

Risk Reduction Indicators

Introduction

In support of the Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS) initiative, the ProVention Consortium has solicited papers from several experts on different aspects of disaster risk reduction and drawn on the review feedback of a wide set of colleagues within the Consortium¹ to outline potential disaster risk reduction (DRR) indicators and provide a set of supporting documents.

TRIAMS is a project of the governments of India, Indonesia, the Maldives, Sri Lanka, and Thailand, with support from the IFRC, WHO, and other UN agencies to measure the impact of the recovery efforts in response to the Indian Ocean Tsunami. A set of core indicators have already been established by the TRIAMS partners in early May 2006.

This paper is meant to provide additional information about indicators specifically relating to risk reduction in order to inform the possible selection and adaptation of risk reduction indicators during the finalisation of both the core set of TRIAMS indicators and potential country-specific indicators.

Approach

From the outset ProVention has sought to foster a very flexible approach in developing this paper. The countries participating in the TRIAMS programme were all affected by the tsunami in different ways, and their outlook toward future risks is influenced by different patterns of hazard and vulnerability. In pursuing the TRIAMS objectives there are also undoubtedly variations in the type of data that already exists, the ease with which that data can be accessed, and the pace with which more comprehensive qualitative indicators can be introduced among these countries. Seeking to inform the consideration of DRR indicators across this range of partners and programme contexts, the current project has tried to provide a diverse range of views and suggestions regarding DRR indicators.

This working paper includes three parts:

- 1) A basic set of recommended indicators that are likely the most adaptable and feasible for immediate implementation within the TRIAMS programme (see next page).
- 2) A comprehensive set of indicators, produced by the four experts who contributed background papers and also incorporating input from the larger review group (see the last two page in this section).
- 3) A set of four background papers for further context (see the attached annexes).

The background papers were written on related topics in DRR: A) linking relief, rehabilitation, and development; B) social vulnerability; C) institutional capacities; and D) infrastructure and municipal planning. While there is overlap among the indicators and discussion within the papers, this indicates the scope and importance of some core priorities which are hopefully described from the diversity perspectives in the papers presented.

Feedback

Please send any feedback on these papers to ian.odonnell@ifrc.org. Please also check ProVention's website (www.proventionconsortium.org) in the future for updates on DRR indicators activities.

¹ The four background papers were contributed by Ian Christoplos, Ben Wisner, Yasemin Aysan, and Fred Krimgold. The ProVention Consortium would also like to thank Margaret Arnold, Stephen Bender, Mihir Bhatt, Cynthia Burton, Antony Spalton, Margaret Stansberry, and Juan Carlos Villagrán De León for contributing valuable comments and input.

Basic DRR Indicators

Recognising the current need to finalise the indicators within the TRIAMS programme, this paper highlights the set of indicators which are the most feasible to implement in a rapid time-frame, using data sources likely to already exist already to the extent possible. In order to highlight the intrinsic inter-connection between DRR and other areas of recovery, the indicators in the list below are grouped according the relevant areas of recovery outlined in the TRIAMS core indicators list.

The full set of suggested indicators from the background papers is provided as a ‘Comprehensive List’ on p. 4 of this Summary section. In addition further context is provided in the related annex papers listed for each indicator.

	Suggested Output Indicators	Suggested Outcome Indicators	Data Source	Annex
Vital Needs	▶ % of houses constructed according to building codes with appropriate hazard-resistant features.		Surveys conducted to determine occupancy as source for other TRIAMS indicators.	D
	▶ % of population with appropriate awareness of disaster hazards and preparedness steps.	▶ % of population practicing safer behaviours as a result of disaster preparedness awareness.	Surveys in schools and markets, particularly in high-risk areas. Evidence of local preparedness plans and drills.	C
		▶ % of population perceiving that they are safe (vs. unsafe, powerless, etc.)	Surveys, particularly in high-risk areas.	C
Access to Basic Social Services	▶ Number of citizen and other interest groups (small business owners, fishermen, women, etc.) that have been formed or re-started since the tsunami.	▶ Restoration of social capital for promoting local disaster resilience.	Registration and governmental recognition for such groups. Local press coverage can be mined for the existence and range and frequency of activity of such groups.	B
Rehabilitating & Reconstructing Infrastructure	▶ Number and % of schools rebuilt, re-located, or retrofitted to take into account their exposure to future hazards.	▶ % of children attending schools in safe structures and school environments.	Municipal data, ministry of health and education data.	B, C
		▶ Reestablishment of trade and transport links between disaster affected rural areas and markets for products, labour and services.	Local economic surveys. This should be an indicator of service restoration for the infrastructure output indicators in the TRIAMS core list.	A
Livelihood		▶ Depth of poverty and poverty severity (need to look beyond just incidence of poverty to evaluate extent to which inequalities are changing and whether the vulnerabilities associated with poverty are being mitigated).	Registration for social protection and safety net services. Poverty gap is often measured as the mean percentage distance below the poverty line multiplied by the proportion of people that live below the poverty line.	A
	▶	▶ Diversity of livelihood and local economic activities.	Household budget surveys and local employment surveys.	B, A

Other relevant issues

The following comments draw extensively on a dialogue over e-mail in July 2006 among the paper contributors and the reviewers named on the first page. Where the phrasings come directly from the individual, the paper includes their name as well for reference.

Ultimately, the real proof of effective risk reduction is the extent to which DRR measures are transferred to other high-risk areas of the countries in which they are implemented. While DRR inputs into recovery programmes in the tsunami-affected areas are important, it is the broader process to increase risk reduction throughout each of these countries that is critical in the long-term, looking beyond simply rebuilding to broader commitment to reducing vulnerabilities to disaster hazards and other threats to safety (Yasemin Aysan).

It is most important that reconstructed communities not only be left with reduced risk but with the capacity to manage future risk independently (Fred Krimgold). In this sense, effective DRR indicators will be those that are relevant to track changes both during recovery and longer-term development, both inside and outside the recovery areas. Similarly there will also be an important place for “process” indicators in tracking the stages of capacity building in terms of training new personnel and developing and implementing effective risk reduction plans.

As a core driver of vulnerability, there is also a need to look in detail at poverty and the potential for increased inequality in recovery. Simple measures of restoration of services may mask negative and disruptive effects on patterns of access as the poor are often affected by multiple dimensions of risk. Comprehensive DRR indicators must fundamentally address human security and look beyond whether poverty is increasing or decreasing to whether vulnerabilities associated with poverty are being mitigated (Mihir Bhatt and Ian Christoplos).

To be effective in the long-term, DRR measures need to be integrated in all recovery and development projects. The donors, implementers, owners, operators of these projects should be charged with stating the risk standards to which the projects are being designed and implemented (Steve Bender). Ultimately all development activities should leave people with greater resilience and capacity to cope with natural hazards than before the development activity began (Ben Wisner).

Similarly the need for local and national governments to respond appropriately when such standards are not met places critical emphasis on monitoring the effectiveness of inspection and enforcement systems. Granted it is often quite difficult to measure the inputs and investments in comprehensive DRR measures.

Proxy indicators, several of which are used in the current set of TRIAMS core indicators, often provide an effective method for simplifying this measuring process and focusing attention on specific metrics. In the Basic DRR Indicators listed above, the safe rebuilding of schools has been suggested as a proxy for broad attention to risk reduction in reconstruction, relying on a community’s interest to keep children safe in schools as an indication of general commitment to keeping the entire community safe.

In developing this paper similar suggestions have been made about the efficacy of attention to coastal hazards as a proxy for a multi-hazard DRR approach and for looking at community-based watershed management practice as a proxy for broader community-based natural resource management. In these cases the increased attention to specific metrics needs to be considered against the need to measure progress in DRR ultimately in terms of the effective implementation of DRR measures throughout the countries involved, including areas at risk to different hazards and environmental threats.

Ultimately a comprehensive set of DRR indicators needs to be well-tailored to both the intended end-users and uses of that information. Past experience has often shown that indicators are most successful when they are developed by – or at least with – those who will use them for explicit decision-making. Given the extent to which risk reduction is embedded within many aspects of social, economic, environmental, and institutional recovery and development, this will mean that a considerable number of decision-makers across many levels will ultimately need to be involved in the initiative to maximise the chances of success in significantly reducing disaster risks.

Finally it is important to point as well to other DRR indicator efforts such as the ongoing work by UN-ISDR and other partners to develop DRR indicators to track progress toward the goals outlined in the Hyogo Framework for Action adopted by 168 countries in Kobe, Japan in January 2005.

Comprehensive List of Suggested Indicators

Suggested Indicators	Data Sources	Annexes			
		A	B	C	D
Livelihood sustainability					
▶ Scale of area directly or indirectly affected by the tsunami in which <u>community-based watershed management plans</u> have been established and/or reassessed.		A			
▶ <u>Stability of employment rates</u> after the discontinuation of food and cash for work programmes.	Employment surveys.	A			
▶ Number of homeless families and <u>homeless</u> street children and youth.	Municipal data.		B		
Diversity of livelihood and economic activities					
▶ <u>Reestablishment of trade and transport links</u> between disaster affected rural areas and markets for products, labour and services.	Local economic surveys.	A			
▶ Number of <u>different activities</u> by gender and age in the household. ▶ Index of diversity of livelihood activities.	Household budget surveys and local employment surveys.		B		
▶ <u>Remittance flows</u> return to normal after tsunami related disruption.	Transfers through postal systems or Western Union.	A			
Local resilience systems					
▶ Percentage of population in affected areas that are judged as <u>chronically poor</u> and that have access to social protection measures (comparison before and after the tsunami).		A			
▶ Reestablishment (or increase) in flows of resources through pre-existing <u>social protection schemes</u> .	Registration for safety net and social protection services.	A			
▶ <u>Social capital</u> - number of citizen groups and other interest groups (among small business owners, fishermen, women, etc.) that have been formed or re-started since the tsunami.	Registration and governmental recognition for such groups. Local press coverage can be mined for the existence and range and frequency of their activity.		B		
▶ <u>Exposure to violence and abuse</u> - Incidence of domestic violence and crimes against persons.	Crime statistics.		B		
Safety of schools, hospitals, and other critical infrastructure					
▶ Number and % of <u>schools and hospitals rebuilt, re-located, or retrofitted</u> to take into account their exposure to future hazards and conforming with building regulations; level of transfer of this practise to other high risk areas outside the tsunami affected municipalities.	Municipal data, ministry of health and education data.		B	C	D
▶ # of <u>infrastructure systems</u> including the energy, transportation, communications water and solid waste sectors which have carried out hazard and <u>vulnerability assessments</u> with specific reference to coastal hazards.	Survey of infrastructure system owners and operators (often public agencies).				D
▶ % of hospitals and other critical facilities that have sufficient backup water, power, and communications.	Municipal data, ministry of health and planning data.		B		D

Suggested Indicators	Data Sources	Annexes			
		A	B	C	D
Building Safety					
▶ % districts that have adopted <u>building standards</u> appropriate for coastal zone hazards.	Reports from districts and municipalities to ministry of local government or housing.				D
▶ <u>Plan check and inspection</u> - % districts which have effective land use and building regulatory agencies.	Reports from districts and municipalities to ministry of local government or housing.				D
▶ <u>Standards for reconstruction</u> - % of reconstruction projects specifically implementing standards of siting and design for future risk reduction.	Survey of all government, donor agency, NGO, and private reconstruction projects in affected areas.				D
Hazards assessment					
▶ <u>Exposure to future natural hazards</u> - % of people living in zones where they are now exposed to further hazards.	Spatially-based sample of new settlements to see whether people are living in zones where they are now exposed to further hazards.		B		
<u>Stronger institutional capacities for risk identification and dissemination</u> Forecasting of hazards and vulnerabilities, and early warning systems for multiple hazards are strengthened through: ▶ level of investment in equipment and technology ▶ national and regional cooperation agreements to exchange information and experience ▶ increase in the number of public information dissemination campaigns via media and schools for measurable change in public understanding of acting on early warning.	National and regional agreements, multi-hazard risk maps, academic and research institutions, technical government departments, school curricula and media reports, beneficiary perspective surveys. Existing risk assessment and development indicators from public-health and related fields.			C	
▶ % of districts which have prepared a formal, comprehensive <u>hazard assessment</u> with emphasis on coastal flooding and inundation.	Report by districts and municipalities to ministry of local government or planning.				D
▶ % of districts that have developed <u>hazard zonation</u> maps defining permitted land uses.	Report by districts and municipalities to ministry of local government or planning.				D
Institutional capacities - planning and legislation					
▶ Number of <u>preparedness and response plans</u> (national and provincial) written or revised to reflect improved information on multiple risks in the tsunami affected provinces as well as in other high risk areas of the country.	Modifications to national preparedness plan since the tsunami, municipal emergency preparedness and response plans; business plans; community preparedness plans.			C	
▶ <u>Enabling policy framework</u> - Number of policies and legislations drafted or revised to facilitate action, regulation, enforcement and/or incentives (including insurance and other risk transfer mechanisms).	Legislation, policy, and plans as captured in the media and official government documents – with evidence of good practice.			C	
▶ % districts and municipalities which have included <u>hazard management annexes</u> in their regional and urban development master plans.	Reports from districts and municipalities to ministry of local government or housing.				D

Risk Reduction Indicators

... Linking Risk to Relief and Development

Contributed by Ian Christoplos

From linking relief, rehabilitation and development to linking risk to relief and development strategies

The reduction of disaster risks is dependent on the interplay of a number of variables. A single output, in the form of a new communication system for example, will only be effective if other initiatives are in place to ensure that the information which is communicated leads to appropriate response. It is therefore misleading to assume that desired impacts can be assured through narrow project interventions. A focus on one specific variable should not be allowed to detract from the need to always approach risk from a broad perspective.

A perspective that links relief, rehabilitation and development (LRRD) adds a further *temporal* dimension to this complexity. Activities that constitute good practice in the midst of a humanitarian emergency may be irrelevant once recovery is well underway, and vice versa. In some countries this is related to the relative importance of international humanitarian actors (in the early stages of a disaster response when national/local structures are overwhelmed) versus full reliance on 'normal' systems to manage risk during later stages in a disaster. Another difference in approaches at different stages may be found in the reliance in acute emergency phase on relatively simple checklists for issues related to environmental management to *ensure that risks are not increased* by inappropriate logging and land clearance for housing. In later stages more attention can be paid to working with communities with natural resource and watershed management plans that can actually *reduce future risks*. There is rarely time to engage in the latter during emergency response.

Of particular importance in understanding where LRRD can contribute to risk reduction is in ensuring that the lessons about risk and vulnerability that have emerged in the course of the disaster are applied in reconstruction programming. After a major disaster the public, politicians and the media are all suddenly acutely aware of the disaster risks that they face. However, this awareness does not automatically lead to effective response during early phases of disaster response. Experience shows that this so-called 'window of opportunity' for enhanced risk reduction is most apparent in the later stages of recovery when the initial intense pressures to get affected populations into housing and jobs gives way to more considered and critical reflection about risk. Mistakes may have already been made, but the perceived need to react rapidly regrettably tends to displace attention to underlying risk. A pragmatic approach to the window of opportunity may be to strive for modest 'do-no-harm' objectives in earlier stages while investing more concerted effort into reduction strategies in later stages.

Concrete risk reduction indicators manifest themselves in specific sectors. There are no broad overarching indicators that will prove equally meaningful for monitoring the impact of road, housing and health interventions on risk. For this reason the following suggestions take up questions of risk from within the parameters of some specific sectors. The indicators below are thus illustrative of how disaster risk reduction may manifest itself at different phases of a disaster within specific sectors.

Livelihood sustainability

In recent years increasing attention has been paid to promoting livelihoods in LRRD. This has been justified based on the assumption that without such targeted interventions disaster risks will increase since destitute people will engage in destructive actions, such as logging forests in the search for firewood for household use and income. Lack of livelihood opportunities for affected populations has also been associated with increased social and political risks, for example as related to vulnerability to trafficking or intensified intra-communal conflict over access to limited land and water. Evidence from the early tsunami response has shown that livelihood interventions are frequently not sustainable, either in terms of promoting livelihoods that will prove viable after the discontinuation of outside assistance or with respect to natural resource management. Immediate risks have been mitigated but

longer-term risks related to inappropriate livelihoods have proven more difficult to address. The following two indicators are intended to reflect whether these interventions contribute to risk reduction over time.

Indicator one: Scale of area directly or indirectly affected by the tsunami in which community-based watershed management plans have been established and/or reassessed.

Indicator two: Stability of employment rates after the discontinuation of food and cash for work programmes.

Resilience through livelihood diversity

In today's globalised world, high levels of risk are more and more related to over-reliance on a narrow set of livelihood opportunities. Research is showing that resilience from the effects of a disaster is not just related to how fast a farmer is able to start planting rice again, but rather whether a household is also able to access remittances from relatives, obtain wage labour in an urban area, produce for changing consumer markets or (in the case of many tsunami affected areas) adapt farming systems to increased salinity. Resilience is related to diversity rather than business as usual. And resilience is the key to risk reduction by ensuring that households can shift their efforts to alternative livelihood opportunities when a disaster destroys assets or limits market access.

Indicator three: Reestablishment of trade and transport links between disaster affected rural areas and markets for products, labour and services.

Indicator four: Remittance flows (monitored through postal systems, Western Union, etc.) return to normal after tsunami related disruption.

Reinstating and reforming social protection systems

The concept of a 'disaster' is often associated with the insufficient capacity of existing national and local social protection systems to respond to the needs of the affected population. In a LRRD perspective, the risks that a population faces are often related to a gap that appears between the phasing out of the major relief structures and the continued inability of pre-existing social protection systems to cope with a huge, vulnerable population. Lack of permanent housing, poor sanitation, social alienation and other factors can lead to many households facing massive risks after relief efforts have been discontinued since 'normal' development patterns may take years to be re-established. These risks should be addressed through national poverty programmes, social funds, employment generation schemes and social welfare structures. Such programmes need to be scaled-up beyond pre-disaster levels due to large numbers of people who have entered the ranks of the chronically poor due to disaster-related indebtedness and loss of livelihoods and housing. Governmental capacities to administer these programmes in a transparent and effective manner may be decreased due to deaths in the civil service, reduced local tax revenues and increased demands on local government to administer massive reconstruction programmes. Seemingly mundane responsibilities such as re-establishment of postal services to manage pension and social security payments are not popular among donors. It is essential to monitor whether these structures are given the attention they deserve, with particular focus on the gap between relief and development programmes.

Indicator five: Percentage of population in affected areas that are judged as chronically poor and that have access to social protection measures (comparison before and after the tsunami).

Indicator six: Reestablishment (or increase) in flows of resources through pre-existing social protection schemes.

Risk Reduction Indicators

... Social Vulnerability

Contributed by Dr. Ben Wisner, bwisner@igc.org

Introductory Comment on Data

Before suggesting indicators of social vulnerability, I will discuss a few general limitations of, or at least challenges for, data collection

For the most part TRIAMS seeks to use indicators that rely on data available through “existing government systems for household surveys and administrative data collection.” However, because of violent conflict in eastern Sri Lanka and in Aceh province of Indonesia, “routine” base line data may be absent or suspect. In addition, with the violence escalating in Sri Lanka, it is uncertain that routine data collection in this zone highly affected by the tsunami will be possible.

Secondly, I doubt if routine data collection covers some of the most important processes from my point of view – such as homelessness of children and youth, trafficking and other abuse of women and children, and the knock on effects of interrupted remittances from coastal employment. In addition, there is considerable evidence that some populations such as *Dalit* day laborers in coastal Tamil Nadu have been very little surveyed by the authorities.¹

Finally, one might question the [oft-repeated] invocation of “data fatigue”. While there is no doubt the tsunami-affected grew weary of repeated surveys by different groups, I am not convinced that particularly marginal and disadvantaged groups would be very happy to make their voices and needs heard as long as they had ownership of the process (necessarily, then, a “strong” participatory one²) and felt there was some concrete benefit that would result. I may be wrong, but I think we should consider the phrase “data fatigue” critically.

Where “data fatigue” is probably most severe is among civil servants and officials and professionals associated with the tsunami affected national NGOs, especially those based in the affected coastal zones. They have probably been interviewed many times by teams asking identical or similar questions, have given many external teams tours and orientations. Of course care must be taken not to over burden these national cadres. On the other hand, if this project successfully integrates risk indicators into surveys that are routinely carried out, the added burden will be minimal.

Conceptual Background

I begin with the definition of social vulnerability as “the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recovery from the impact of a natural hazard” (*At Risk*, Wisner et al., 2004: 11). Cannon (one of the co-authors of *At Risk*) has developed a parallel and overlapping view of social vulnerability, the components of which are presented in Figure 1 (Cannon, 2000).

Figure 1

¹ Human Rights Watch, “Tsunami Recovery Efforts: Human Rights Watch Letter to Clinton,” 10 May 2005 http://hrw.org/english/docs/2005/05/10/india11024_txt.htm .

² On “strong” or transformative vs. instrumental and other pro forma varieties of participation, see Wisner (1988) & the literature resources on the ProVention Consortium toolkit for community risk assessment: <http://www.proventionconsortium.org/?pageid=44> .

<p>1. Livelihood & its resilience Assets and income earning activities</p> <p>2. Base-line status - well-being Health (physical & mental), nutrition</p> <p>3. Self-protection Quality of house construction & location</p> <p>4. Social Protection Adequacy of building controls; large-scale measures</p> <p>5. Governance Power system, rights, status of civil society</p>

This definition of vulnerability implies the use of indicators across the range of all four “themes” used to frame this project (social factors, institutions, livelihoods, and infrastructure). For example, the definition of vulnerability above implies that overcoming vulnerability (that is, building capacity or capability in the face of hazards) requires access to educational opportunities, access to communications and early warning, available means of risk mitigation (social and personal protection), economic surplus available for preparedness, social assets (networks) available for preparedness, savings and other buffers and resources (social and personal) for reconstruction and recovery.

Suggested Indicators

Looking at the draft recovery output and outcome indicators developed at the Bangkok consultation (May 2005) and provided to consultants, I will discuss indicators that complement and enrich some of those already agreed upon as core indicators. I will divide them into two sets of three each. The first are easily “readable” off existing, routinely gathered data (of course bearing the caveats I expressed in section 1 in mind). These are:

- Safety of schools.
- Exposure to future natural hazards
- Diversification of household livelihoods

The second group would ideally also be subjects of data collection but would probably require new, specific sample surveys or focus group discussions, or, at a minimum, standardized and period consultations with experts in the field. These indicators are:

- Local organizational & social capital
- Exposure to violence and abuse
- Homelessness

These six indicators may help to assessment the impact of tsunami recovery activities on social vulnerability/ capacity or resilience. They are consistent with my previously published work and also with other work such as that of Cannon (see cited above) and Cardona et al. (2005), who developed a “prevalent vulnerability index” (PVI) made up of 8 indicators of exposure, 8 of socio-economic fragility, and 8 of the lack of resilience (pp. 7-11).

I will discuss these one by one.

SCHOOL SAFETY

The number or percentage of schools rebuilt, re-located, or retrofitted to take into account their exposure to future hazards (flood, landslide, etc. and not just tsunami in the future) is a sensitive indicator of a number of processes of value in creating a “culture of prevention.”

- Integration of risk awareness into planning
- Application of risk-reduction standards and norms into public works
- Allocation of economic resources to safety of children
- Enhanced community risk awareness through provision of a visible, high profile example of good practice
- Protection of educational access and continuity of the educational process.
- Provision of a safe shelter and community center space

The TRIAM core indicators correctly highlight primary school enrollment, primary school drop out rate, and numbers primary school students and teachers per school. They also list as an indicator “% of **destroyed/ damaged schools rebuilt or rehabilitated by category by sub-district.**”

The last mentioned, however, **leaves open the question of safety of the school.** Has the rebuilt/ rehabilitated school been reviewed as regard the safety of its location? Has it been retrofitted to make it seismically safe – at least to the standard of life safety/ safe collapse – in the event of an earthquake? (OECD, 2004; Wisner et al., 2003)

EXPOSURE TO FUTURE NATURAL HAZARDS

The issue here isn't simply whether a year after the tsunami-affected people still live on exposed coasts. Most or many survivors will necessarily be exposed in that sense. But do they live in houses that have been raised or strengthened? In addition, perhaps even more important – since the return rate for tsunami, while uncertain, is probably quite long – have people been resettled or spontaneously re-housed themselves in zones where they are now exposed to OTHER hazards (Flooding? Landslide? Chemical or explosive hazards?)

The first set of issues is covered by the core indicators (the items on habitat restoration and coastal protection); however, spatially-based sample of new settlement would be required to reveal NEW exposures.

DIVERSIFICATION OF HOUSEHOLD ECONOMIC ACTIVITY

Diverse livelihood activities by a range of household members is a good hedge against the failure of one or another of these income streams due to another extreme event. Also, during the recovery period, even if the pre-tsunami employment or livelihood pursuit has been taken up again, the revenue may be lower due to missing equipment, use of damaged equipment, and marketing problems. Where routine household budget surveys allow it, a tally should be made of the number of different activities by gender and age in the household.

An index of diversity of livelihood activities would complement the 10 core recovery output and outcome indicators under the category of “livelihood” (5 May 2005).

Perhaps a start might be to keep track from time period to time period the number and type of new employment opportunities that exist in a locality and the percentage of the workforce in each. Where livelihood is natural resource-based, it would be good to see if the diversity of natural systems utilized is increasing or decreasing (e.g. do people just fish, or do they also exploit forest resources, farm, engage in small scale mining, etc.). The ratio of natural system-dependent livelihoods to those derived from manufacturing (informal sector or formal employment) would also be helpful.

EXPOSURE TO VIOLENCE AND ABUSE

A number of the reports and reviews of human rights aspects of tsunami recovery have mentioned sexual abuse and trafficking of women and, in particular, children. This is very hard to measure, but government and TRIAMS partners should consult with local human rights and women's advocacy groups to see if the situation has stabilized.

Where there are crime statistics collected routinely, the incidence of domestic violence as well as crimes against persons should be monitored among the re-settled population as an early warning of social pathology associated with unsuccessful re-settlement. Data may also be acquired by temporally-spaced, standardized interviews with community leaders, religion leaders and counselors, health workers – especially female ones – who may see undocumented cases of domestic violence and other forms of abuse.

LOCAL ORGANIZATION & SOCIAL CAPITAL

Success in re-establishing livelihoods and in gaining voice with government so that problems with infrastructure and social services are addressed in a timely way are both very much facilitated by a high level of local social organization. This can be measured by the number of citizen groups and other interest groups (among small business owners, fishermen, women, etc.) that have been formed or re-started since the tsunami. Unfortunately this is not the sort of thing that is covered by routine

administrative data collection unless there is a formal process of registration and governmental recognition for such groups. Otherwise, local press coverage can be mined for the existence and range and frequency of activity of such groups.

Second to the safety of schools, this may be the most important indicator of social vulnerability/ capacity/ resilience both because of the leverage such organization provided in accessing information and resources, but also because local organization makes possible two-way flow of information with authorities.

This may be the most important indicator of social vulnerability/ capacity/ resilience both because of the leverage such organization provides in accessing information and resources, but also because local organization makes possible two-way flow of information with authorities.

HOMELESSNESS

If there is baseline data on the number of homeless families and homeless street children and youth, then an increase may indicate problems with recovery. But why, one might ask, is homeless also an indicator of risk? Homeless people are more vulnerable to flood and tsunami as they have no shelter. They are also vulnerable to heat waves, to urban air pollution, to violence and abuse. Homeless street children and youth may also be at risk to sexual exploitation (and STDs and HIV-AIDS), trafficking, and violence.

Figure 2 provides the context for understanding the situation of homeless youth, children, and families in a landscape of likely future urban hazards.

Figure 2

SOME POSSIBLE NEW PATTERNS OF URBAN RISK

New Vulnerable Groups	<i>Climate Change</i>	<i>Urban Violence</i>	<i>Unregulated Industrialization</i>	<i>Increased Sprawl</i>	<i>HIV/AIDS & New Diseases</i>
Ex-Child Soldiers		+++			+++
Trafficked Women & Children					+++
Sweat shop Workers		+++	+++		
Displaced Indigenous Groups	+++	+++			
Isolated Urban Elderly or Disabled	+++			+++	

[Source: Wisner’s contribution to Feinstein International Famine Center (2004, p. 24)]

Explanatory and Concluding Notes

Numerous authors have tried to understand the temporal sequence of recovery. In fact, discrete “phases,” as once proposed by Kates et al. (1977) are not at all universal. Situational and policy variables influence post-disaster activities. Relief, temporary re-settlement, permanent re-housing, reconstruction of infrastructure, and economic recovery interact and may delay or accelerate one another.

Nevertheless, it is important for practical programming reasons to see if there are some albeit approximate “stages” or significant milestones.

Reading both grey and published literature, my hypothesis is that the five indicators I have suggested correspond to a sequence of perceptions by those affected by disasters of salience or urgency. If true, some additional implications for risk communication and local level planning should be considered.

Most urgent immediately following a hazard impact is exposure. People are worried about earthquake aftershocks or additional tsunamis. Concern decays with time, but peaks again when temporary shelter or re-settlement options are offered. Beneficiaries may (or may not) look critically at shelter locations from the point of view of their exposure to the same, or, indeed, other, new hazards. A second peak of saliency may arise when permanent re-housing takes place.

Soon after the initial peak of concern with hazard exposure is past, the most urgent concern is with water and food. This curve of salience decays either rapidly or slowly with time (depending on the logistical success of relief efforts and issues of distribution) and stabilizes at some lower, but significant level representing “normal” anxiety about basic human needs.

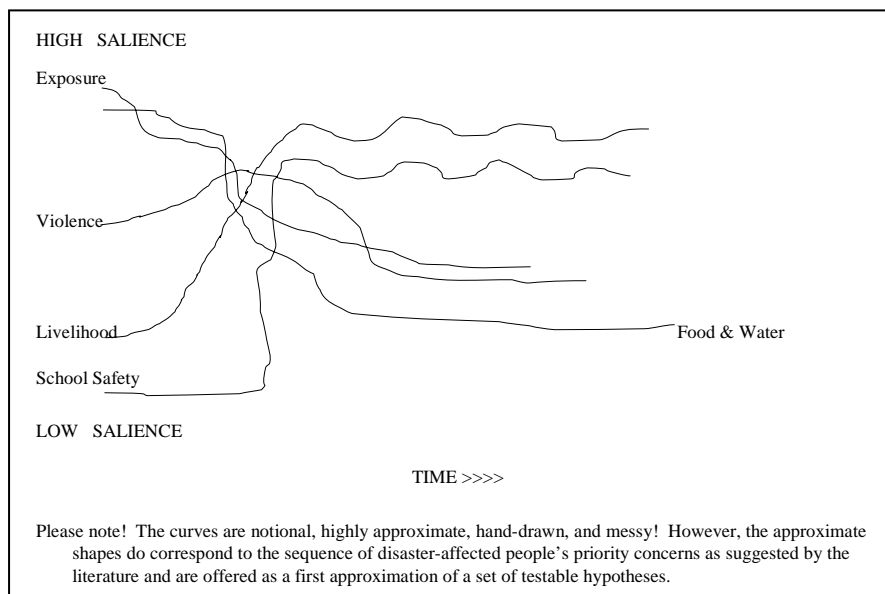
Concern with violence and abuse cannot compete with these first two in the early post-disaster period, but seems to rise rapidly and then fall as arrangements for temporary shelter are made, including arrangements for public safety in such camps or locations.

Concern with livelihoods does not rise as rapidly as these other perceived priorities, but does increase gradually through temporary shelter and re-settlement processes, indeed the availability of employment or other livelihood considerations may make or break the success of re-settlement efforts. Livelihood concerns, being central to people’s lives, then understandably oscillate at a high level depending on employment and commodity markets, availability of credit and technical assistance, and other recovery programs.

Finally, the perceived priority of continuity of schooling for ones children first rises sharply when temporary shelter is established and, quite often, relief agencies begin some classes or activities for children and youth. This curve oscillates at a level just below that of livelihood salience from the on in time, depending on the success achieved in rebuilding permanent schools, staffing them, providing teaching materials, etc.

Interestingly, all of these curves seem to cross at the point in time when temporary shelter is being consolidated, some of them with significant inflection points (Figure 3).

Figure 3



References Cited

Cannon, T. (2000). Vulnerability Analysis in Disasters. In: D. Parker, ed., *Floods*, pp. 43-55. London: Routledge [also available at www.radixonline.org/resources/cannon-floods-chapter.doc].

Cardona, O. et al. (2005). *Indicators of Disaster Risk and Risk Management*. Main Technical Report. Manizales, Colombia & Washington, D.C.: National University of Colombia- Manizales, Institute of Environmental Studies & Inter-American Development Bank. [Also see <http://idea.unalmz.edu.co>].

Feinstein International Famine Center (2004). *Ambiguity and Change: Humanitarian NGOs Prepare for the Future*. Medford, MA: Tufts University, August
http://nutrition.tufts.edu/pdf/research/famine/ambiguity_and_change.pdf .

Haas, E., Kates, R., and Bowden, M. (1977). *Reconstruction Following Disaster*. Cambridge, MA: MIT Press.

Human Rights Watch (2005). "Tsunami Recovery Efforts: Human Rights Watch Letter to Clinton," 10 May <http://hrw.org/english/docs/2005/05/10/india11024.txt.htm> .

OECD. (2004). *School Seismic Safety*. Experts Final Recommendations. Paris: OECD [see also http://www.oecd.org/document/23/0,2340,fr_2649_33723_31968087_1_1_1_1,00.html].

ProVention Consortium (2006). CRA Toolkit <http://www.proventionconsortium.org/?pageid=44> .

Wisner, B. (1988). Ben Wisner, *Power and Need in Africa*, London: Earthscan.

Wisner, B. et al. (2003). *School Safety: Falling Between the Cracks?* RADIXONLINE
www.radixonline.org/resources/school-seismic-safety-august2004.doc .

Wisner, B., Blaikie, P., Cannon, T., and Davis, I. (2004). *At Risk*, 2nd edition. London: Routledge [Part I, pp. 3-124, available at <http://www.unisdr.org/eng/library/Literature/7235.pdf>].

Risk Reduction Indicators

... Institutional Capacities

Contributed by Yasemin Aysan

Strong institutions are essential for the success of sustained risk reduction. In most disasters, traditional institutions exist for managing emergency response -the military, civil protection, fire brigade, Red Cross/Red Crescent Movement and the humanitarian organisations. In many countries there are currently few national and local institutions engaged in, or which have adequate capacities, to oversee risk reduction strategies and actions on a continuous basis.

Risk reduction, is multi-faceted and requires a complex set of institutions, public and private, academic and civil society, to interact and cooperate. A comprehensive organisational framework that brings together the necessary actors for the integration of risk management into the recovery process is not always in place prior to a disaster. This cooperation needs to happen among the national, local municipal and community level organisations. As the tsunami as well as some floods in the Indian sub-Continent and the Mekong Delta have revealed, at times institutional cooperation at the appropriate sub-regional level is also essential for the exchange of information and experiences.

Strong institutions at all these levels, together with political will, are expected to elevate disaster risk reduction as a policy priority, allocate the necessary human and financial resources for it, enforce its implementation and assign accountability for failures, as well as facilitate participation from civil society to private sector. The process of recovery further reveals the lack of human resources and systems in place to ensure that future risks are eliminated for the affected population but also transferred to other potentially high risk areas.

The need for speedy recovery and the desire to integrate risk reduction into the process may at times be in conflict with one another. Experience has shown that successes with strengthening institutional capacities for risk reduction seldom follow a linear line. Most countries, both in the developed and developing world report of uneven progress. Disaster reduction is often high on the agenda after a disaster as failure is blamed on institutional weaknesses in reducing risks, but in time it becomes the least implemented as other priorities for recovery take over.

During recovery, due to national and internal pressures new organisational structures are introduced and their human resources are strengthened in numbers and through training. But, often institutions to maintain risk reduction are not well invested in and sustained over time. It is essential that policy direction and operational capabilities be developed and invested in over a long period of time in multiple areas of government and civil society if a culture of risk reduction is to be cultivated into the recovery process and extended into the future.

The measurement of improvements in institutional capacities is particularly challenging. Ultimately, it is not possible to prove their effectiveness without the recurrence of the hazards of previously damaging intensity. For this reason, we must rely on indicators of the application of standards and practices that reflect priority areas for institutional strengthening such as in identifying and communicating risks, in preparing to deal with their consequences and enforcement of standards and legislations. Indicators should also reflect the improvements in the necessary enabling environment for the institutions to function, such as policy and legislative frameworks, financial and human resources.

The suggested 4-5 years for the monitoring of progress is too short to reflect sustainability of the institutional outcomes as institution building can take a very long time and institutions are subject to political changes that can interrupt continuity of policies and human resources. Therefore, indicators that reflect the planning steps in the 'right direction' are suggested where concrete outcomes are difficult to achieve within the suggested time frame.

A) Stronger institutional capacities for risk identification and dissemination

Post disaster period is when the interest in knowing about future disaster risks is high and rumours are widespread. Where knowledge that contributes to an understanding of risks exists, it is often fragmented in various institutions, may tend to be the domain of academic and research organisations

or, not always communicated to the public for practical action. While future tsunami risk may be low, the affected countries face other disaster risks. Strengthening capacities in the identification and dissemination of the multiple risks not only in the affected areas but in other high risk parts of the country can contribute to reduce future losses.

Indicator 1: Forecasting of hazards and vulnerabilities, and early warning systems for multiple hazards are strengthened through:

- a) level of investment in equipment and technology
- b) national and regional cooperation agreements to exchange information and experience
- c) increase in the number of public information dissemination campaigns via media and schools for measurable change in public understanding of acting on early warning.

Data sources: National and regional agreements, multi hazard risk maps, academic and research institutions, technical government departments, school curricula and media reports, beneficiary perspective surveys.

B) Improved institutional capacities for preparedness

Well prepared countries are where the losses of life are relatively low for the same scale of events. Preparedness involves a wide range of areas from investment in hardware such as operations centres, communications systems and provision for emergency health care to the strengthening of software such as national and local preparedness plans, trained staff and community based first aid. While central level preparedness is essential for large scale disasters local institutions such as NGOs, civil society organisations, municipalities and neighbourhood groups need to be strengthened primarily in high risk areas and within potentially at risk communities.

Indicators 1: No. of preparedness and response plans (national and provincial) written or revised to reflect improved information on multiple risks in the tsunami affected provinces as well as in other high risk areas of the country

Data Sources: Modifications to the national preparedness plan since the tsunami, municipal emergency preparedness and response plans; business plans; community preparedness plans.

C) Devised an enabling policy and legislative framework

Good governance will provide an enabling environment for disaster risk reduction, which will translate into political commitment of decision-makers. Possible indicators of political commitment may be the launching of policy reform processes or the formulation of legislation on risk reduction issues. Assessing the effectiveness of disaster reduction also include the extent to which governments commit themselves and then implement relevant policies. National policies provide the framework for commitments of the state to risk reduction priorities and give a clear mandate to decision-makers, planners, practitioners as well as the civil society. Effective policies set out the broad goals and strategic objectives for reducing disaster risks, and for strengthening the legislative framework, and the necessary financial and human resources and capacities for implementation. Comprehensive disaster reduction policies are also well integrated with development as well as environmental policies and legislations.

Indicator 1: No. of policies and legislations drafted or revised to facilitate action, regulation, enforcement and/or incentives.

Data sources: legislations, policies and plans, policy statements in the media and official government documents;

D) Strengthened institutional capacities for enforcement of legislations and standards

Ultimately, it is the application of legislations through risk reduction practices and tools that will bring about the desired changes at all levels of intervention and reduce vulnerabilities in the long-term. These include existence of an effective land use and building regulatory capacity to ensure compliance with standards in construction as well as the evidence of an active enforcement policy with immediate priority given to regulating the quality of health and educational facilities. While initially the efforts should focus on such facilities in the tsunami affected area, eventually all schools and hospitals in other high risk areas of the country should also be improved to conform to the necessary building regulations.

Indicator 1: Number of school and hospital buildings conforming with building regulations (strengthened, demolished or rebuilt) as a percentage of such building stock since the tsunami; level of transfer of this practise in other high risk areas outside the tsunami affected municipalities.

Data sources: Municipal data, ministry of health and education data.

Risk Reduction Indicators

... Infrastructure and Municipal Planning

Contributed by Dr. Frederick Krimgold, krimgold@vt.edu

Risk Reduction Indicators

The TRIAMS program has been initiated to track recovery progress in areas affected by the Indian Ocean Tsunami in India, Indonesia, the Maldives, Sri Lanka and Thailand. A core list of indicators has been selected to monitor progress in four sectors: Vital Needs, Access to Basic Social Services, Rehabilitating and Reconstructing the Infrastructure and Livelihoods. The indicators selected by the five countries relate to measures of recovery of health, social and economic status. They do not explicitly focus on risk reduction as an objective of the reconstruction effort. The motto of the reconstruction activity has become “build back better.” A key aspect of “better” is safer. This discussion will explore the feasibility of tracking indicators of risk reduction in four areas: Linking Risk Reduction to Development, Social Vulnerability, Institutional Capacity and Infrastructure and Municipal Planning.

There is some overlap among the sectors used by TRIAMS since meeting vital needs for water and health requires restoration of infrastructure service systems; access to social services requires the reconstruction of health, education and welfare infrastructures; and reestablishment of livelihoods requires the reconstruction of the physical element of the economic infrastructure. In all four sectors, measures should be taken during recovery to reduce risk of future disaster loss and to increase resiliency.

The four areas of risk reduction also exhibit significant interdependency. All risk reduction measures are related to development. Fundamental objectives of development are increased security for individuals and stability for planning and investment. The central purpose of infrastructure service systems is social vulnerability reduction. Service distribution systems provide energy, water, sanitation, communication and transport to overcome isolation and enhance resiliency. The purpose of urban planning is to safeguard the health, welfare and safety of the public. Institutional capacity is necessary for the adequate management of infrastructure systems and for the administration of municipal plans.

Risk reduction cannot be ignored in the recovery process. It is essential that risk reduction measures be thoroughly imbedded in all sectors of the physical, social, economic, institutional and environmental recovery. Risk reduction must be mainstreamed in to all sectoral planning, implementation and management. The institutions and practices of risk reduction must be established and maintained permanently. Risk reduction should grow from the recent experience of disaster loss, demonstrated in the execution of recovery and made a permanent fixture of public and private practice in the affected areas.

The TRIAMS Rehabilitating and Reconstructing the Infrastructure sector includes indicators of physical recovery for roads, bridges, harbors, jetties, schools, health facilities, natural habitat and coastal protection. However, the sector list makes no provision for the measurement of progress in risk reduction. There are no indicators of the quality of recovery, in terms of future safety in extreme natural events. Only limited measures are provided for the restoration of infrastructure systems. Recovery is measured in terms of repair to damaged physical structures, rather than restoration and distribution of services. For infrastructure systems, recovery should be measured in terms of volume of service, distribution of service and access to service.

Core indicators

This note provides an updated TRIAMS 'core set' of indicators with the most directly approachable risk reduction indicators highlighted in relation to the other indicators leadly developed. Indicators of risk reduction that should be added to the “core indicators” list in the “Rehabilitating and Reconstructing of Infrastructure” sector are presented in order of priority:

Indicators	Data Source	Potential use in risk reduction
<p>Hazard Assessment</p> <ul style="list-style-type: none"> ▶ % of districts which have prepared a formal, comprehensive hazard assessment with emphasis on coastal flooding and inundation. 	<p>Report by districts and municipalities to ministry of local government or planning.</p>	<p>Hazard identification is fundamental to physical risk reduction. This will provide essential guidance to public, private and individual decisions on siting and design of structures.</p>
<p>Hazard Zonation</p> <ul style="list-style-type: none"> ▶ % of districts that have developed hazard zonation maps defining permitted land uses. 	<p>Report by districts and municipalities to ministry of local government or planning.</p>	<p>Hazard zonation will influence the behavior of builders, developers, public agencies and individuals in the location on critical activities and assets.</p>
<p>Building Standards</p> <ul style="list-style-type: none"> ▶ % districts that have adopted building standards appropriate for coastal zone hazards. 	<p>Report from district or municipality to ministry of local government or ministry of housing.</p>	<p>Building standards provide basis for training of architects, engineers, developers, construction laborers, self-builders and inspectors. They are the basis for positive behavior change for risk reduction.</p>
<p>Plan Check And Inspection</p> <ul style="list-style-type: none"> ▶ % districts which have effective land use and building regulatory agencies. 	<p>Reports from districts and municipalities to ministry of local government or ministry of housing.</p>	<p>Effective local land use and building inspection and enforcement are the most valuable assurance of actual risk reduction implementation.</p>
<p>Master Plan Hazard Annex</p> <ul style="list-style-type: none"> ▶ % districts and municipalities which have included hazard management annexes in their regional and urban development master plans. 	<p>Reports from districts and municipalities to ministry of local government or ministry of housing.</p>	<p>Long-term risk reduction requires comprehensive planning including the selection of safe sites for future development and infrastructure investment.</p>
<p>Safe Siting And Construction Of Schools</p> <ul style="list-style-type: none"> ▶ % schools sited and designed to survive coastal hazards. 	<p>Ministry of Education.</p>	<p>Safety of children is the highest priority in every society. Safe schools provide a visible example for the rest of the community.</p>
<p>Safe Siting And Construction Of Health Facilities</p> <ul style="list-style-type: none"> ▶ % health facilities sited and designed to survive coastal hazards. 	<p>Ministry of health.</p>	<p>Health facilities house vulnerable populations and are of critical importance following disasters. The example of attention to risk reduction in siting and construction will influence the decisions of the rest of the community.</p>
<p>Infrastructure System Vulnerability Assessment</p> <ul style="list-style-type: none"> ▶ # of infrastructure systems including the energy, transportation, communications water and solid waste sectors which have carried out hazard and vulnerability assessments with specific reference to coastal hazards. 	<p>Survey of infrastructure system owners and operators (often public agencies).</p>	<p>Infrastructure service delivery systems are critical to the functioning of urban areas and as extended network systems are particularly vulnerable to geographically distributed hazards. Infrastructure owners have responsibility for the well-being of their customers and must be held accountable for risk reduction measures.</p>
<p>Standards For Reconstruction</p> <ul style="list-style-type: none"> ▶ % of reconstruction projects specifically implementing standards of siting and design for future risk reduction. 	<p>Survey of all government, donor agency, NGO, and private reconstruction projects in affected areas.</p>	<p>This survey will serve to reinforce attention to risk reduction in reconstruction projects and to document the range of standards being applied.</p>

Background on Infrastructure and Municipal Planning

Infrastructure

Infrastructure generally describes the systems associated with delivery of municipal and regional services. The principal sectors of infrastructure are energy, transportation, communication,

water/waste water. In a highly industrialized society, the list of critical infrastructure sectors has been expanded to include the following.

- Agriculture
- Food
- Water
- Public Health
- Emergency Services
- Government
- Industrial Base
- Information and Telecommunications
- Energy
- Transportation
- Banking and Finance
- Postal and Shipping

While functional and efficient systems in all of these sectors are essential to recovery and development, it is suggested that emphasis be placed on those basic systems for which physical reconstruction can be readily observed and service restoration can be documented. Food, Water, Public Health and Energy may be closely associated with Vital Needs. Public Health, Emergency Services, Information, Government, Banking and Finance may be closely associated with Basic Social Services and Agriculture, Industrial Base, Energy, Transportation, Banking and Finance and Postal and Shipping may be closely associated with Livelihoods.

Each of the principal sectors includes numerous distinct systems. For example, the Energy sector includes electric power, natural gas, fuels and lubricants, as well as generation, distribution and storage. The transportation sector includes road, rail, air, river and sea transport including facilities and vehicles for passengers and freight. The communications sector includes telecommunications, broadcast communications, cyber and print media (as well as emergency communication for warning and response). Water includes water for drinking and personal hygiene, industrial uses and irrigation. The dependence on infrastructure systems for service delivery varies greatly between developed and developing countries and between urban and rural areas.

In the coastal areas affected by the Indian Ocean tsunami of 2004, severe disruption was experienced in water systems, transportation systems and at least short-term disruption was experienced in electric power and communications systems. Because these systems are often highly interdependent, loss of function in one system may immediately affect a capacity of dependent systems. For example, loss of electric power may interrupt pumping for water supply. Loss of transport interrupts fuel delivery and reduces energy for all uses including transport.

The most obvious indicators of service provision in infrastructure systems are measures of service flow. In the case of electricity that measure is kilowatt hours per year; in the case of water, cubic meters of water per year; in the case of transport, number of tons of goods or number of passengers transported per year; in the case of communications, the connected calls for voice communications and number of bytes per year for data communication. These gross volumes of service delivered to the affected areas are centrally collected and reported. They can be used for comparison with pre-tsunami levels of service and to track the rate of service restoration.

Damage to road systems is typically reported as number of kilometers of roadway damaged. Damage to electric power systems is reported in terms of number of kilometers of distribution wires and polls lost. Water and sewer system damage is reported in terms of kilometers of pipe disrupted or number of pipe breaks. Although repair is also reported in these terms, a more relevant measure for overall social and economic recovery would seem to be the volume of service provided rather than simply the physical status of the delivery system.

Indicators of recovery should reference the pre-disaster level of service in the affected area. This requires a clear definition of the affected area and affected population. A clear demarcation of the geographic definition of tsunami-affected areas and the definition of tsunami-affected populations is needed if measures of recovery are to be comparable over time. Where possible, estimates of the pre-disaster service delivery flow in each of the primary infrastructure service sectors should be obtained for affected area. It will then be possible to measure those flows, on an annual basis, during the period

of recovery to determine the percentage of pre-disaster service achieved. Additionally, in terms of distribution of services, it is desirable to ascertain the percentage of affected population served by each sector (e.g. the percentage of population in an affected area benefiting from electric power compared to the percentage of population benefiting from connection to the electric power grid at defined times during the recovery process). In some cases, quality of service measures may also be appropriate. In the case of communications, the comparison of basic copper wire landline telephone connections to broadband wireless connections may lead to new benefits of access and equity.

The interdependencies of critical infrastructure systems may pose significant problems during restoration and recovery. Lagging recovery in electric power may slow the rate of reconstruction in communications and water supply. Lagging recovery in transportation may slow the rate of material delivery for reconstruction.

Infrastructure Resilience

For each of the principal sectors of critical infrastructure, there are model standards for reliability and resilience. These standards include provision for natural disaster loss reduction and accelerated service restoration following disasters. Infrastructure systems are either publicly owned and managed or privately owned and publicly regulated, so governments are responsible for maintaining standards in both cases. In the recovery process, critical infrastructure systems should be restored in a manner consistent with such vulnerability reduction and resiliency standards. This may require system-wide modification and upgrading beyond the tsunami-affected area.

For infrastructure systems such as electric power, water, communication and transportation, there are often relatively sophisticated administrative and engineering support organizations. For these publicly regulated organizations, formal vulnerability assessments should be required. These system assessments must be based on comprehensive hazard assessment for the area covered by the service system. A simple indicator could be the percentage of infrastructure system owners who have completed a comprehensive hazard and vulnerability assessment for their system. This should be asked of each system owner in each community. A further indicator might be a survey of infrastructure systems owners to ascertain the percentage who have made investments to reduce future disaster loss since the tsunami. These are simple indicators of the state and possible development of risk reduction measures for the affected areas of the six countries over the next five years.

Indicators of risk reduction in infrastructure system restoration include:

- 1) Reference to recognized construction and management standards for coastal zone development and flood mitigation.
 - a) Indicator: Existence of legally binding risk management standards for each infrastructure system.
- 2) Plan, review and inspection to ensure compliance with standards.
 - a) Indicator: Number of infrastructure system plans reviewed, approved and disapproved for hazard mitigation for each affected district.

Municipal Planning

Following a major disaster, municipal planners should take advantage of focused public awareness and support for disaster risk reduction. In those communities where urban master plans are prepared, specific hazard components outlining relevant natural and technological hazards should be mapped. This hazard mapping should be carried out in advance of reconstruction for existing settled areas as well as for areas of potential redevelopment. In the case of existing settlement areas, hazard maps should be used to prioritize investments in strengthening or relocating buildings and infrastructure. In the case of sites identified for new development, hazard exposure should be factored into site selection criteria.

The tsunami was a catastrophic but rare event. Other hazards -- such as storm surge, riverine flooding, air and water pollution, hazardous materials release, and industrial accident -- should be considered in the same hazard assessment and should be addressed in a comprehensive mitigation component of the urban master plan.

Municipal planning indicators:

- 1) The percentage of affected districts and municipalities completing comprehensive hazard assessment.
- 2) The percentage of affected districts and municipalities completing municipal mitigation strategies.
- 3) The annual budget for the maintenance and enforcement of the municipal urban master plan.
- 4) The number of variances granted for deviations from urban master plans since the tsunami.

Risk Reduction

Before we can discuss risk reduction we must understand risk. Before we can understand risk we must understand hazard and vulnerability. There are basic issues that we must address if we are not just to build back the same level of risk that existed before the disaster. There are several phases in physical reconstruction process that must be followed regardless of who is funding or in charge of the reconstruction.

The measurement of risk reduction is particularly challenging. Ultimately, it is not possible to prove the effectiveness of risk reduction measures without the recurrence of the hazards of previously damaging intensity. For this reason, we must rely on indicators of the application of standards and practices which have been shown to correlate with loss reduction elsewhere. Theoretically it is possible to estimate future disaster losses and loss reduction that can be achieved through application of specific mitigation measures. For areas affected by the tsunami, it may be more reasonable to concentrate on the careful assessment and understanding of losses that have been experienced and to deal directly with visible evidence of continuing vulnerability.

Risk Reduction and Recovery

The restoration of the ex-ante conditions is not an adequate objective for recovery programs. The theme "Build Back Better" requires not only restoration of pre-tsunami material standard of living, but the application of hard-won lessons about vulnerability and mitigation. Unfortunately, there do not seem to be adequate measures for the restoration of infrastructure services in the TRIAMS core list; the objectives of risk reduction are not the subject of any of the currently proposed indicators.

While there is legitimate controversy about the feasibility and advisability of introducing risk assessment and mitigation measures during post-disaster reconstruction, the opportunity for incorporating mitigation and reconstruction should not be squandered. There is great pressure to accelerate recovery and to facilitate rapid physical reconstruction. However, in order to build back better, sufficient time must be taken to complete hazard assessments and to introduce land use and building regulations for the reconstruction to help reduce future loss. Although it may entail extending the time disaster victims spend in temporary shelter, this is the best opportunity to change in building practice and development related behavior for the long term.

Physical Reconstruction Process

Comprehensive hazard assessment should be done before any land use planning or reconstruction. Since the tsunami of 2004 is estimated to have a return period of 600 to 800 years, it may not necessarily be the dominant hazard consideration for the affected areas. Other natural hazards associated with the coastal zone are at least as important. Many involve water intrusion. This makes elevation a key factor in land use management. (Elevation related land use management makes better sense than the buffer zone concept based on distance from mean high tide.) There are also many non-natural hazards that need to be considered in a comprehensive assessment such as environmental pollution and hazardous materials exposure and traffic safety. These are all issues that must be dealt with in plans for safe and healthy new communities. Tsunami risk should not dominate the reconstruction thinking to the exclusion of other hazards.

Hazards must be identified. They must be documented and mapped, where possible. One simple indicator of risk reduction would be the percentage of communities in affected areas that have prepared comprehensive hazard assessments and mapped their hazards. This measure does not address the quality of the hazard assessment or the use that is made of it in planning. However, without this type of assessment, neither individuals, municipalities, nor national governments can make effective, informed choices to reduce risks. Some of this knowledge of hazards is intuitive, local and traditional; some is not, and requires competent, scientific and engineering expertise. A major

issue in coastal reconstruction is safe siting. Hazard mapping to support safe siting decisions is fundamental: communities for which any such effort has been undertaken should be counted.

Once hazards have been identified and mapped, it makes sense to relate levels of hazard to appropriate land uses. Critical community facilities such as hospitals, schools and life-line infrastructure systems should be located on the least hazardous sites. Permanent habitation should be prohibited in the most hazardous areas. Land use management and zoning provisions should contribute to risk reduction. A possible indicator might be the percentage of communities with active land use management organization and capability for risk reduction.

After identifying safe, or relatively safe, sites for reconstruction, the next issue is safe design of structures. Structures in coastal zones should be designed according to the loads they are expected to bear. Coastal flooding and storm surge require that structures be designed to accommodate severe loads. This is accomplished with reinforced concrete frames and breakout panels that allow water to flow through the ground floor. Inhabited buildings in high hazard areas should provide the possibility of vertical evacuation.

Design and construction standards for coastal zone reconstruction must be adopted. These standards of practice should be the basis for training of engineers, architects, builders and construction laborers. An indicator could be the percentage of communities that have adopted standards of design and construction of buildings that address coastal hazards. This is basic, even in a community with no training or enforcement; there must be some reference standard for those voluntarily interested in risk reduction. A direct measure of risk reduction could be the percentage of new buildings that are properly sited, designed and constructed to survive coastal hazards.

In order to carry out hazard identification and mitigation, planners, architects, engineers, developers, builders, investors and insurers must be trained to understand and implement disaster risk reduction measures. In villages the training may include laborers and homeowners. Indicators for training could be the number of training programs and people trained in safe siting and construction methods for the coastal zone.

The critical components of physical risk reduction are zoning and construction standards administration and enforcement. Once the hazard and mitigation information is available and relevant categories of people have been trained to carry out safe reconstruction, it is necessary to check that standards are being applied. This requires the administrative and technical capacity to review plans and to inspect construction on site. A basic indicator of this capacity could be the percentage of communities served by land use management and building regulatory offices.

Equity, Access and Quality of Service

As important as the gross indicators of rate of physical reconstruction of infrastructure systems and buildings, are the issues of distribution and participation in the benefits of recovery. Equity of distribution of services and shelter during recovery should be monitored as closely as the parameters of building. Equality of opportunity and access to resources are important social factors related to risk reduction.

Specific attention is required to monitor the conditions of poor and disadvantaged populations. The recovery process provides a potential opportunity to balance distribution of resources and opportunity. However, dependent populations are less likely to be represented in recovery decision making and may lose ground as a consequence of the recovery process. Specific indicators of equity of distribution of resources and participation in decision-making should be developed to include the processes of infrastructure service restoration and municipal reconstruction.

Indicators of service distribution for infrastructure systems could include the geographic dimensions of service areas and the percentage of population served. Indicators of equity in distribution of risk in reconstructed communities might relate household income to safe housing in terms of location and construction. Quality of service could also be the subject of household survey. Customers and beneficiaries could be asked to evaluate their experience of access to and quality of infrastructure services before the tsunami and during the recovery period.

Preparedness for Response

An important component of risk reduction is the capability to respond rapidly and effectively in the event of a natural or unnatural disaster. The status of emergency management and response

capabilities in the affected communities should be considered. Indicators might include investment in public safety, including budgets for fire, police and emergency medical services, emergency management organizational capability, (including emergency operations centers) emergency communications and warning systems and provision for emergency mass care.

Incentives for Risk Reduction

Incentives for risk reduction can be provided both by the public and private sectors. Because mitigation is an up-front cost, and benefit comes at an uncertain point in the future, timely incentives for mitigation investment are key. They can include direct subsidy of the added costs of mitigation measures, tax benefits tied to mitigation investment, and risk based insurance premiums. Such incentives play a useful role encouraging private investment in mitigation. Indicators should be considered that track the availability of risk reduction incentives during the recovery period and the effectiveness of specific incentive programs.

Insurance

Insurance is relevant for large-scale infrastructure systems, large commercial enterprises, and the tourism industry. Insurance data are centrally collected by insurance companies and governments. Although, in most affected areas, the insurance penetration is less than 5%, the rate of insurance coverage can provide an interesting indicator of the degree of risk awareness.

Indicators and Data Collection

Indicators are measurable quantities that represent, or correlate with, phenomena of interest. Very often, the factor of greatest interest is not available or tractable for measurement. The process of data collection in any society is expensive. There are limits on the amount and quality of data that can be collected regularly over a long period of time. The discussion of indicators should begin with a review of which data are already collected routinely and which are likely to be reliably available over the period of interest. This presents a significant limitation for the selection of feasible indicators.

Data related to the indicators suggested for risk reduction for infrastructure systems and municipal planning can be collected at the community level and at the regional level from agencies administering community and municipal development. Data on rates and price of service provision are routinely maintained by the service provider and reported to regulatory agencies. It is also possible to track infrastructure system revenues from operator records for the relevant periods and areas.

Process and Product Indicators

Both process and product indicators are relevant for the measurement of risk reduction. Process indicators are those associated with the hazard assessment, building standards development and administrative capability for zoning and building regulation. The relevant product indicators are associated with the physical result of planning and construction. These product indicators should be based on the observation and evaluation of the built systems and structures and the extent to which mitigation measures have been successfully implemented. Process indicators are an interim proxy for product indicators. The true measure of the process is ultimately the quality of the product it produces. And by extension the product indicator is a proxy for actual performance during future, extreme events.

Output and Outcome Indicators

The distinction between output variables and outcome variables is made in the TRIAMS core list of indicators. While it is easier to track the governmental inputs to the recovery process than to evaluate and quantify the ultimate contribution to health, safety and welfare, it is the outcome that is more important.

For the built environment the processes of planning, designing, constructing and managing represent inputs for risk reduction. The first step in the implementation of risk reduction occurs in the planning process. This is where hazard assessment and building and siting standards are brought to bear. The construction process may be seen as the implementation of the planning process. This is where the

physical evidence of the planning process will become more visible. The management of existing structures and systems also contributes to risk reduction over time.

As the period of the TRIAMS project is meant to be four years, much of what will be available to evaluate will be in the planning phase. It is important that there be useful indicators of the introduction of risk reduction measures in the planning process for infrastructure systems and urban master plans. These will be comparable to the other indicators of output. Indicators of follow through and implementation of planned risk reduction measures in construction and management will provide measures of outcome.

Ultimately, the measure of success for risk reduction measures will be the reduction of expected losses. Some estimation of expected, unmitigated losses must be carried out if one is to measure the reduction of loss due to risk reduction. The dilemma of mitigation is that when it is successful, it is a non-event.

Application of Risk Reduction Indicator Monitoring Results

Risk Reduction requires behavior change by many key members of a community and the general public. Those concerned with the construction and regulation of the built environment must change their practice to effectively incorporate risk reduction. The public must be encouraged to understand the value of risk reduction, to support public policy for risk reduction and to make independent choices in patterns of behavior and consumption that reduce risk.

Ultimately, the output of TRIAMS should provide a basis for decision support for a range of public and private decisions that affect risk exposure. We should have a sense of where this work goes and what purpose it will serve. Who will use these indicators to make what decisions? Who is the target audience for this effort? Risk reduction decisions are made at all levels of society. The origin of TRIAMS seems to have been with international organizations and national governments. While they have an important role in risk reduction, most risk reduction decisions are made locally. Analysis is needed to identify and describe the character and context of those local risk reduction decisions.

Importance of Recovery Impact Assessment

The term "recovery impact" implies that recovery may be seen as an external process thrust upon an affected population. The term also suggests that all aspects of recovery may not be positive. Improved understanding of the dynamics and effects of the disaster recovery process is necessary to ensure efficient use of resources, to avoid unnecessary social dislocation and ultimately to improve the health, welfare and security of disaster-affected populations. To date, there has been limited systematic study of the long-term effects of specific policies and investment priorities. The systematic collection of data from the tsunami recovery process in five countries of the Indian Ocean region will provide a valuable database both for the management of recovery programs and for the improved understanding of the recovery process in general. It is important to measure both expenditures and personnel inputs and to relate them directly to programmatic outcomes.

Appendix

The topic of risk reduction indicators has been addressed in the following publication of the Inter-American Development Bank (IDB):

Indicators of Disaster Risk and Risk Management, Inter-American Development Bank, Universidad Nacional de Colombia – Sede Manzales, and Instituto de Estudios Ambientales, Summary Report for World Conference on Disaster Reduction, January 2005

The indicators identified for development of Risk Management Index (RMI) are relevant for the measurement of risk reduction in the TRIAMS project. The indicators listed below are, for the most part, consistent with those discussed in the ProVention document.

The Risk Management Index, RMI, brings together a group of indicators related to the risk management performance of the country. These reflect the organizational, development capacity and institutional action taken to reduce vulnerability and losses, to prepare for crises and efficiently recover.

Formulation of RMI takes into account four public policies:

- a) Risk identification, RI (that comprises the individual perception, social representation and objective assessment);
- b) Risk reduction, RR (that involves the prevention and mitigation);
- c) Disaster management, DM (that comprises response and recovery); and
- d) Governance and Financial protection, FP (that is related to institutionalization and risk transfer).

Eight indicators have been proposed for each public policy. Together, these serve to characterize the risk management performance of a country. The RMI is the average of the four composite indicators:

The valuation of each indicator was achieved using five performance levels: low, incipient, appreciable, notable, and optimum. These correspond to a range of 1 to 5, low to high.

Indicators of Risk Identification

The indicators that represent risk identification, RI, are the following:

- IR1. Systematic disaster and loss inventory
- IR2. Hazard monitoring and forecasting
- IR3. Hazard evaluation and mapping
- IR4. Vulnerability and risk assessment
- IR5. Public information and community participation
- IR6. Training and education on risk management

Indicators of Risk Reduction

The indicators that represent risk reduction, RR, are the following:

- RR1. Risk consideration in land use and urban planning
- RR2. Hydrographic basin intervention and environmental protection
- RR3. Implementation of hazard-event control and protection techniques
- RR4. Housing improvement and human settlement relocation from prone-areas
- RR5. Updating and enforcement of safety standards and construction codes
- RR6. Reinforcement and retrofitting of public and private assets

Indicators of Disaster Management

The indicators that represent the capacity for disaster management, DM, are the following:

- DM1. Organization and coordination of emergency operations

- DM2. Emergency response planning and implementation of warning systems
- DM3. Endowment of equipments, tools and infrastructure
- DM4. Simulation, updating and test of inter institutional response
- DM5. Community preparedness and training
- DM6. Rehabilitation and reconstruction planning

Indicators of Governance and Financial Protection

The indicators that represent governance and financial protection, FP, are the following:

- FP1. Interinstitutional, multisectoral and decentralizing organization
- FP2. Reserve funds for institutional strengthening
- FP3. Budget allocation and mobilization
- FP4. Implementation of social safety nets and funds response
- FP5. Insurance coverage and loss transfer strategies of public assets.
- FP6. Housing and private sector insurance and reinsurance coverage