Stock taking and Overview

**What are challenges?** HFA priorities have been progressing in all areas mainly due to the leadership of disaster management agencies and collaboration of critical ministries/agencies for DRR. Especially during the past decade, capacity in monitoring and risk assessment has been developed in many countries. However, economic loss due to disasters has been increasing in spite of substantial progress in DRR policies promoted by Hyogo Framework of Action (HFA) (UNISDR, 2015a). Disaster interrupts or slows down economic growth by damaging public and private infrastructures and negatively affecting people and economic activities.

To reduce the impacts of disaster, governments need to invest in DRR. However, governments in most countries are suffering from tight budget constraints. Fiscal primary balance has been negative during the decade and is expected to remain so in coming years (IMF, 2014). The financial situations of low-income countries are especially tight given the debt they have accumulated.

Public investment, especially in low and lower middle-income countries, is very volatile. On the other hand, in spite of the budgetary constraints, public investment is significant, recently representing 6 to 10 % of GDP in developing countries (Calculated based on World Bank Development Indicators). Governments must protect the hard-won fruits of these investments.

Disasters have diverse impacts on society; they are often categorized into economic, social and environmental impacts. Economic impacts include, for example, loss of assets and business interruptions. Social impacts include death, injury and changes to the functioning of communities, to name a few. Some impacts are both economic and social. For example, increased poverty and unemployment would be interpreted from both perspectives. Environmental impacts are for example, loss of habitats for animals and deforestation due to natural fire. When these are all combined, disaster can have a macro-economic impact, for example, the reduction of GDP and trade balances.

It is important to clarify the difference between direct loss (physical loss centred), indirect loss and macro-economic impact. National disaster loss databases often focus only on direct loss. Probabilistic risk assessment is also often limited to physical impacts of disasters. In these cases, economic analysis based on available loss and risk data will also be limited to direct loss only.

Direct loss is nearly equivalent to physical damage. Examples include death and loss to physical assets such as damaged housings, factories and infrastructure. Direct losses usually
happen within the first few hours after the event and are often assessed immediately after the event to estimate recovery cost and claim insurance payment. These are tangible and can be relatively easily measured. However, there are still technical challenges, for example, how to assign monetary value to such damage. Or, should direct losses be estimated as purchased value, book value or replacement cost? There is another important issue in measuring direct loss; "How to evaluate human loss?".

Indirect loss is more complicated. For example, a reduction in labour force and physical capital will cause business interruption and therefore a decrease in production. The reduction of production might be instantly recovered but most often it lasts several years. Damage to economic activity, therefore, should be monitored over a longer period. Measurable impacts are often loss to production and income due to destruction of physical assets. Though these indirect losses might be seemingly measurable, it is difficult to isolate the impact of disaster from others, for example, global financial crisis. There are also immeasurable indirect losses, for example, human suffering. Though they are not easily measurable, it is important to recognize such issues.

Macro-economic impact is much more complicated, because economic activity is interlinked. For example, production decreases are likely to push prices upward, if demand level remains stable. Reconstruction activity through public spending might produce effective demand for depressed economy but might crowd out private investment in growing economy. To estimate macro-economic impact, it is important to model the causal relationship of all these factors. Macro-economic impacts such as GDP, inflation and trade balances will often persist for several years and should also be monitored over time.

In analysing macro-economic impact, it is very important to analyse the impact from supply and demand sides and short and long-term perspective (see brief issue paper of JICA for their DR2AD model). From supply side, decrease of production due to capital loss can be observed as a negative impact in the short term. However, there are evaluations that in the long term, replaced new and more productive factories can improve efficiency and produce positive impact. From the demand side, decline of income, asset value, and population can be all observed as negative impacts in the short term. However, reconstruction demand can have a positive impact, especially for depressed economies that lack effective demand. The total impacts can be evaluated as the balance of supply and demand side impacts. A macro-economic model is constructed based on assumptions reflecting causal relationships that impact both the demand and supply sides.

When considering the impact of disasters on public finance, similarly we need to explore the demand and supply sides of public finance. On the demand side, increased need for expenditure in response, recovery and reconstruction are always observed. On the supply side, decrease of financial resources by reduced tax and fees can be also noted. Therefore, fiscal balances almost always worsen. A worsened fiscal balance often has a negative impact on the macro economy: debt increase, expansion of monetary supply, tax increase. IIASA’s CATSIM model estimates the impact of public finance on macro-economy (see brief issue paper of IIASA for their CATSIM model).

Although “risk as opportunity” has become an attractive political motto, on the ground, disaster risk simply represents costs for financial planners (both public and private) and society. While we often focus on disaster loss and impacts, the overall cost of disaster risk is a summation of a) ex-ante DRR investment and risk financing mechanisms, b) post-event
response, recovery and reconstruction cost and c) disaster loss and impacts. The cost of disaster risk management distracts financial resources from other priorities regardless of ex-ante or post event efforts. The impact of disaster risk on public finance should be considered based on the overview of these three categories of costs.

**What are the gaps to be filled?** It is important to focus on the lack of linkages between natural science and social science, especially in economics. Risk information produced by natural science is not well connected to cost information examined by social science. Even when risk information exists, if it is not linked to cost information, it is difficult to promote DRR Investment. For example, Solomon Islands states in their HFA Monitor report “If policies based on risk information would lead to increased project costs, budget constraints may limit utilization of the risk information. Promoting cost benefit analysis is necessary in order to counteract this.”

Related to the lack of cost information is an opportunity cost issue. Ministries of Finance are not concerned only about disaster risk. They need to respond to other competing country priorities. In many countries DRR is not a high priority and policymakers tend to allocate limited financial resources to other urgent needs such as poverty reduction, education and public health. It is also difficult to explain why there is a sense of urgency surrounding DRR, a challenge that often leads to problems securing financial resources. A classic dilemma for policy makers is whether they can justify giving up investment in growth and invest in DRR? In other words, risk needs to be examined through a socio-economic lens in each country.

In the risk management cycle, response, recovery and reconstruction also place pressure on the allocation of DRR budgets. Reconstruction and compensation for those affected is imminently needed in the majority of cases. In such situations, budget restructuring following a disaster often takes money away from DRR for use in reconstruction. To assure sufficient money for DRR investment, it is necessary to be able to justify the cost effectiveness of that DRR investment –as compared to expenditure in response and reconstruction.

What exacerbates this difficult situation even more is that most countries do not have DRR labelling or dedicated budget lines for DRR in their public accounting system. So they don’t know how much they spend on DRR, response and reconstruction. Sectorial DRR is especially hard to label, as it is often embedded in larger projects. For example, earthquake proof school building is included under the larger category of school building so that the part of budget dedicated to strengthen the facility is not visible, making investment tracking almost impossible.

Not having a DRR budget monitoring system results in the inefficient use of resources and an insufficiency of funds. Without knowing their current budget status, countries cannot properly evaluate the current level of DRR and estimate how much funding is required for further promoting DRR activities. Nepal claims in their HFA Monitor report “The budget allocated for disaster preparedness and mitigation is spread among different projects which render it ineffective. There is a need to develop and implement a financial tracking system to monitor all DRR related expenditures for mitigation, preparedness and emergency response”.

Considering all, the key questions that governments must tackle would be, "how much money should be allocated to DRR in total?" and “how to decide the most efficient and effective allocation of money between risk reduction and risk financing?”. Subsequently, more specific issues need to be examined: the design of risk sensitive investment mechanisms and risk
financing mechanisms (i.e. appropriate combination of contingency funds, insurance and other tools). Both macro-economic modelling and cost benefit analysis supports these analysis.

II. Way forward

Given the overview, the way forward is facilitation of development in the following four economic analytical methodologies to support better public investment planning and financing strategies (see UNISDR, 2014).

(a) Post-event economic loss and impact assessment: The economic impact analysis is important for promoting smooth reconstruction and preparing for future events. Analyzing disasters that have occurred will contribute to the cost benefit analysis and the economic impact modeling of probable disasters. Estimating the economic and social impact of disasters and storing such information in a database is a precondition for estimating future disaster impact. The biggest challenge in carrying out economic impact analyses is the lack of common definitions regarding impacts. This leads to ambiguity about the type of data that should be collected. DaLA approach developed by ECLAC and implemented worldly since 1972 should be further promoted and refined.

(b) Cost Benefit Analysis and complementary tools for appraising DRR investments: Cost benefit analysis (CBA) and other DRR investment appraisal techniques are important tools for practitioners and stakeholders to integrate DRR into development and public investment planning (see IFRC brief issue paper for community based CBA). The use of CBA and other tools is also expected to raise the awareness of policy makers, including financial officers. However, existing CBA research is often sporadic or inadequate. Most countries in HFA Monitor cited a strong and urgent need for enhanced, integrated CBA.

Recently, complementary approaches to CBA, such as Cost-Effectiveness and Multi-Criteria Analysis are seeing increasing application. The emerging evidence in fields such as climate change adaptation shows that the use of such holistic appraisal tools can help to identify low-regret, high co-benefit risk reduction measures that are embedded in a country’s development agendas.

There are, however, major obstacles for applying CBA and other appraisal techniques, such as the lack of awareness and technical capacity to perform such analysis (in terms of methodology and data availability), administrative and financial constraints. The most difficult methodological issue to deal with is how to estimate the benefits of DRR investment, which are probabilistic in nature. For example, in probabilistic CBA, avoided damage given countless risk scenarios is assumed to be a “benefit” of DRR policies. The dearth of basic socio-economic data also hinders stakeholders’ ability to estimate the “benefits”. This is especially true when tracking past damage in order to estimate future losses. Derivative approach should be also developed given the ethical or technical difficulties to translate some factors (e.g. human life) into economic value (see brief issue paper of IIASA regarding the need to adopt wider approach). For example, cost – effectiveness analysis can be used to find the least-cost option when a given target is defined, removing the need to quantify benefits.

(c) Ex-ante economic impact assessment: In HFA Monitor, fewer country reports provided
comments on ex-ante macro-economic impact analysis. Assessing the economic impact of disasters is important for mid to long term economic planning. This analysis however, presents several methodological challenges. These include lack of input data (especially past disaster loss data and probabilistic risk data), how to define the impact (not only direct losses, but also indirect losses and macro-economic impacts) and how to deal with inter-sectoral linkages (See brief issue paper of OECD). It is more challenging to estimate the impact of disaster preventive investment on economic growth path at macro scale given the lack of data to cost-effectiveness of each DRR investment (see brief issue paper of JICA). Little research has been carried out in this field and more methodological courses of action should be pursued. Inputs from the private sector are also required to have good quality economic impact analyses. Impact on public finance should be also examined to continue public service provision during and after crisis and establish contingency finance strategy.

(d) DRR budget monitoring mechanism: Many countries explained in their HFA Monitor that they do not have a system to measure and monitor their budgets for disaster risk management and DRR because resources are allocated to several ministries/agencies and DRR activities are often funded through sectoral investments. In many cases, it is difficult to track sectoral investment, and DRR investments cannot be counted separately from entire project or budget reports. Not having a DRR budget monitoring system reflects a lack of coordination amongst ministries and results in the inefficient use of resources and inadequate funds. Without knowing their current budget status, countries cannot properly evaluate the current level of DRR and estimate how much funding is required for further DRR activities.

With regards to absent monitoring systems, some countries have already made efforts to remedy the situation. Consideration should be given to the development of a monitoring system that enables better tracking of DRR spending and investments across all agencies. Creating a DRR single purpose fund or programme that covers various projects helps stakeholders create budget estimations because it generates a specific budget line for DRR. Latin American countries often utilize this method and some now have the capacity to track their DRM investments (UNISDR, 2014).

Another way is to utilize DRR marking system by labelling DRR budget items. Such a system should be relatively easy to design and is dependent upon a) the determination of the activities by ministry and agency that will be tagged as DRR and b) the consistent use of this template to conduct regular reviews of relevant budget expenditures. Countries in South West Indian Ocean region piloted the research to estimate DRR budget utilizing DRM Marker method developed by OECD, the World Bank and UNISDR (see UNISDR, 2015b, OECD, 2014).

The resulting information would enable stakeholders to analyze trends in DRR spending and contribute to strengthened strategic decision making for DRR investments and programming. It would also assist in measuring progress with respect to DRR mainstreaming. The Cook Islands, for example, uses budget tagging in the field of climate change budgeting, which shows that designing and employing tracking systems is relatively easy once all stakeholders agree what constitutes DRR within each framework.

The lack of DRR financial monitoring stems from an inadequate understanding of what DRR is and what constitutes DRR. Creating a comprehensive DRR plan and/or clearly
placing DRR in an economic development framework would help national stakeholders understand the concept and by default define what represents DRR.

Even if budget-monitoring systems are in place, gaps remain if the results are not analyzed. After a financial monitoring system is developed a sound analysis must be made to estimate the required investment and help inform decision making on prioritized policies.

The analyses accumulated during the decade of HFA have suggested that a risk-layered approach (Figure 1) is crucial to manage disaster risk. In the extensive risk layer (high probability and low expected loss), investment for risk reduction is basically the most cost-efficient. However, some measures for risk reduction (e.g. emergency drills as preparedness) can be cost-efficient (and efforts should be devoted to) at all risk layers.

In the intensive layer (low probability and high expected loss), risk reduction is often an unaffordable and prohibitive option. Regarding risk financing, contingency funds will be effective in middle risk layers. However, to prepare for intensive risk, risk transfer schemes, such as insurance, would be more cost-efficient.

It is important to note that DRR efforts increase the scope for risk financing mechanisms, bringing risk premiums down and making insurance more affordable. DRR investment and risk financing mechanisms, therefore, should be considered in synergy to identify the optimum mix in public finance policy.

**Figure 1: Risk layered approach**

In the Latin America and South-west Indian Ocean regions, integrated capacity building project for packaging reliable disaster loss database building, probabilistic risk profile and economic analysis have been implemented to support public investment planning and financing strategy (see UNISDR 2015b). Emerging network on Ministry of Finance for DRR in these regions will facilitate mutual learning and exchange of good practice.

Organizations with technical expertise should collaborate to support such initiatives by providing technical advice and contributing capacity building which are lacking in many
countries. Disaster Management Agencies which often have ownership of disaster loss database and risk profile should collaborate with Ministry of Finance and other key public investment planning agencies so that the packaged and coordinated approach should be promoted and more easily understandable information should be provided to the policy makers and the general public to support risk-sensitive public investment planning and financing strategy.

References:


World Bank Development Indicators.
Appendix A
Brief Issue Paper submitted by co-organizers

International Federation of Red Cross and Red Crescent Societies (IFRC) .................................................................10

International Institute for Applied Systems Analysis (IIASA) ..........................................................................................15

Japan International Cooperation Agency (JICA) ...............................................................................................................20

The Organization for Economic Co-operation and Development (OECD) ................................................................. 27
Economic Efficiency of Community-based Disaster Risk Reduction: Lessons learnt from IFRC programming

Drafted by International Federation of Red Cross and Red Crescent Societies (IFRC)

I. Stock taking (Overview of the evolution of the subject matter, setting the scene etc.)

In recent decades there has been growing awareness among humanitarians and development organisations that when it comes to effective disaster management, prevention – in this case, disaster risk reduction (DRR) – is better than cure – in this case, disaster response (DR). Nevertheless, accessing sufficient resources to support DRR, at a scale needed for sustainable global impact, continues to be a challenge. Many decision-makers are asking for proof of impact showing specifically that prevention is cheaper than cure.

Due to this demand, as well as a desire by practitioners to better measure the impacts of their work, the issue of cost–benefit analysis (CBA) has become a key topic for debate within the sector. There is a growing awareness of the benefits of CBA but also of its limitations as a means of providing the increasingly complex evidence that funders are demanding.

Through a series of case studies, the IFRC has been able to evaluate the benefits of CBA while highlighting the need to use it appropriately, and the risk of practitioners who are insufficiently skilled producing results that appear robust but are actually invalid. CBA can be an appropriate option, but always within a wider emphasis on project planning and monitoring.

II. Overview (Current opportunities, challenges, and achievements)

The IFRC has conducted a number of CBAs in the context of its community-based programming.

In an effort to further highlight the impact, efficiency and sustainability of DRR interventions, an external evaluation was for example conducted on the community-based ‘Mangrove Plantation and Disaster Risk Reduction’ project implemented by the Viet Nam Red Cross Society (VRCS) in the disaster prone coastal provinces of northern Viet Nam. The evaluation assessed performance and progress against set objectives and analysed the extent to which it has contributed to the building of safer, resilient communities. Project’s output over the course of its 17-year implementation, directly or indirectly, increased the resilience of communities. The benefit to cost ratio amounts to 3 (within the 68 communes studied), when excluding ecological benefits. If ecological benefits in the form of carbon sequestration (expected to materialize under appropriate protection of the mangroves) are accounted for, the ratio ranges from 28 to 104.
The Community-based Disaster Risk Reduction (CBDRR) programme conducted by the Bangladesh Red Crescent Society (BDRCS) between 2005 and 2011 has also been evaluated through a CBA. The calculation shows with confidence that in the four communities studied, benefits exceeded costs. Ratios at present stand between 1.18 and 3.04. If future protective benefits over a time frame of 15 years are considered, ratios were identified to be between 3.05 and 4.90. But this case study also illustrated a number of challenges on both the cost and the benefit side. As available financial records did not allow for a direct attribution of individual expenditures to a particular community, the study deployed an informed estimate. Considering benefits, many benefits were identified but had to be excluded from the calculation for several reasons - many could not be quantified or monetized or would have required much more substantial research.

To better understand the economic efficiency of community-based DRR, as well as the use of CBA for community-based DRR in the Red Cross Red Crescent context, the IFRC and some of its member National Societies implemented in particular three case studies between 2008 and 2010 on three separate DRR programmes in Nepal, the Philippine and Sudan.

The table below lists the results of the case-study CBAs in those countries, reported as the benefit–cost ratio. The analysis periods were selected based on actual programme start dates, foreseen project life spans and data limitations. The resulting benefit–cost ratios ranged from less than 1 to more than 25. Most results were substantially above 1.0, meaning that the community-based DRR programme and activities can be considered economically efficient.

<table>
<thead>
<tr>
<th>Country</th>
<th>Location</th>
<th>Activities</th>
<th>Analysis period</th>
<th>Benefit-cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nepal</td>
<td>Ilam District</td>
<td>Integrated structural, non-structural and livelihood activities to strengthen overall resilience, including risk management strengthening, constructing evacuation shelters, community organisation, first aid training and providing income-generation funds.</td>
<td>2005-2021</td>
<td>19</td>
</tr>
<tr>
<td>Philippines</td>
<td>Barangay Pinan-an and Indap-an, Sibalom, Antique Province</td>
<td>Building a hanging footbridge for safe transportation during floods increasing access to market, health care and schooling</td>
<td>2004-2018</td>
<td>24</td>
</tr>
<tr>
<td>Philippines</td>
<td>Barangay Poblacion 1 &amp; 2, Bugac, Surigao Del Norte Province</td>
<td>Building a sea wall to protect houses and crops from storm surges</td>
<td>2000-2019</td>
<td>5</td>
</tr>
<tr>
<td>Philippines</td>
<td>Barangay Roxas, San Isidro, Surigao Del Norte Province</td>
<td>Building a dyke to protect houses, crops and livestock from river flooding</td>
<td>2000-2014</td>
<td>0.7</td>
</tr>
<tr>
<td>Sudan</td>
<td>Al Maneir, Deirdiella, Red Sea State</td>
<td>Constructing terraces to capture run-off for farming</td>
<td>2005-2015</td>
<td>&gt;25</td>
</tr>
<tr>
<td>Sudan</td>
<td>Lachob, Red Sea State</td>
<td>Building earthen dams and embankments to capture run-off for farming</td>
<td>2005-2015</td>
<td>2.4</td>
</tr>
<tr>
<td>Sudan</td>
<td>Hamisi, Red Sea State</td>
<td>Developing a communal garden for perishable produce, increasing household income</td>
<td>2004-2014</td>
<td>&gt;25</td>
</tr>
<tr>
<td>Sudan</td>
<td>Doflu, Red Sea State</td>
<td>Building a small (retention pond) to provide water for poultries and livestock</td>
<td>2005-2020</td>
<td>2.7</td>
</tr>
</tbody>
</table>

(Source: IFRC/RC 2010)

All three case studies produced lessons and recommendations for the use of CBA in community-based DRR programs.

1. A primary recommendation is that extensive, in-depth CBA should not be applied across-the-board to all Red Cross Red Crescent community-based DRR programming. An attempt to do so would be neither realistic nor useful given the cost and time commitments required. Rather, community-
based DRR programmes should be selected for extensive CBA studies based on their implementation timeframes, data availability, the scope of the programme, the relevance and applicability of CBA to support decision making, and the opportunity to develop reference CBA values for common types of DRR interventions.

2. For the Red Cross Red Crescent it is also essential to capture distributional aspects of interventions. CBA generally treats the beneficiaries of a project as a homogenous group, whether it is a single community, all communities in a region, or an entire country. It therefore tends not to account for differences in the distribution of costs and benefits. If within a targeted community certain people benefit or perceive to benefit less than others, CBA does not capture this quantitatively. For the Red Cross, which is focused on serving the most vulnerable, any CBA must be complemented by methodologies that consider how costs and benefits are distributed.

3. CBA for community-based DRR is additionally challenging in that the main benefit of community-based DRR is a reduction of disaster losses, which can be very difficult to measure and which often accrue over long-term periods further complicating the issue of distribution of costs and benefits mentioned above. Often baseline data on losses does not exist, or due to changing disaster patterns driven by such processes as climate change, past experiences cannot be considered relevant for current and future conditions. The table below provides examples for impacts that are typically not included in CBAs. Better information and rigorous, but easy-to-use models for calculating potential disaster losses are needed.

<table>
<thead>
<tr>
<th>Primary reason for non-inclusion</th>
<th>Examples of activities or impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-quantifiable benefits</td>
<td>Improved community coordination and cohesion</td>
</tr>
<tr>
<td></td>
<td>Empowerment of women including women's centres</td>
</tr>
<tr>
<td></td>
<td>Greater sense of security</td>
</tr>
<tr>
<td>Non-monetisable benefits</td>
<td>Lives saved (for example, by multi-purpose evacuation centres)</td>
</tr>
<tr>
<td>Too complex to monetise</td>
<td>Longer-term economic impacts</td>
</tr>
<tr>
<td></td>
<td>Strengthened basic health care services</td>
</tr>
<tr>
<td></td>
<td>Increased education – particularly for girls</td>
</tr>
<tr>
<td>Lack of data</td>
<td>Some small-scale physical mitigation works</td>
</tr>
<tr>
<td></td>
<td>Strengthened disaster preparedness for response</td>
</tr>
<tr>
<td></td>
<td>Increased water supply (sub-surface water dams, hand pumps, protected wells, distribution systems, etc.)</td>
</tr>
</tbody>
</table>

Based on the experiences of the IFRC, as well as other organisations, it is clear that community-based DRR can be economically efficient or financially worthwhile as long as is properly designed and implemented.

As a process, CBA can be a very useful means of better planning and understanding community-based DRR, focusing on outcomes represented through benefits, and maximising the impacts of limited resources. Where it is carried out, all stakeholders should be involved in the process – particularly in terms of participating in a transparent process to agree the many assumptions that are often needed. Unless solid baselines have been put in place at the start of the initiative, ex-post analyses require baselines to be reconstructed retroactively. This is generally difficult, and will affect the quality of the assessments.
III. **Way forward** (Where to from here? Highlight opportunities, next steps, expectations post-Sendai.

The various case studies conducted by the IFRC demonstrate that when CBAs are conducted for the right purpose and within an appropriate context, difficulties can be addressed in a robust way, at least to some degree. Community-based DRR programmes should be selected for CBA based on their implementation timeframes, availability of data and, most importantly, the relevance and applicability of CBA to support future programming decisions within the specific country or regional context. If it is determined that a CBA will indeed be productive, then this should be done following the recommendations and guidance derived from previous experience such as those discussed in the above section.

CBA and other relevant decision making techniques may be integrated into existing community participatory approaches such as IFRC’s Vulnerability Capacity Assessments (VCA) in order to ensure the application of their systematic decision making capabilities. The IFRC in working with communities on implementing DRR activities already extensively use participatory assessment processes to gather, organize and analyse information on the vulnerability and adaptive capacity of the communities. Additionally, these participatory processes are completed in conjunction with the collection of secondary information to provide a baseline of communities risk to different hazards. Therefore, linking to VCAs provides a good entry point for collecting baseline and monitoring data, as well as for gleaning community views on potential costs and benefits.

Once the VCA process has started in the selected communities, CBAs can potentially provide two useful roles here: (1) to assist in the decision-making process of which DRR strategies to employ based upon the economic efficiency criterion, or (2) to provide insight into the intangible benefits of the various DRR initiatives to assist in prioritizing them for a further quantitative analysis.

Finally, as has been shown earlier in regard to the CBAs implemented by the IFRC from an ex-post perspective, CBA is useful in monitoring just how effective the various DRR initiatives have been given their implementation. Further understanding, developing, applying and testing the role in a community case study context of a decision toolbox comprised of the different tools (not just CBA) will be a key focus of our future work.
References:


ISSUE BRIEF

Sound Public Investment and Financing Decisions based on Broader Understanding of Risk Information

Drafted by International Institute for Applied Systems Analysis (IIASA)

I. Stock taking

Incorporation of risk information into public and private investment decision-making is increasingly seen as an important element to manage disaster risks globally. Over the past decades, the International Institute for Applied Systems Analysis (IIASA) has engaged in providing policy-relevant analyses regarding disaster risk management in the public sector using Catastrophe Simulation (CATSIM model). The use of macroeconomic and fiscal risk assessment using CATSIM played a key role in the adoption of risk management policies by a number of developing countries, including the establishment the Caribbean Catastrophe Risk Insurance facility in 2006, and the first-ever government-issued catastrophe bond against natural disasters by Mexico in 2007. In recent years, the use of fiscal risk assessment has also helped to shape global discussions on disaster risk management. In 2015, IIASA in collaboration with the United Nations Office for Disaster Risk Reduction (UNISDR), for example, has conducted risk assessment of 160 countries for the Global Risk Assessment (GAR 15).

Traditionally, the debates regarding public sector disaster risk management have focused primarily on the use of economic efficiency-oriented tools such as Cost-Benefit Analysis (CBA); however, recently the scope of the debates has broadened to include multiple objectives such as equity and distribution. Following the 2nd WCDRR held in Kobe, Japan in 2005, in which the importance of CBA in disaster risk management for raising awareness and gaining political will for risk reduction investment is reiterated, an increasing number of countries have adopted economic appraisals as part of public investment decision-making. Based on the Hyogo Framework of Action (HFA) monitoring over the 2011-2013 period, 37 out of 99 countries have conducted economic appraisals on DRR investment (Kellet et al. 2014). While the use of economic assessment is growing globally, the need for a more holistic understanding and use of risk information is also being emphasized. In particular, there is growing recognition of the limitations regarding the sole use of economic efficiently-based criteria such as benefit-cost (B/C) ratio and net present value (NPV) for DRR investment. Successful mainstreaming of disaster risk into development planning demands a broader incorporation of additional criteria such as robustness, equity and distributional consequences, and public acceptability. This issue brief overviews the evolution of this topic and suggests a way forward towards a broader understanding and use of risk information in public investment decision-making.
### II. Overview

With the increase in global disaster risk, sound public investment and financing are needed to protect, promote, and transform livelihoods and development. Recent evidence shows an increase in direct disaster impacts globally, with diverging consequences observed between low and high-income countries (IPCC, 2012; IPCC, 2014; ODI, 2014). Over the past two decades, disasters have, in total, affected 4.4 billion people worldwide, causing $2 trillion in economic losses (Kellett, 2014). In highly exposed low-income countries such as Bangladesh and Mozambique, repeated damages from natural disasters amount to approximately 3-5% of GDP every 5 to 10 years, posing a considerable obstacle to the achievement of steady growth and development (ODI, 2014). While the lower-income countries suffer disproportionately from high fatality rates, the burden of rising economic losses has increasingly fallen on the world’s emerging and developed economies, as more people and assets are located in hazard-prone areas of these countries (IPCC, 2012; GAR, 2013).

The effects of natural disasters can be severe on all levels, and financing the recovery can be overwhelming, particularly in developing countries. At the national level, disasters can have severe impacts on aggregate economic performance because of i) physical damage on capital stock such as infrastructure, machinery, and buildings and ii) indirect losses such as reduce outputs through supply chain connectivity. Disasters can also adversely affect the labor force, undermine industry competitiveness, and have indirect and long-term ramifications for a nation’s economy. In many instances, “coping mechanisms” on the part of the public and private sector and households are limited. In particular, households are forced into “erosive” actions, such as the selling of productive assets or tools or taking on burdensome credit at unfavorable rates (Heltberg et al, 2012, Keating et al, 2014). Such erosive actions may eventually lead to the vicious cycle of the poverty trap where additional support is required from government entities at different scales (Carter, 2007; Keating et al, 2014).

Risk reduction and management have been shown to offer promising economic returns in terms of reduction in loss of life and injury as well as economic losses avoided. To evaluate investments in disaster risk reduction (DRR) projects, CBA has been used as one of several appraisal tools in developed and developing economies (Mechler et al, 2014). The corporate sector uses internal rate of return (profit) reasoning, which compares the private benefits associated with an investment to the costs. Building on this, governments have also used CBA as a major analytical tool to identify and appraise the societal costs and benefits of public investments. Governments have used CBA to examine the inherent trade-offs and economic efficiency associated with public policy, programs, and projects in general (Brent, 1998) and increasingly to appraise DRR investment. CBA analyses conducted for DRR projects globally conclude that DRR investment produces savings in the long run: while the exact benefit-cost ratio (BCR) varies widely, the U.S. Federal Emergency Management Agency (FEMA) estimated an average BCR of approximately 4 in a review of over 4,000 DRR investment projects in the USA (MMC, 2005). Foresight (2012) also found the benefits of DRR to be equally strong and, on average, about four times the costs in terms of reduced losses (Foresight, 2012; Mechler, 2012).

Increasingly, DRR investment appraisals have embraced risk-based methodologies. It is important to analyze the costs and benefits of DRR investment in a probabilistic (risk-based) framework, as opposed to a deterministic framework (Michel-Kerjan et al, 2012), as natural disaster risk is inherently probabilistic. Evaluating any single event does not capture the full extent of possible disaster occurrence. Consequently, a particular DRR option may be efficient for a particular layer of risk (delimited by the probability of events or return periods), but it may not be effective for all possible events. In general, for the low to medium loss risk layers (i.e., relatively frequently events), prevention is likely more economically efficient in reducing risk. For the high layers, risk transfer instruments such as insurance are generally more suitable. Only when a true risk-based approach is used (as opposed to deterministic or expected value), can this important difference be seen (Mechler...
Although CBA has been the primary appraisal technique used to enable a transparent and coherent assessment of risk management projects, it faces important methodological and practical limitations. Other tools, such as Cost-Effectiveness Analysis (CEA), Multi-Criteria Analysis (MCA) and Robust Decision-Making Approaches (RDMA) are increasingly being used in the context of DRR investment:

- **Cost-Effectiveness Analysis (CEA)** identifies least-cost options to meet a certain, predefined target or policy objective (which in effect represents the project benefit). CEA does not require the quantification of benefits, as the project costs are the key variable of consideration to be minimized. Project goals such as reducing disaster fatalities and losses to a certain level must be determined beforehand.

- **Multi-Criteria Analysis (MCA)** assesses how well DRR investments achieve multiple objectives such as economic, social, environmental, and fiscal goals. Using selected criteria and indicators as verifiable measures for monitoring across time and space, MCA observes and evaluates DRR investment performance in quantitative or qualitative terms (Mechler et al, 2014).

- **Robust Decision-Making Approaches (RDMA)** has received increasing emphasis recently, particularly in the context of climate change adaptation. RDMA approaches comprising both quantitative and qualitative methodologies draw focus away from optimal decisions (such as those supported with CBA and CEA) and aim to identify options with minimum regret, that is, minimal losses in benefits of a chosen strategy under alternative scenarios where some parameters are highly uncertain.

For effective DRR investment strategies, the challenges and limitations of various decision-support tools must be understood along with their usefulness. The challenges and limitations of various approaches may include the difficulty involved in monetizing all benefits for CBA, the difficulty of defining ambition level for CEA, the use of subjective judgments for MCA, and technical and computational complexity for RDMA (Mechler et al, 2014). Furthermore, these decision-support tools should be used as a part of a holistic assessment involving participation of stakeholders and experts, analysis of risk and vulnerability, and transparent processes for data collection and analysis (IFRC, 2010).

To date, a number of challenges have resulted in the limited application of DRR investment strategies. Despite the positive results of CBA and other tools, proactive DRR investment globally remains limited. Over the past two decades, an estimated $107 billion has been spent on natural disasters, 87% of which has gone to emergency response, recovery, and reconstruction, and only 13% toward ex ante reduction and mitigation of disaster impacts (Kellett and Caravani, 2013). Moreover, in the world’s top 40 humanitarian recipient countries, only 1% ($3.7 billion) of the total $363 billion in development aid was spent on DRR (Kellett and Sparks, 2012). A major impediment to proactive DRR is the lack of funds available over the long term (Gordon, 2013). Moreover, knowledge is lacking regarding both the process and the benefits of conducting DRR investment appraisal. In the absence of credible information regarding the social and economic benefits of DRR and under tightening fiscal pressure, many governments have been reluctant to spent significant resources on DRR investments (Benson and Twigg, 2004).
III. Way forward

DRR investment decision making must be improved through the application of a broad set of decision tools catering to a wide range of stakeholder needs. Ultimately, economic efficiency underlying CBA is only a single decision-making criterion among many that are relevant for prioritizing DRR investments. Decisions regarding investment in risk reduction and resilience building are likely to be made based on a range of criteria, some of which may not be as transparent as others. Criteria such as risk-effectiveness, robustness, equity and distributional concerns, and acceptability are increasingly seen as keys to successful implementation of DRR projects. Consideration and application of appropriate tools can make a more comprehensive case for DRR investment, though alternative tools may not offer easily communicable metrics such as benefit-cost ratios. It should be stated that different appraisal tools are effective for different scenarios and applications (Mechler et al. 2014), for example:

- **Cost-Benefit Analysis (CBA)** is generally suitable for well specified, hard infrastructure projects with easily quantifiable economic benefits (e.g., flood risk prevention through dikes).
- **Cost-Effectiveness Analysis (CEA)** is generally suitable for well specified interventions with important yet difficult to quantify intangible benefits (e.g., loss of life).
- **Multi-Criteria Analysis (MCA)** is generally suitable for multiple and systemic interventions involving multiple benefits that are difficult to monetize (e.g., environmental resource management).
- **Robust Decision-Making Approaches (RDMA)** is generally suitable for projects with large uncertainties and long time frames (e.g., climate change adaptation).

These DRR investment appraisal tools need further application with respect to capacity building in various areas such as:

- Building necessary knowledge and skills in interpreting risk information and implementing risk-based budgeting and management decisions.
- Fostering understanding regarding the usefulness and limitations of alternative appraisal techniques and the ability to apply appropriate DRR public investment appraisal methods in a participatory manner.
- Enhancing data collection and sharing of policy lessons through development of effective information channels.

Developing these capacities at different levels enables the iterative process of risk management, which facilitates the identification, evaluation, and implementation of successful DRR and public investment strategies.

References:


Intergovernmental Panel on Climate Change (IPCC), (2012). Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX).


I. Stock taking

Insufficient Resource Allocation for Disaster Risk Reduction

Economic loss due to disasters has not yet been decreased substantially, even though the mortality due to disasters has been reduced by the efforts implementing HFA since 2005. UNISDR Global Assessment Report highlights US$1.68 trillion in economic losses due to major intensive disasters globally between 2001 and 2011 (UNISDR, 2013). Where the world population will increase from 7 to 9.3 billion by 2050 and the urban population will grow from 3.3 billion to 4.9 billion by 2030 (ODI, 2014), economic losses could reach over $400 billion a year by 2030 (UNDP, n.d., UNISDR 2013). Impacts of disaster on small economy can be devastating. Hurricane Ivan in 2004 caused to Grenada a loss over 200% of Gross Domestic Products (UNISDR, 2013).

However, preventive investment has been paid little attention in most of the countries. In most of the cases, the government funds were allocated for response after disaster (ODI, 2014), instead of disaster risk prevention and mitigation. Preventive investment is still considered as “cost”, which hinders investment in disaster risk reduction and prevention.

Looking at international community, UNDP report says, over 20 years it has spent only one out of every ten ‘disaster’ dollars before a crisis strikes ($13.5 billion for disaster risk reduction) while it financed $69.9 billion for Response and $23.3 billion for reconstruction and rehabilitation (ODI, 2014).

Japan’s case:

Japan, having been suffered from frequent disasters, has sustained significant budget allocation for preventive investment in DRR even from the period when GDP per capita was low (figure 1). Japan enacted the Disaster Countermeasures Basic Act in 1961, formulating a comprehensive and strategic disaster “risk” reduction system. Since then, each disaster has led to review and reform of the disaster risk reduction system of the country. Japan, still struggling from intensive catastrophe such as Great East Japan Earthquake of 2011 or Kobe Earthquake of 1995, has generally succeeded to reduce and manage disaster risk from extensive (frequent but small scale) risk. It is important to make effort for disaster risk reduction and preparedness from ordinary times especially in public financial planning, in order to protect human lives and to reduce loss and damages in terms of social, economic, and environmental resources (the Cabinet Office, Government of Japan, n.d.).
Building on Japanese experience, JICA, as the governmental technical cooperation organization, has promoted the effectiveness of DRR investment through its international cooperation projects to enhance the capacity of DRR institutions in developing countries, especially in public investment planning and financing strategies. JICA has contributed to raise awareness of the need for protective DRR investment and both developing countries and donor communities have increasingly recognized the importance of DRR investment. The current draft for post-2015 Framework for Disaster Risk Reduction (at the time of writing this brief issue paper) highlights the importance of “Investing in economic, social, cultural and environmental resilience”.

II. Overview

\textbf{DRR\textsuperscript{2}AD Model (ver.1.4) Simulations --- A forward-looking macroeconomic model to demonstrate positive impacts of DRR investment to support risk-sensitive policy formulation ---}

\textbf{Rationale:}
Once a disaster occurs, society loses not only human lives but also properties and assets accumulated by individuals and private companies. Those damages hamper subsequent development process. Moreover, significantly large amount of funds will be required as emergency response, recovery and reconstruction after the disaster. Hydrological-meteorological disasters such as flood tend to hit the same areas and people repeatedly. As a result, disasters deprive people living there and communities of opportunities of
economic growth and may plunge them into the vicious cycle of disaster and poverty. Preventing these consequences necessitates formulation and implementation of disaster risk reduction policies, plans, laws and regulations in all relevant sectors. Preventive investment in DRR plays a critical role in the future development to achieve the MDGs and SDGs (JICA, 2014).

Investing in risk reduction through structural and non-structural measures is essential to enhance the economic, social, cultural resilience of persons, communities and the country and conserve national cultural assets and environment (Ministry of Land, Infrastructure, Transport and Tourism, Government of Japan, n.d.). DRR investments are cost-effective and instrumental to save lives and reduce economic losses.

Although there are many reasons for insufficient allocation of the budget for DRR, based on development priorities strategy and social as well as cultural backgrounds of each country, the critical reasons include; difficulty of setting up an index for evaluating DRR effects and targets (for example, reduction of economic loss); difficulty in quantitatively showing evidence on how much preventive DRR investment contributes to the country’s sustainable development.

To address these challenges, JICA has developed an economic model called DR2AD (DRR Investments Accounts for Development), which is a pioneering initiative to showcase the benefit of preventive DRR investment and to shed light on its impact on the economic growth path and welfare of the country in quantitative and visible manner. The model will contribute to raise awareness of and promote the importance of preventive investment in every country. (Figure 2)

![Pattern Diagram of Investment for DRR and Economic Development](image)

Figure 2. Loss mitigating impact of preventive DRR investment on economic development
The Model:

The DR²AD Model can quantitatively demonstrate impacts of disasters on the long-term economic growth given different scenarios of disasters (scales and likelihoods)*. Moreover, it is designed to show how much the disaster risk is to be mitigated by preventive investment in DRR. The model can simulate a variety of impact scenarios according to combinations of disaster levels and mitigation ratios of preventive investment. The model would be a useful tool for forward-looking development planning taking disaster risks into consideration.

Case Studies:

Figure 3 and 4 show simulation results of Pakistan (flood) and Honduras (various hazards), respectively. They highlight the ratios of “GDP with DRR investments” to “GDP without DRR investments”.

![Figure 3. Simulation for Pakistan](image)

- **Scenario 1**
  - Until 5th year, DRR remains 0.
  - From 6th year, DRR is increased to 50%.

- **Scenario 2**
  - Until 5th year, DRR remains 0.
  - From 6th year to 10th year, DRR is increased to 20%.
  - At the beginning of 11th year, DRR reached to 50%.
Assumptions:

For both cases, the first 5 periods (years) reflect actual disaster loss data, then from 6th period to 20th probabilistic risk scenarios building on empirical data are applied. In probabilistic risk scenarios, the graph traces the average path after implementing Monte Carlo simulation (1000 scenarios). We assume that at 6th period, the countries will experience a large scale disaster.

a. Preventive DRR Investment

Baseline scenarios for both country cases assume preventive DRR investment will have mitigate the disaster loss (loss to private assets, productive capital and mortality) by 50% or 20%. Overall impacts of disasters on GDP are calculated by the production function calibrated for each country. Both Figures show the ratio of “impact with DRR investment (50% or 20% mitigation)” to “impact without DRR investment”. In this manner, the effects of DRR investment is observed as vertical deviation from 1 (left-hand scale). These base line scenarios are set to show that DRR investment should be effective to mitigate damage from period-1.

b. Timing of DRR investment

The model can also show different impacts of preventive DRR investment depending on timing of investment or time lag between investment and expected outcome.

In both Pakistan and Honduras cases, scenario 1 assumes that there is no DRR investment until 5th period and 50% mitigation investment starts at 6th period. The GDP path of this scenario is compared with the base line scenario of 50% mitigation.
Scenario 2 assumes the case of gradually increasing mitigation rates from 6th period to 10th until 20% and achieving 50% mitigation rate at 11th period. The long term impacts of this scenario 2 are compared to the base line scenarios and scenario 1 to check effectiveness of gradual implementation of DRR investment.

**Simulation results**

Both cases of Pakistan and Honduras highlights that preventive DRR investment would significantly mitigate the negative impact of disaster on the economy while its effect depends on country context including disaster patterns, damage rates and production activities. Even in cases of delayed DRR investment (scenario 1 or 2), the investment would be effective in the later periods although less effective than early implementation case. Simulation results show “the sooner is the better” in implementing DRR investment.

III. **Way forward (Where to from here? Highlight opportunities, next steps, expectations post-Sendai. )**

JICA expects more policymakers to utilize and apply the model to clearly understand the importance of allocation of resources for preventive DRR investment to secure the stable and sustainable growth of the economy over the long term as well as human security. Budget allocation for DRR will foster national and local governments to build a disaster resilient society.

The vital allocation of budget for preventive DRR investment reduces negative disaster impacts and secures sustainable development in developing countries. Some developing countries, such as Indonesia and Philippines where JICA has continuously supported for years, have recently moved into action for preventive DRR investment. Indonesia, through 2006 to 2012 budgets, increased allocation for DRR by 55% beside rehabilitation and reconstruction budget. In Philippines, over 2% of the total national budgets were allocated to DRR in 2011 (Kellett et al, 2014, Kellett and Caravani, 2013).

Preventive DRR investment should be strongly promoted to substantially reduce disaster risk and economic losses through implementation of Post-2015 Framework for Disaster Risk Reduction to build a new disaster resilient society.

JICA, a representative technical cooperation organization of Japan, continues to promote the importance of the preventive DRR investment and mainstreaming of DRR through its projects in partner countries, building on the Japanese experience. It is important to disseminate the concept of “Low Regret Investment” meaning that preventive DRR investment, based on ex-ante assessment of disaster risk and economic impact, makes regret as small as possible, instead of continuing budget allocation only for recovery and reconstruction while only assuring marginal budget to adapt future environment change.

*Note: DR2AD Model is an optimum growth model of Ramsey-type, suite of probability of disaster occurrence with its scale levels and percentile mitigation rate by preventive investment. For the prototype model description, refer to Yokomatsu et al, “An Economic Growth Model for Disaster Risk Reduction”, 2014 IEEE International Conference on SMC, Oct. 2014.*
Reference:


Jan Kellett, Alice Caravani, Florence Pichon. 2014. Financing Disaster Risk Reduction: Towards a coherent and comprehensive approach. ODI and UNDP.

Jan Kellett, Alice Caravani. 2013. Financing Disaster Risk reduction: A 20 years story of international aid. ODI and GFDRR
I Stock taking and Overview

1. Why monitoring/reporting mechanism is important?

The scale of economic losses from disasters is highest in the high income countries, and is growing at a pace that outstrips the overall rate of economic growth in most these countries. During the past 10 years economic losses amounted to above USD 1.5 trillion in OECD and BRIC countries. Economic impacts were particularly felt on the sub-national level, significantly decreasing regional economic growth after disasters occurred. To stem or reduce the rate of disaster losses, governments need to implement risk sensitive investment and risk financing mechanisms, which reduce the stock of risk, enable businesses and households to build back faster, and require governments to build back better.

To do so governments need to take informed decisions based on sound economic analysis, to make sure risk reduction investments yield the highest net benefit. To conduct such analyses there is a need to improve the evidence base on the costs of disasters. Information needs to be collected more consistently and systematically ex post of disasters, to take stock of the social and economic losses that in turn informs the overall effectiveness of risk reduction measures in reducing losses in the long run. This evidence base needs strengthening. In OECD countries alone for only around 30% of disasters are economic losses reported. These calculations almost exclusively account for direct economic losses only, significantly underestimating the knock-on, indirect economic impacts big disasters can have. Having a better understanding about how much governments invests in ex ante versus ex post measures in disaster risk management could greatly help in strengthening prevention and preparedness across countries against large scale disasters.

Improving this set of information will help governments to increase the effectiveness of their investment measures in DRM, and also enhance their financial contingency planning ex ante to alleviate the burden on public coffers in case of a disaster.

2. What gaps need to be filled?

Achieving financial resilience is a challenge, especially in OECD countries that suffer a large share of the economic costs of disasters. Significant opportunity costs exist in making ex ante financial arrangements for disasters and countries need to carefully decide from a set of policy options to see what is most suitable to put in place in their country context:

The OECD/G20 framework on disaster risk assessment and risk financing provides options to countries in how they might achieve financial resilience to disasters. In addition to
ensuring individuals and businesses recover financially from disasters, it describes mechanisms that governments may use to ensure the resources necessary to manage financial and economic consequence of disasters.

Planning for disasters in national budgets as contingent liabilities is one of the governance gaps that need to be filled. Finance ministries should be able to assess governments’ contingent liabilities for disasters, which is a necessary basis for efficient fiscal management. In its work on contingent liabilities the OECD examines the feasibility of ex-post financing arrangements (such as domestic or foreign borrowing or fiscal measures) versus ex-ante financing arrangements (including reserve funds, contingent spending arrangements, contingent debt facilities, and private and public insurance and re-insurance arrangements), based on economic efficiency criteria and degrees of risk aversion among governments. Its policy guidelines can help governments determine the right mix of financial instruments, while being mindful of not crowding out private financial risk arrangements.

In addition to financial contingency planning the evidence base for disaster risk reduction investments needs to be strengthened. The OECD works on several ends to contribute to this:

- The OECD is working on improving the standards to account for direct and indirect economic losses and will engage its member countries to collect loss information consistently and systematically. Together with its member countries the OECD proposes to collect DRM expenditure information more consistently and based on a common standard. Given the complexity of the work involved a lot of work needs to be put into defining a standard that is feasible enough for countries to find this information in public accounts, yet aggregate and comparable enough to assess and benchmark this across different countries.
- In addition to collecting information ex post of disasters the OECD is promoting the assessment of ex ante economic losses to inform policy decisions on risk reduction investments. The OECD developed a prospective damage loss methodology in the context of an OECD study on a potential large-scale flood of the Seine river in Paris. The framework examines two problems: the cascading effects of the interruption to critical networks on companies’ activities and the long-term macro-economic impact at national level, given the importance of the Ile-de-France region in the French economy (30 % of national GDP in 2011). The model, that shall be applied to other such studies in the future, yields results on the development of private and public capital, GDP, private and public investment, employment, wages, government debt and private consumption under all three flood scenarios and under the assumptions of constant fiscal policies as well as increased public investment after the flood.
II Way forward

*Countries should commit to ex ante modelling to better inform budget planning and public investment in disaster risk reduction.*

The OECD High Level Risk Forum has developed a dedicated methodology to assess direct and indirect economic impacts of major shocks on large metropolitan areas. In addition to assessing an event’s direct damages to capital stock, this methodology incorporates two critical elements of use to decision makers: it quantifies the most important cascading effects on business activities that follow interruption of critical infrastructures (electricity, transportation, telecommunication, water). It estimates the macro-economic impacts on a quarterly basis in terms of job losses, GDP growth, and public finances.

This hybrid model combines scenario-based risk modelling, macro-economic general equilibrium modelling and the utilisation of large GIS data-bases on assets and firms, as well as multi-disciplinary expertise. The model takes data on exposure of an area to a disruptive event, such as a major flood, evaluates public and private capital destruction and business losses directly linked to that event, and then extrapolates indirect impacts of the shock over the medium term, by incorporating the non-linear effects on the economy, as well as different recovery scenarios and their impact on public finance.

A recent OECD study on a major flood of the Seine in Paris (OECD, 2014) applied this model receiving significant attention in media, policy discussions and amongst private sector decision-makers. Providing this more complete picture on major risks to decision-makers is fundamental to the debate on preparedness and investments to increase resilience of our modern societies. It is particularly important as evidence to convince the private sector to contribute to in resilience efforts. This OECD methodology developed by the High Level Risk Forum contributes to bridging the risk knowledge and awareness gap. Similar studies could be replicated for other risks in major hubs of the world economy, provided that access to similar underlying datasets is made available.

Reference
