

Extreme events and disasters: a window of opportunity for change? Analysis of organizational, institutional and political changes, formal and informal responses after mega-disasters

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Abstract Disaster associated with natural hazards can lead to important changes—positive or negative—in socio-ecological systems. When disasters occur, much attention is given to the direct disaster impacts as well as relief and recovery operations. Although this focus is important, it is noteworthy that there has been little research on the characteristics and progress of change induced by disasters. Change, as distinct from impacts, encompasses formal and informal responses to disaster events and their direct and indirect impacts. While smaller disasters do not often lead to significant changes in societies and organizational

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structures, major disasters have the potential to change dominant ways of thinking and acting. Against this background, the article presents an analytical framework for distinguishing change from disaster impacts. Drawing from research in Sri Lanka and Indonesia, formal and informal changes after the Indian Ocean Tsunami of 2004 are examined and discussed against the background of the conceptual framework. The changes examined range from the commencement of the peace process in Aceh, Indonesia, to organizational and legal reforms in Sri Lanka. The article concludes that change-making processes after disasters need to be understood more in depth in order to derive important strategic policy and methodological lessons learned for the future, particularly in view of the increasing complexity and uncertainty in decision making due to climate change.

Keywords Disasters, change · Formal and informal responses · Social learning · Adaptation

1 Introduction

The attention of governments, the international community, science, environment, and emergency management agencies is increasingly focused on climate change, adaptation, and disaster risk reduction, as management options for responding to the actual and potential consequences of environmental change and natural hazards.

Set against the challenge of climate change in the context of ongoing development challenges, the perception that we can fully manage risk or nature must be increasingly questioned (see, Birkmann 2006, 2008). Living with climate change increases complexity in terms of identifying the range of impacts as well as their interactions with socio-ecological systems and introduces greater uncertainty for the character and consequences of impacts (in terms of scale, location, timing, and frequency) and indeed about what longer term changes may result from climate change–development interactions. Complexity and uncertainty need to be considered in any adaptive or strategic planning dealing with the consequences of global environmental, social, political and economic change.

Smaller crises or disasters often do not lead to significant changes in societies, institutions, and organizations because the impacts can be managed within existing regulatory regimes, which means within existing institutions and organizations. However, this applies much less strongly to major disasters. Particularly, from the political economy theory point of view, larger crises and disasters can represent threshold events leading to organizational and institutional change where dominant ways of thinking and acting are subject to critical review and revision (see, e.g., Görg 2003). In this regard, disasters can catalyse structural and irreversible change by creating new conditions and relationships within environmental, socioeconomic and political structures, institutions and organizations.

Change signifies an alteration in the state or direction of social, economic, political, and environmental conditions that deviates from pre-disaster conditions, from an extrapolation of existing trends and which is substantial in terms of the impact on people's lives. Change may be judged socially progressive or regressive and is dependent upon the viewpoint of the observer. Change as we view it encompasses formal and informal responses—for example in terms of learning—which are clearly different from direct impacts of the disaster event. Change, even substantial and structural change, may be difficult to identify close to the point of origin. Also change, as distinct from impacts, has rarely been the subject of disaster research, with a few exceptions such as Quarantelli and Dynes (1985), and thus the methods and tools for identifying, analyzing and assessing change are not well developed.

The article presents an analytical framework for distinguishing change from disaster impacts and then applies this to a comparative assessment of the pathways that opened and closed opportunity for change in Sri Lanka and Aceh, Indonesia following the 2004 Tsunami.

1.1 Reasons for addressing the issue of change in the context of disaster

First, some empirical but largely anecdotal evidence suggests that disasters are linked to and can provide a space in which significant change can occur in relations in and between socioeconomic, organizational, political, and environmental domains (IRP 2007; DHS 2000; UNISDR 2007; Wisner et al. 2004). This space allows for unplanned, and often unnoticed, change to occur. It also allows for planned and purposeful change with a set of specific objectives and interventions to occur.

Second, change is a dynamic and a constant of human society. Disasters occur within this dynamic and may accelerate or modify it. Change and reorganization within and after disasters or perturbations are also two key factors when dealing with newer concepts of resilience linked to coupled social-ecological systems (Folke 2006, p. 257; Berkes et al. 2003; Holling 2003). Interestingly, the concept of change is also a counterpoint to the idea of building disaster resistance by creating robust systems that can withstand disaster impacts, and thus do not need to change or adapt.

Third, with forced and rapid global environmental change (such as climate change, more extreme events, and environmental degradation), societies need to learn how to develop change management strategies as well as how to learn from past disasters. Reviewing past changes and suggesting a systematic structure on how to capture and account for change is a key topic which we address in this article.

1.2 Windows of opportunity

In this article, we consider whether disasters provide “windows of opportunity” (Kingdon 1995) for change. Kingdon (1995) postulated that separate streams of problems, policies, and politics come together at certain critical times, then solutions become joined to problems, and both of them are joined to favorable political forces. He suggests that the coupling of problem–solutions with favorable contexts is most likely when a “policy window” is open and that policy windows are opened either by the appearance of compelling problems (e.g., a catastrophic disaster) or by events in the political realm (e.g., policy discourses or political actors that can be promoted through a positive response to the problem).

The idea of “windows of opportunity” was picked up, for example, by van Eijndhoven et al. (2001a), whose empirical analyses of societal responses to the issues of climate change, acid rain, and stratospheric ozone depletion showed that windows of opportunity enabled institutions not previously engaged to become involved in the issue and often precipitated renegotiation of leadership on the issue within already engaged institutions. They also provided an opening for new institutions to develop and become engaged. These shifts in the network of actors involved also led to issue reframing.

In this article, we seek to examine whether disasters provide a window of opportunity for changes in various dimensions. Recent evidence has begun to unpack this moment for change and suggest that dominant political actors are able to resist fundamental changes in political systems, while allowing more superficial changes in technological systems (Pelling 2006). In this context, the article also aims at developing a systematic framework to analyze and capture changes, after disasters associated with natural hazards. The article

offers preliminary comments and our expressed intent is to open up to a wider audience and for wider discussion the issue of how, in the context of climate change primarily and natural disasters secondarily, we can manage change and plan, structure, and implement adaptive arrangements.

1.3 Disaster

Disasters reveal the extreme differences in the way in which societies, communities, and individuals manage their lives and cope with and respond to adversity (Kates et al. 2006). Disasters are significant events which imply major harm and losses for those who are exposed to them. The United Nations International Strategy for Disaster Risk Reduction UNISDR) defines a disaster as:

“a serious disruption of the functioning of a community or a society causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community or society to cope using its own resources.” (UNISDR 2004, p. 17)

We fully acknowledge that preventive policies have to be a priority in disaster risk reduction. However, the issue of how disasters have triggered change and how that change is to be dealt with also has to be examined when trying to understand the complexity of environmental hazards, disasters, and change itself. Particularly, it is important to generate lessons learned from past disasters and to evaluate the nature, extent, and depth of change. Thus, disasters need to be prevented but the international community also points out that these disasters can sometimes be seen as an opportunity for change that might allow building more resilient nations and communities (UN 2005, p. 7).

There is little research on the circumstances under which disasters generate opportunities for change. Routinised data collection undertaken by humanitarian or affected governments prioritizes loss inventories and catalogues and emergency relief activities (see reports on Relief Web 2008a), but is rarely complemented by indicators to systematically identify lessons that could be learned and to track any changes in the policy or practice of reconstruction and mitigation.

In an analysis of agenda setting and policy processes in the context of disaster in the US, Birkland (2001), argues that individual rapid onset large disasters (earthquakes and hurricanes) act to focus attention and can lead to change where there is a clear discourse championed by influential policy actors. In the US, discourse is dominated by scientists and technical experts with little engagement from broad-based public interest groups that might press for more fundamental political and social policy change to reduce vulnerability (Birkland 1997). In the international community, the Action Learning Network of Accountability and Performance in Humanitarian Action is predominant and undertakes annual reviews of response and relief work to encourage learning in the humanitarian sector. However, this network is again focused on technical efficiency rather than the possibility that the political systems of impacted societies might themselves undergo formal and informal changes post-disaster (see ALNAP 2008).

2 Dimensions of change

Disaster impacts and subsequent change need to be distinguished. Disaster impacts include not only direct loss or damage but also indirect and secondary losses felt as impacts move

from affecting objects (people, buildings) to socio-ecological systems (markets, human health, etc.). Indirect and secondary impacts magnify loss, but are not interpreted here as change. Change is a response to impact, but is theoretically separate from it. As disaster impacts unfold change in response to one impact can condition vulnerability or resilience of an object or system to secondary and indirect impacts. In this way, it is not always easy to distinguish change from impact on the ground. There is a continuum of significance for changes—some may be of little consequence, whereas others may redirect entire political regimes.

Here, we are most interested in change that leads to long-term alterations or transformation in socio-ecological systems. Change is referred to by Olson and Gawronski (2003) as a critical juncture—a change that sets into motions a new trajectory for action, policy, or institutional regime. Changes can affect systems from the individual to the international in scale. Our primary focus is on national and local organizational systems, as these are the dominant actors in reconstruction and development. Change may be subtle and, in the short term, almost indistinguishable from background dynamics. Linking change to a particular disaster is therefore difficult and in some instances impossible. However, even though change may have multiple points of origin, we focus on post-disaster opportunities for change, without asserting that disaster is the only root-cause for changes.

We recognize that this distinction is derived in part from methodological exigencies, but it does highlight that impacts are a different class of analytical object to changes wrought by social responses to the disaster. Impacts are passive—received by a social actor; change is active (though not necessarily consciously chosen) and can be reflexive (spontaneous, automatic, not thought through) or reflective (strategic, planned, thought through) (Beck 1998). Change can be felt as part of the disaster itself—particularly changes that magnify or re-distribute suffering or loss—or as a response and feedback to the catastrophic outcome. In addition, change may be slow or rapid, planned or unplanned, linear or non-linear, predictable or non predictable. For our systematization, we distinguish primarily between formal and informal dimensions of change. While formal responses refer to changes undertaken by governmental organizations, informal responses refer to changes and actions where non-state actors are dominant as the sites and mobilisers of change (individuals or social groups; civil society or the private sector). In this way, an analysis of change links to the concepts of coping and adaptation (Table 1).

The following table provides a classification of the different qualities of impact and change.

In each cycle of impact and change, we construct the impact as the initiating event so that change is responsive. We do, however, acknowledge feedback between change and subsequent rounds of indirect or secondary impacts. In this way, causal relationships between the disaster and impacts are clearest for direct impacts with changes potentially shaping the path of secondary and indirect impacts. Impacts are closely defined as consequences resulting from a damaging act, changes are a product of conscious and unconscious social action or, in the environmental sphere, an alteration of functioning of ecosystems (discussed under the “domain of attraction”—concept; cf. Renaud et al. in this issue). Changes may unfold with non-linear and unpredictable consequences. Beside the systematization of the differences between impacts and change, change also might manifest itself in various dimensions, such as social, institutional, legal, organizational, economic, and environmental structures and settings.

Differences not only between impacts and change, but also between informal and formal responses as key components of change can be outlined as follows: (Fig. 1)

Table 1 Differentiation between impacts and change in post-disaster processes

Systematization of the differences between impacts and change

Order and time	Causal relationship	Intention	Type of phenomena	Characteristics of effects
Quality of impacts An initiating event	Direct impacts are determined by hazard and pre-disaster vulnerabilities, secondary and indirect impacts may be influenced by feedback from changes	Passive; unintentional	Determined by the severity of hazard, exposure, and susceptibility	Damage to health, wealth, and livelihoods; bounce back to situation/structure that was prevalent before the event or permanent loss (i.e., casualties)
Quality of change A responsive event	May be consequential on impacts or other changes. Mediated through reflexive and reflective action	Active; may be unintended but may also be intended and planned. Planned action can also lead in a second phase to unintended consequences of intentional behavior	Complex in terms of non-linearity, interactions with other dynamics, implies medium and long-term consequences for different social, political, and other entities	Technological, social, political, and environmental systems regime change. Different structures and/or processes from situation before the event

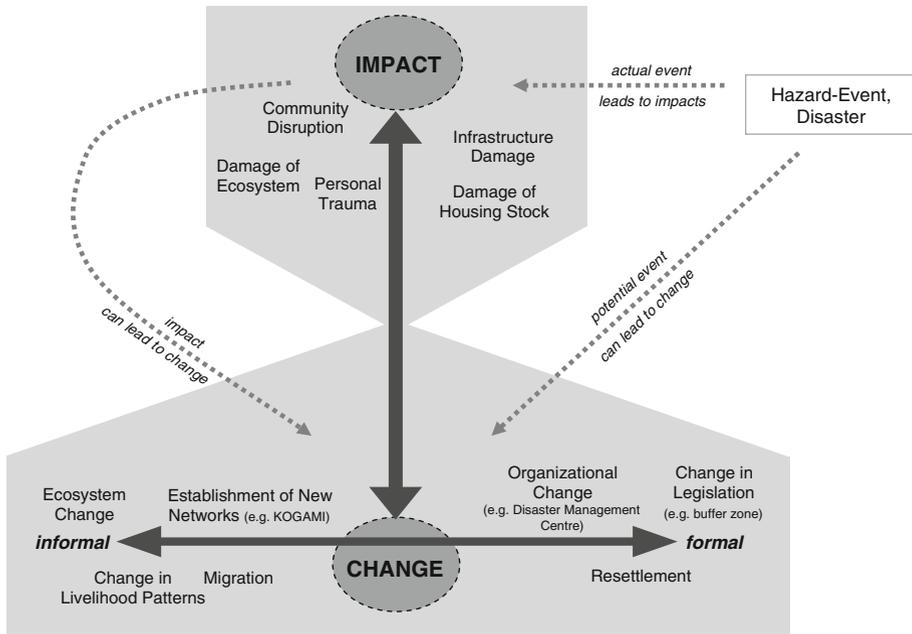


Fig. 1 Differentiating impacts and change

Overall, current research does not give sufficient emphasis to the question of understanding change processes after disasters and lessons learned. Empirical studies suggest, however, that in the broad area of global environmental risk management self-conscious (reflective) evaluation of lessons learned is rare (van Eijndhoven et al. 2001b), pointing to a weakness in societal responses to environmental risks. Based on these observations and through the application of the framework described above, the following section presents an analysis of major changes occurring after the Indian Ocean Tsunami of 2004.

3 The Indian Ocean Tsunami 2004

The Indian Ocean Tsunami of December 26, 2004 brought to light the vulnerability of coastal communities to low-frequency, extreme events. The human toll—roughly 230,000 fatalities—and the total economic impact of at least US\$ 10 billion made this disaster one of the most destructive events in recent times. Although tsunamis in some regions are frequent phenomena, severe tsunamis are low-frequency events. Societies can often cope with known and frequent hazards, but to cope with and adapt to low-frequency hazards is much more difficult (Birkmann 2007). The analysis of changes after the disaster discusses the cases of Indonesia and Sri Lanka, two of the most severely hit countries. Interestingly, in both countries the regions hit hardest were also facing violent conflicts.

3.1 Impacts of Tsunami

The December 26, 2004 Tsunami caused heavy loss of life and great destruction both in Indonesia (Aceh) and Sri Lanka (North-East and South-West). The sectors most affected

Table 2 Analysis of Impact on Individual Sectors in Indonesia and Sri Lanka (Mio. US\$)

	Indonesia			Sri Lanka		
	Damages ¹	Losses	Total	Damages	Losses	Total
Social sector (housing, health, education)	1,675	66	1,741	494	5	499
Productive sectors (agriculture, fisheries, industry and commerce, tourism)	352	830	1,182	367	269	636
Infrastructure (water supply, electricity, transport)	636	241	877	273	36	309
Cross sectional (environment and others)	258	394	652	10	0	10
Total	2,920	1,531	4,452	1,144	310	1,454

Source ADPC (2006, p. 16) and BAPPENAS (2005)

were the social sector (housing), private-sector assets, and activities that relate directly to the livelihoods of the communities such as fisheries, agriculture, tourism, and transportation. In general, the analysis of the direct and indirect impacts of the tsunami in different sectors shows that the affected areas in Indonesia suffered more in terms of the total damage and loss (see Table 2).

The tsunami and its impact drew global attention to the affected countries, although this may have been partly due to countries like Thailand, Sri Lanka, Indonesia, and the Maldives being major destinations for Western tourists. Adding the government of Indonesia's contribution with that of NGOs and Donors, a total of USD 8.85 Billion was pledged (BRR 2005) for Indonesia, and for Sri Lanka a total of about USD 4 Billion (own calculations based on Relief Web 2008b). This funding made available for the relief and reconstruction activities was a key for the rapid reconstruction process; however, it also led to problems in terms of coordination of various stakeholders, projects, and activities. In some cases, conflicting interests between various stakeholders became apparent.

In the following part, we examine major formal and informal responses that describe the changes that took place in the post-tsunami phase.

3.2 Formal responses

While the reconstruction process was taking place, there were various efforts to increase resilience to tsunami and natural disasters in the affected areas. Although it is difficult to get an overview of the different strategies and projects undertaken to increase resilience, Birkmann (2007) indicated that particularly for the reconstruction and recovery process in Sri Lanka and Indonesia, main strategies and formal responses to increase resilience of coastal communities were as follows:

- (a) the establishment of a "Buffer Zone" and "Resettlement";
- (b) the development of "Tsunami Early Warning Systems";
- (c) the creation of new organizations and institutions.

¹ ADPC and BAPPENAS use the damage and loss assessment methodology developed originally by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), which defines damages as the replacement value of destroyed physical assets while losses are an estimation of economic losses arising from the temporary absence of assets.

3.2.1 Buffer zone

In Sri Lanka, an important discussion emerged after the tsunami about the establishment and declaration of a “buffer zone.” This zone is to prevent houses being built again in areas of high tsunami exposure. The issue of the buffer zone is closely linked to the subject of resettlement. Thus, both strategies will be reviewed jointly.

It is noteworthy that the buffer zone in Sri Lanka (“no construction zone”) was formally required since 1997 by the “Coast Conservation Plan” that identified 35–125 m as a necessary buffer zone according to the specific coastal risks.² However, this plan was not properly enforced. Following the catastrophic human toll and losses in the tsunami disaster, the Sri Lankan Cabinet decided in January 2005 to amend and fully enforce a buffer zone of 100 m in the south and southwest and of 200 m in the north and northeast, as the human loss and the damage of property due to the Indian Ocean Tsunami was higher in the north and northeast than in the south of Sri Lanka (Department of Census and Statistics Sri Lanka 2004). These zones were officially reintroduced as a public safety measure in order to minimize human loss of life and property damage in case of future tsunamis. However, this intervention and strategy had ambivalent consequences, particularly for those who had been living in the buffer zone before the event. For example, these groups did not get financial support for the reconstruction of their houses in the first phase of the reconstruction process. They were put “on hold” until the resettlement areas were constructed and permission given for relocation. These problems linked to the management of the buffer zone put the Sri Lankan Government and in particular the Coastal Conservation Department under massive public criticism. Soon after the first declaration of the buffer zone of 100 m, regulations were frequently changed. This contributed to a climate of uncertainty that hampered further investment and a fast recovery process especially for those who were living in the highly exposed area. On the other hand, after the disaster many people wanted to move out of the buffer zone for various reasons (see Birkmann and Fernando 2008; Birkmann et al. 2006). In summary, the “buffer zone” has on the one hand generated many conflicts particularly due to the lack of transparency, the frequent changes (no investment security), and the different treatment (apparent inequity) of the south and north, north-east region (Birkmann 2007; Birkmann and Fernando 2008). On the other hand, the buffer zone and the relocation strategy was an opportunity for some households—especially landless households in the highly exposed area—to get out of chronic poverty by acquiring a plot of land and a well-constructed home in a relocation site. Nevertheless, the lack of job opportunities (derived from dependency on close proximity to the coastal zone) and the drawn out process in developing appropriate relocation sites contributed to massive problems that emerged from the establishment of the no construction zone.

Indonesia also proposed a buffer zone in tsunami-affected regions through a master plan for the reconstruction of Aceh (President Act No. 30/2005 on Master Plan of Rehabilitation and Reconstruction in Aceh and Nias). This plan contains proposals for two buffer zones: a 300-m coastal strip to be kept free of buildings and a 1.6-km wide secondary buffer zone in which re-building will be greatly restricted (Fitzpatrick 2005). However, this buffer zone

² Already in 1981, the newly established Coast Conservation Department (CCD) declared a 300-m Coastal Zone under the Coast Conservation Act No. 57. According to this act, any development in that zone requires a permit from the CCD. Every construction without a permit is called unauthorized construction and is by law amenable for demolition by the CCD. In reality, however, large numbers of houses were built in the Coastal Zone without proper clearance from the CCD prior to the tsunami, mainly with the blessings from the politicians in the respective area.

policy has also generated tensions. From our research activities in Indonesia, we know that in some places fishermen communities are still allowed to live within these zones while other groups and communities were and will be resettled by the government. However, it is difficult to get a comprehensive picture about the implementation of the buffer-zone regulation in Aceh.

Overall, the implementation of the buffer zone and the resettlement process as two major formal responses to the tsunami disaster—implemented by the national governments often in cooperation with the district and local governments—had positive and negative consequences. On the one hand, the tsunami hazard exposure was reduced by these interventions and some households could get out of chronic poverty; on the other hand uncertainty, the lack of transparency and the long time taken for relocation led to major problems for affected people. This is an outcome of our in-depth research in Sri Lanka. Many people are closely linked in their livelihood to activities and jobs at the coast. Thus relocation to sites inland generated new vulnerabilities for tsunami-affected communities, especially around the maintenance of livelihoods. These difficulties led some people to swap one risk for another by moving back to the coast.

Whether the buffer zone and the resettlement allowed people to reduce vulnerability and increase resilience depended mainly on the household characteristics, their need to work at the coast, and the support they received from governmental agencies and NGOs. Interestingly, the consequences and implications of these strategies in reality show the dualistic and ambivalent nature of the changes undertaken by formal interventions. We can see formal, planned responses in the form of legislation (buffer zone) and the building of “new communities” (resettlement process) and informal responses such as moving back to homes close to the source of livelihoods or the change of livelihood activities and strategies in some of the new locations.

3.2.2 *Early warning systems*

Soon after the tsunami, international concern regarding the need for a tsunami early warning system for the Indian Ocean intensified. At the World Conference on Disaster Reduction in Kobe (WCDR), in January 2005, the international community agreed that the establishment of a tsunami early warning system was essential for the preparedness and safety of coastal communities.

At the early stage of the development of Tsunami Early Warning System, the efforts in Indonesia and Sri Lanka were mainly centered on technical issues, such as installation of surface buoys and ocean-bottom pressure sensors. In Indonesia, for instance, 16 national institutions with the support from international teams have been working on the establishment of the tsunami early warning system. The installation of the technology has been completed and an operational system was officially launched by the Indonesian government on November 11, 2008.

It has been recognized that the technical challenges are only one set of important issues that have to be solved if warning chains and evacuation plans are to be effective in saving the lives of the exposed population, reducing economic damage in different sectors, and building resilience in the mid and long-term (Birkmann 2008). In order to get a comprehensive overview of the situation of coastal communities, people-centered early warning, risk, and vulnerability assessments were conducted at sub-national and local level to identify those groups, regions, and economic sectors that are most vulnerable. From this information base, we may be able to start developing viable options for EWS (see e.g., Post et al. 2007; Birkmann et al. 2007).

Different activities related to tsunami preparedness have been conducted in some coastal regions in Indonesia, such as evacuation drills, development of different dissemination media for warning at local levels, as well as awareness-raising activities. The initiatives vary across the coastal regions, some communities such as in the city of Padang (Indonesia) are very active also in terms of increasing awareness in local communities and preparing an evacuation plan, while other communities and municipalities remain passive and mainly view early warning as a national and governmental task, rather than as an integrative strategy of warning institutions and response agents.

3.2.3 *New organizations and legislation*

Sri Lanka established a new “Disaster Management Act” on May 13, 2005, and the Disaster Management Centre (DMC) became operational in September 2005 to oversee disaster management and applying a multi-hazard approach. The main aims of the Disaster Management Act are the establishment of the National Council for Disaster Management (NCDM); the Disaster Management Centre; the appointment of technical advisory committees, and the preparation of disaster management plans (Disaster Management Act No 13 of Sri Lanka 2005, p. 280). At present, the Disaster Management Centre (DMC) is within the Ministry of Human Rights and Disaster Management. Besides the establishment of the Disaster Management Centre, the Government of Sri Lanka also created an institutional mechanism to coordinate assistance by setting up three task forces under the President namely:

- The Task Force for Rescue and Relief (TAFRER),
- The Task Force for Law and Order and Logistics (TAFLOL),
- The Task Force to Rebuild the Nation (TAFREN).

It is too early to assess the effectiveness of these institutional reforms.³ Although new organizations and management structures were created to avoid disasters, it has to be acknowledged that these organizational changes could not prevent the intensification of the military conflict, a civil disaster of long standing. Indeed some conflict was intensified through the competition for aid resources and the aid distribution process, such as manifested in the debate about the “joint mechanism” (UNDP 2006).

In Indonesia, major organizational changes were also introduced after the tsunami. The coordination of the reconstruction process after tsunami was managed by a newly created agency called Reconstruction and Rehabilitation Agency of Aceh and Nias (BRR) which was established by the President based on Government Regulation Substituting a Law No. 2/2005. This agency is operating in Aceh and Nias until 2009. Furthermore, in 2006, a national plan was developed and issued by the National Development Planning Agency (BAPPENAS) and the National Coordinating Management Agency (BAKORNAS), including Disaster Risk Reduction as a national and local priority for building resilience at all administrative and community levels. As in Sri Lanka, progress in disaster management structures has also been achieved in Indonesia. A new Disaster Management Law (UU 24/2007) has been issued in the year 2007, putting more emphasis on the establishment of national as well as local (Province and District) disaster management agencies. The new law replaced the existing disaster management coordinating body which had only limited functions (coordination function only), by a structure and organization which has also

³ TAFRER, TAFLOL, and TAFREN, which together constituted RADA (Reconstruction and Development Agency), were later on integrated into one organization, the newly established Nation Building Ministry.

implementing competences. The National Disaster Management Agency was founded in October 2007, while at the provincial and district level local agencies as well as action plans are being prepared in parallel.

Overall, the post-tsunami and recovery process implied major changes in organizational structures, the creation of new agencies and legislations for disaster management in both Sri Lanka and Indonesia. Although this tendency is positive, particularly with regard to the development of institutional memories and deriving lessons learned from the disasters through new organizational structures, some problems need to be pointed out.

In Sri Lanka, most of the newly created organizations particularly in the disaster management area consist of former military personnel, that also has consequences on the strategic direction and mind set of these agencies. Most of these agencies therefore developed disaster response plans, rather than prevention and adaptation plans, which focus more on planning and long-term preparedness. However, the future will show whether this disaster management focus and the personnel involved is going to focus on disaster management from a more military perspective or whether also other views on disaster—especially a holistic perspective—will manifest themselves within the new organization. Often disaster management agencies composed of primarily military staff have the tendency to view disaster and natural hazards as sudden shocks affecting society, rather than as complex emergencies, which also are emerging from various social vulnerabilities within the society. It is noteworthy that the DMC together with UNDP developed a comprehensive strategy for disaster risk reduction called “Road Map for Disaster Risk Management” (MDM 2005).

Whether this will be the guiding vision for the DMC in the future is still to be seen. Particularly for Sri Lanka, activities for preparedness, evacuation, and early warning were not conducted due to the intensification of the military conflict in the north-eastern region.

3.3 Peace establishment in conflict region Aceh, Indonesia

The political changes that have emerged after the disaster in terms of the ending or intensification of the violent conflict in the most affected areas in Indonesia are a combination of formal and informal responses.

Interestingly, both countries—and especially the most affected regions—were characterized by endemic conflict before the tsunami. In Sri Lanka, the conflict between the Tamil Tigers for Tamil Eelam (LTTE) and the Sri Lankan government has eroded the political, social, and legal rights of many Sri Lankans, and particularly those who are living in the eastern and northern provinces. Similarly, the island of Sumatra, particularly the region of Banda Aceh, is subject to a 30-year long violent conflict between the Free Aceh Movement (GAM) and the national government.

Attempts at a peace agreement had been taking place in Aceh prior to the tsunami event, but the tsunami catalyzed the process by shifting the attention from conflict to survival, revealing the inefficient local government capacities growing after decades of conflict, as well as opening the influx of civil society involvement and international players (Tjhin 2005). A Memorandum of Understanding (MoU) was signed on August 15, 2005 by both GAM and the Indonesian government. The same process was initiated in the conflict regions in Sri Lanka, but unfortunately due to the different treatment of the eastern and northern provinces, the deep mistrust and the lack of achieving a consensus about the distribution of national and international aid and reconstruction support, the conflict rather intensified in the post-tsunami process. The linkages between the disaster response and the diplomatic activities at international and national level in Indonesia and Sri Lanka are also

explored in different articles within the research field of disaster diplomacy (see, e.g., Kelman 2007; Kelman and Gaillard 2007).

3.4 Informal responses

In addition to the formal responses discussed previously, which are based on legislation, land use planning, and organizational restructuring, important changes in the daily life of people have also been observed in Sri Lanka and Indonesia after the tsunami.

The tsunami in Indonesia and Sri Lanka has brought about traumatic feelings and memory for the affected communities as well as the neighboring regions—as an example of an immediate change. Moreover, we observed also medium and long-term changes. In both countries, people are in general more aware of the tsunami risk, which is also still a topic in the national media. Household surveys in selected cities in Sri Lanka and in Indonesia revealed that tsunami still ranks among the priority threats of people in coastal communities in 2008. Additionally, we observed in Indonesia that some households moved to higher grounds, since they were afraid of tsunami occurrence at the coast. These changes in psychological status and perception of risk—we also know from other events—can be very long lasting.

In addition, some of the affected households that were resettled indicate that although the majority is still living in these resettlement areas, some households have major problems dealing with and adapting to formal responses and changes. In particular, those households that returned to the coast showed that job security and the livelihood dependence of people on the coast creates a conflict between the interest of living in a safe place inland and the need to travel long distances to the coastal strip for work every day. For these communities, special attention and awareness-raising must be provided, which is a challenge, since these activities require long-term engagement, also far beyond the time-frame of a reconstruction phase.

In terms of medium and long-term changes and adaptive measures, it is noteworthy that some fisher communities, for example in the city of Padang (Sumatra/Indonesia), have established informal groups for financial risk sharing. They are saving some of their earnings for needs that might occur due to future extreme events, such as coastal storms. In the city of Padang, the community is proactively promoting awareness on tsunami risk and coastal hazards in general. An NGO established after the tsunami, named Tsunami Alert Community (KOGAMI), is one of the major stakeholders. Its main program is to educate people on disaster preparedness and to inform them what to do in the case of extreme natural events, especially earthquake and tsunamis. The members of KOGAMI are coming from different disciplines; interestingly, mainly encompassing a group of students or former students who are concerned about disaster risk reduction. This kind of initiative is a good example of informal changes happening in communities, especially among those who did not experience disaster directly, but take it as a lesson to build their own resilience in the post-tsunami process.

In the following, we summarize the major changes identified in the post-tsunami process in Sri Lanka and Indonesia (see Tables 3, 4). These tables are not intended to be comprehensive. The overview illustrates that important changes after the tsunami can be systematized and captured in terms of immediate changes, formal and informal responses, and with regard to different dimensions: legal/political, organizational, economic, social, and environment.

Table 3 Changes identified after Tsunami in Indonesia

	Immediate changes	Formal response	Informal response
Legal/political	International attention and interventions through donor countries/ organization Foreign military enters the affected region for assistance	National Action Plan for Disaster Management New Disaster Management Law (UU 24/2007) Early warning system Integrating disaster risk reduction into reconstruction strategies, e.g., spatial planning, evacuation plans, buffer zone	The use of disaster related activities to mediate ongoing political and military conflict
Organizational	Need of coordination during disaster relief and reconstruction	A national coordinating body for rehabilitation and reconstruction (BRR) in Aceh and Nias established New structures and roles of disaster management agency Development of national and local disaster management plan	New NGOs initiative in raising disaster awareness and preparedness (e.g., KOGAMI)
Economic	Financial needs for affected economic sectors Unemployment	Donation of fishing boats Microfinance activities in order to recover livelihoods in the affected areas	In some cases arrangement of community group to secure the livelihood in case of natural events (risk sharing)
Social	Displacement and forced migration Trauma Lack of access to infrastructure	Disaster preparedness socialization and campaign Peace agreement in Aceh (Indonesia)	Changing perception on risk Moving from coastal region Dependence on aid
Environment	Salinisation of wells Uplift and submergence of some land areas	Mangrove plantation	Heightened awareness of the value of environmental systems/environmental services

4 Conclusions

We have used the 2004 Indian Ocean Tsunami to illustrate that disaster impacts can be differentiated from medium- and longer-term structural change within societies. Disaster is a driver of both impact and changes and can provide a “window of opportunity” for the latter. Using this case study, we have argued that change may occur within a number of interacting domains including social, economic, environmental, and legal systems. Furthermore, change can occur in reflective-planned and deliberate ways or in unplanned, reflexive modes. Change can be classified as primarily linked to formal responses (governments, legal interventions, amendment of organizational structures) and informal responses (individual groups, households, often occurring at very local levels).

A better understanding and a critical appreciation of change resulting from disasters will support the further development of conceptual and policy frameworks and thus improve the understanding of societal responses to environmental risks including climate change. In this respect, it is important to keep in mind that climate change introduces greater uncertainty into decision making. This uncertainty calls for an understanding of the social processes that shape behavioral change pre- and post-disaster (Pelling et al. 2008).

Table 4 Changes identified after Tsunami in Sri Lanka

	Immediate changes	Formal response	Informal response
Legal/political	International attention and interventions through donor countries/ organization Foreign military enters the affected region for assistance.	New Disaster Management Act Early warning system Buffer zone Development of a national Disaster Risk Reduction Strategy called “Road Map” with support of UNDP	Uncertainty, disregard of rules and regulations put in place by formal organizations. Using the chance to get out of chronic poverty, through relocation.
Organizational	Need of coordination during disaster relief and reconstruction	Establishment of DMC Establishment of TAFRER, TAFLOL, TAFREN Development of tsunami Early Warning System/Plan	Aid hampered to a certain degree own initiatives to recover in the first phase;
Economic	Financial needs for affected economic sectors Unemployment	Aid distribution to all affected people Distribution of new boats and fishing equipment	Swapping of “safety” for “livelihood security” People maintaining primarily in the same occupation or economic sector
Social	Changes in the household size and composition Loss of breadwinner Migration Trauma Lack of access to infrastructure	Resettlement due to buffer zone intervention Disaster preparedness socialization and evacuation training in the South	Changing perception on risk and hazard priorities Moving from coastal region Lack of access to social and economic infrastructure in the new settlement area Moving back to the buffer zone
Environment	Damage of ecosystems Pollution of wells	Establishment of protocols and organizations to manage recovery	Heightened awareness of the value of environmental systems, environmental services especially in rural communities which faced the salinization of wells

Unpredictable and extreme events associated with climate change, and other geophysical hazard phenomena are likely to increase the frequency with which existing local hazard mitigation infrastructure and planning fail. This places new emphasis on the need to understand and make visible the social processes that shape post-disaster change.

Interestingly, in both case study countries, the most obvious changes took place in formal responses. This included change in organizational structures, such as the creation of Disaster Management Centre, and in social policy, leading to relocation or migration. Formal interventions undertaken after disasters are often intended to promote resilience and vulnerability reduction; however, in reality many strategies are ambivalent and have dualistic effects. In particular, relocation in both countries, but especially in Sri Lanka, has undermined livelihoods, disrupted social networks, and led to social tensions between relocated and host populations. On the other hand, some households also benefited through these interventions and view their current situation, for example, in relocation sites, as being better than before the tsunami.

At the level of national politics, in Aceh, Indonesia, the destruction and external assistance contributed to the peace process, providing a catalyst for political actors to

negotiate change. This contrasts with Sri Lanka where among other factors the handling of disaster response—especially the joint mechanism and conflict surrounding the buffer zone—arguably contributed to the intensification of armed conflict. Indeed, the disaster fed into a political process leading to increased military action and a collapse of the cease-fire.

This article has developed a first systematic framework for the analysis of changes after a disaster. Based on the lessons learned from the tsunami, some general conclusions can be made:

- Change can occur in many ways, but capturing, observing, and evaluating informal responses is more difficult than identifying formal responses that will be recorded through critical junctures such as new legislation, organizational reform, or policy innovation.
- Disaster-related changes have socially progressive and regressive outcomes and need not lead to reducing vulnerability or enhancing adaptive capacity and development status of the vulnerable.
- Disasters may generate very large resource inflows that provide an opportunity for financing and supporting structural developmental activities.
- New stakeholders and policy communities often become involved in reconstruction or rehabilitation of affected regions and create through their needs, priorities, and agendas changes that are unpredictable and this involvement of new actors is a significant feature of learning processes.
- Disaster changes are manifested across social, environmental, economic, and political domains; often the most visible changes are in the mandate or resourcing of existing organizations or the creation of new organizations, such as seen through the establishment of the Disaster Management Centre in Sri Lanka.
- The case of the tsunami clearly shows that in Indonesia the massive destruction and the enormous help from outside was a major trigger for the peace process in Aceh and for political actors within the region to change their position. In contrast, in Sri Lanka, the handling of disaster response—especially, the joint mechanism and the different treatment within the buffer-zone regulation—contributed to some extent to the intensification of the ethnic and military conflict.
- The changes observed go beyond a very limited adjustment of the status quo. The lessons learned and the capacity to learn through institutional memories and organizational structures need to be strengthened and this requires also the documentation of experiences about sustainable formal and informal responses to disaster.
- It is important to promote change where necessary and not to support the perception that future global environmental change can be managed with the current structures and organizations, since past disasters have proven that this perception is a great risk in itself.
- Future environmental changes—such as climate change—and related disaster risks due to extreme events will require adaptation. From our analysis, we would recommend the intensification of research on changes after disasters also with longitudinal studies in order to generate more expertise about good lessons learned.
- Lastly, it would be fruitful to link the discussion on changes and formal and informal responses more intensively to social learning theory—understood in broad terms by situating learning within social groups in addition to the individual (cf. Pelling and High 2005). Additionally, it would be rewarding to link the discussion on change versus impact to organizational and institutional learning theories and concepts, for example discussed within the humanitarian and NGO sector (see, e.g., van Brabant

1997; Twigg and Steiner 2002). Particularly, it seems to be important to ask how learning takes place in organizational structures as well as within single organizations and how opportunities for learning under time pressure—particularly in the post-disaster phase—can be created (cf. Argyris 1999; Twigg and Steiner 2002; Bohle 2008).

In this article, we make a distinction between impacts and change. We did this not only because there are two dimensions of disaster risk reduction, where change as a multifaceted consequence of disaster has often been overlooked in the past but also because climate change is highly likely to manifest itself in more and increasingly severe extreme events and disasters due to hazards of natural origin.

These disasters as well as slow onset processes, for example, sea level rise, coastal erosion, or salt water intrusion will require new approaches for identifying and assessing risks and dealing with them by paying particular attention to changes that have been introduced through these or previous disasters. The development of a methodology for assessing change after disasters seems to be a valuable goal for promoting a more systematized approach for tracking lessons learned and understanding societal responses to environmental risks.

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