Risk and Resilience in practice: hazards, vulnerabilities, displaced people, local communities and heritages

Guest Editors: A. Nuno Martins, José Manuel Mendes and Pedro Pinto Santos
Risk and resilience in practice: vulnerabilities, displaced people, local communities and heritages

The global assessment report published in 2019, evaluating the lessons from the implementation of the Sendai Report (UNDRR, 2019), directly challenge existing risk assessment approaches to deal with complexity and incorporate surprise as the new normal. The new approaches to risk assessment must also give us tools to tackle and implement the objectives and goals set in the international risk governance instruments, as the Sendai Framework for Disaster Risk Reduction 2015-2030, the Transforming our World: the 2030 Agenda for Sustainable Development, the Paris Agreement, the Addis Ababa Action Agenda and the New Urban Agenda (NUA).

The world faces the emergence of a new climatic regime connected to the increased possibility of natural and human-made hazards, extreme events and massive people displacements. In this new Anthropocene era (Blok and Jensen, 2019), research and analytic approaches must be multi-disciplinary and multi-scalar, incorporating communities and affected population in truly participatory and changing processes.

This special issue results from a first selection of papers presented in the 8th International Conference on Building Resilience that took place in Lisbon on November 2018, under the general theme Risk and Resilience in practice: Vulnerabilities, Displaced People, Local Communities and Heritages. The conference topics were structured according to the four priorities of the Sendai Framework. This first group of papers reflects the orientation of the different conference thematic tracks. They mainly focus on strengthening disaster risk governance to manage disaster risk, understanding disaster risk, enhancing disaster preparedness for effective response and to “build back better” in recovery, rehabilitation and reconstruction and investing in disaster risk reduction for resilience. Often from a comparative perspective, the current articles address strategies to foster community resilience and sustainable livelihoods and how to implement resilience through local-community-based processes.

In the first paper, Mittul Vahanti and Irina Raffiana propose a critical review of the concept of building back better (BBB), emphasising that its conceptual definition by the UNDRR occurred only in 2017. From the authors’ standpoint, the socio-ecological systems perspective, a resilient system always results from system transformation. The authors advance an innovative and operational BBB resilience scheme consisting of six themes: governance, economy, ecology, human settlement, vulnerable communities and safety nets and essential services. The comparative analysis of recovery and reconstruction processes in Bihar (India) and Mentawai (Indonesia) leads the authors’ to conclude for the relevance of strengthening human capabilities and sustaining capacity for resilience building of those living with risk and poverty.

Nuha Eltinay’s paper aims to analyse and redefine the meaning of resilience in the Arab Region context, taking into account climate change, conflict and displacement. The overall approach is based on the notion of “the fragile city”. The comparative framework is structured along a careful analysis of UNDRR Disaster Resilience Scorecard, as it was applied to the city-to-city (C2C) resilience building programme exchange between Amman (Jordan) and Khartoum (Sudan). The main conclusion is that the existing toolkits and United Nations frameworks are marked by an objectivist approach, ignoring the social
constructionism of refugees and internally displaced persons and the need for an approach based on human rights access to land and security.

Francisco Freitas and José Manuel Mendes paper change the context of analysis to Europe, and specifically to Portugal. Taking as a starting point, the forest fires of 2017 and 2018 and their heavy toll on human and material losses, the authors highlight the importance of data for reconstruction, of the application of transparency and accountability principles and the guiding notion of data for social good. They emphasise the need for analysing the role of infrastructure in safety and of design and technology innovations for effectively changing the preparation for future events. For the authors, the Portuguese context lacks a principle of information to foster democracy and safety. They conclude that data for social good and data activism do promote strong ties and community participation, assuring sustainable post-disaster recovery processes.

The paper by Liliane Hobeica and Adib Hobeica focusses on the role of design for built-environment professionals in flood adaptation. The authors compare architectural practices for the integration of flood risk in urbanism through three case studies: Coimbra (Portugal), Antwerp (Belgium) and Bordeaux (France). The main conclusion is that built-environment professionals do not realise their potential as flood designers mainly because of a mindset and contexts of professional practice that portray floods as a constraint and not as an opportunity. For these professionals to deal with flood adaptation challenges, there is a need for acquiring soft skills, beyond technical expertise, as professional openness and a positive mindset.

Abel Táiti Konno Pinheiro analyses the evacuation strategies for childcare facilities in two cities after the Great Eastern Japan Earthquake of 2011. His main objective is to fully understand the effectiveness of early warning and community cooperation in evacuation processes related to coastal hazards. His comparative and meticulous analysis shows the importance of pre-designated emergency plans and emergency meeting points, as well as the explicit incorporation of community cooperation, and its adaptation to the specificities of terrain and internal and external dynamics of the childcare facilities.

The paper by A. Nuno Martins and Aline Rocha proposes a comparative analysis of the role of local NGOs in promoting resilient architectural practices in informal settlements. Based on fieldwork and using a qualitative approach, they study a ‘favela’ in Rio de Janeiro (Brazil) and an informal settlement in Bissau (Guinea-Bissau). The two case studies show how social innovation tools anchored on community participation and addressing disaster risk issues can enhance the sustainability of humanitarian approaches to architecture and urbanism. The authors argue for the crucial role of co-development and co-designing strategies that stem from lived experience, traditions, expectations and risk perceptions.

Florence Zapico addresses the factors that endanger traditional agroecosystems and specifically those inhabited by indigenous tribes. She uses as case studies farming villages in the province of Sarangani in Southern Philippines. The author shows how unregulated application of modern capitalised agricultural, with no regard for ecological, socio-economic and genetic consequences has led to soil impoverishment, agro-biodiversity losses and socio-economic downturns. Zapico proposes a multi-disciplinary, bottom-up and participatory approach. She discusses frontier technologies and local knowledge concerning food production and environmental preservation for assuring the existence and survival of agroecosystems, their peoples and resources.

Finally, Ali Jamshed evaluates the Model Villages programme in a post-disaster context in Pakistan, comparing between governmental and non-governmental resettlement initiatives and their different impacts in promoting community resilience. Resorting to the application of a survey and the construction of a community resilience index, Jamshed
concludes that access to education, health, safety and hazard information can enhance resilience. The results also show better performances in resettlements process coordinated by NGOs. In the conclusions, the author recommends incremental and participatory planning approaches with a broader reach.

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References


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Reliability of Build Back Better at enhancing resilience of communities

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Abstract
Purpose – The purpose of this study is to analyse the reliability of Build Back Better slogan in the context of post-disaster housing reconstruction in developing countries, at enhancing disaster-resilience of housing and its occupants in the long term from socio-ecological systems resilience perspective.

Design/methodology/approach – A predominantly qualitative methodology and multi-disciplinary case study methodology is adopted to compare long-term outcomes of two post-disaster housing reconstruction interventions: post-2008 Bihar Kosi River floods in India and post-2010 Mentawai earthquake and tsunami in Indonesia.

Findings – Out of the nine generalizable findings, two of the most significant findings include giving freedom of choice or human capabilities to the disaster survivors and sustaining capacity development during and beyond the completion of housing reconstruction. These two processes play a significant role in linking reconstruction to resilience in the long term, especially of those living at-risk and poverty.

Originality/value – This paper further advances the current scholarship on overarching long-term impacts of housing reconstruction efforts, based on longitudinal and empirical studies in India and Indonesia. While these findings represent a snapshot of diverse and complex disaster experiences in the developing-world context, the comparison offers insight into how to turn the rhetoric surrounding “owner-driven” or “built back better” into long-term resilience outcomes.

Keywords Post-disaster reconstruction, Developing country, Build Back Better, Housing and settlement, Owner-driven reconstruction, Socio-ecological system resilience, Community participatory, India, Indonesia

Paper type Research paper

1. Introduction
The slogan of Build Back Better (BBB) has gained international recognition in post-disaster recovery efforts since its introduction after the 2004 Indian Ocean tsunami (Clinton, 2006). Since then various international organisations such as the Global Fund for Disaster Risk Reduction and the World Bank have started using BBB in their recovery efforts. To add, BBB has also been used in many recovery efforts as post-2008 Cyclone Nargis in Myanmar, post-2010 earthquake in Haiti, post-2010 Mentawai earthquake and tsunami in Indonesia and post-2011 earthquake in Nepal. BBB being evoked as an injunction for disaster risk reduction (DRR) and enhancing resilience under Priority 4 of the Sendai Framework (2015-...
2030) (UNISDR, 2015). Yet, there is limited research corroborating such claims in the long term. This paper addresses the question of reliability of BBB in contributing to the socio-ecological resilience objective in the long term after reconstruction completion.

Firstly, the paper presents a literature review on BBB, which identified three challenges – a lack of clear definition of BBB, few typologies of resilience concept, which is termed as the goal of BBB and thus challenges in operationalising resilience concept during recovery efforts, as discussed below. Section 2 outlines the research methodology, followed by empirical evidence from case study reconstruction sites in Section 3. Section 4 presents a comparative analysis of mid-term outcomes in Bihar and Mentawai, with discussion on whether and how BBB slogan created pathways or barriers to building resilience from socio-ecological systems (SES) perspective.

1.1 Build Back Better – conceptual definition
Until 2017 there was no definition for BBB. The closest description of BBB (Clinton, 2006, p. 2) was:

[...] a new kind of recovery that not only restores what existed previously, but goes beyond; seizing the moral, political, managerial, and financial opportunities the crisis has offered governments to set communities on a better and safer development path.

However, UNISDR (2017) provided a definition for BBB as:

The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment.

The difference between the description provided by Clinton (2006) and UNISDR (2017) is that BBB was initially promoted as a new kind of recovery as it promotes recoveries at many fronts – physical, societal, economies and environment. However, as per Clinton the goal of BBB is to set communities on a safer development path, while for UNISDR (2017), it is about increasing the resilience of nations and communities.

The authors argue that there is nothing new that the BBB slogan has to offer that the current recovery discourse does not. It is just another term that has been introduced in recovery scholarship. Besides, BBB is at risk of diverse interpretations as observed by Duryog Nivaran (2016, p. 5) as – back to building better (baseline or business as usual reconstruction practices), better build back (rapidity) and BBB (many recoveries).

1.2 Build Back Better goal – socio-ecological systems resilience
The goal of BBB is to increase the resilience of nation and communities, which is an all-encompassing yet not well-articulated goal. The resilience agenda was first introduced in disaster scholarship during the 1990s during the UN International Decade for Natural Disaster Reduction (UNISDR, 2005). It was only in the early 2000, that practitioners started systematically exploring the term resilience in DRR scholarship (Murphy et al., 2018). Resilience is defined by (UNISDR, 2017) as:

[...] the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.
This definition reflects that resilience and its characteristic can have varied meanings. Few scholars (Aldunce et al., 2014; Handmer and Dovers, 1996; Walker and Salt, 2006) have categorised resilience concept into three typologies based on its differing characteristics, as shown in Table I.

Within hazards and disaster risk reduction (DRR), resilience is mainly conceived from an engineering, social or ecological perspective, but rarely from an SES perspective. From a narrow or mere engineering perspective, the goal of BBB can easily be perceived as limited to one-time structural changes to housing and construction system, not necessarily systemic changes. Consequently, the opportunity provided by hazard as “change agent” to trigger transformational adaptations among communities, gets lost (Davoudi et al., 2012).

The characteristics of a SES resilient system are: robustness, redundancy, resourcefulness, rapidity and adaptive capacity (IFRC, 2012 and Kapucu et al., 2013 among others). This paper investigates reconstruction and recovery efforts from an SES resilience perspective, as its ultimate goal.

In recent years, few scholars (Lyons et al., 2010; Murphy et al., 2018; Wisner, 2017) have undertook investigation on BBB in relation to SES resilience. Yet, the scholarship remains in its infancy.

<table>
<thead>
<tr>
<th>Various concepts</th>
<th>Focus on and characteristics</th>
<th>States and scales</th>
<th>Natural hazards as</th>
<th>Timing</th>
<th>Related literature</th>
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<td>Constancy</td>
<td>Linear</td>
<td>shock</td>
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<td>Rapidity/timely recovery</td>
<td>Cause and effect</td>
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<td>Efficiency</td>
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<td>Social or ecological</td>
<td>Absorb change</td>
<td>Multiple stable</td>
<td>On-going</td>
<td>Pre- and</td>
<td>Holling (1973), Jha et al. (2010), Mulligan (2012), IFRC (2012)</td>
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<td>resilience</td>
<td>Robustness</td>
<td>states</td>
<td>disturbance</td>
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<td>Persistence/</td>
<td>Non-linearity</td>
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<td>absorb change</td>
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<td>Maintain functioning</td>
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<td>People–place connection</td>
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<td>Eliminate redundancy</td>
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<td>System memory</td>
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<td>Attain alternative system</td>
<td>Context specific</td>
<td>process</td>
<td>post-disaster</td>
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<td>Renewal cycles</td>
<td>Non-linearity</td>
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<td>dynamic interactions</td>
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<td>Nested scale</td>
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**Table I.** Three typologies of resilience concept from the narrow to the integrated SES interpretation

**Source:** Authors
1.3 Build Back Better and the challenges in its implementation

Review of literature highlights that implementing BBB in a way that contributes to the goal of increasing resilience of communities is challenging. To implement BBB, Clinton (2006) proposed ten key propositions. However, these propositions neither give attention to participatory processes nor to local technical knowledge (Maly, 2017). Consequently, few scholars (Edgington, 2017; Vahanvati and Beza, 2017) question the usefulness of BBB slogan as prevailing terms such as, people-centred or owner-driven reconstruction (ODR), convey such meaning more succinctly than the BBB slogan. Other scholars confirm the challenges of putting BBB into practice as: the lack of familiarity with the term (Rahmayati, 2016) or a lack of institutional capacity (Mannakkara and Wilkinson, 2013, 2014).

The review of literature reveals many overlaps between BBB propositions the 16 prerequisites for “general recovery” process (UNISDR, 2015) and the 5 core standards (The Sphere Project, 2011). For simplification, the ten propositions of BBB are assimilated into six themes as shown in Table II.

2. Method

This research adopts a qualitative methodology with multi-disciplinary case study method. Reconstruction settlements from two different developing countries are investigated from multiple disciplines. Social science method of semi-structured interviews and focus group

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<tr>
<td>Proposition 1: Families and communities drive their own recovery</td>
<td>Core standard 1: People-centred humanitarian response</td>
<td>Vulnerable groups</td>
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<tr>
<td>Proposition 2: Promote fairness and equity</td>
<td>Core standard 2: Coordination and collaboration</td>
<td>Government</td>
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<td>Proposition 10: Good recovery must leave communities safer by reducing risks and building resilience</td>
<td>Core standard 6: Aid worker performance</td>
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<td>Proposition 3: Governments to enhance preparedness</td>
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<td>Proposition 4: Local governments empowered to manage recovery efforts</td>
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<td>Proposition 5: Good information for recovery planning and effective coordination information</td>
<td>Core standard 3: Assessment</td>
<td>Economy</td>
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<td>Proposition 6: Agencies to clarify roles and relationships</td>
<td>Core standard 4: Design and response</td>
<td>Ecology</td>
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<td>Proposition 7: Responsibility for quality in recovery efforts</td>
<td>Core standard 5: Performance, transparency and learning</td>
<td>Human settlement</td>
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<td>Proposition 8: Entrepreneurs to flourish</td>
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<td>Safety nets and essential services</td>
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<td>Proposition 9: Agency partnerships</td>
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Sources: Duryog Nivaran (2016); Wisner (2017)
discussion is combined with the architectural method of visual documentation. Samples are purposively selected to represent the views of beneficiaries from different socio-economic backgrounds. Data was collected from three groups:

1. 27 disaster survivors who benefitted from housing assistance;
2. 7 non beneficiaries; and
3. 10 local stakeholders (government authorities or civil society organisations [CSOs]) for triangulation and data validation.

The data was collected after seven years of floods in the Indian state of Bihar and after five years of tsunami in Mentawai in Indonesia. This research differs from previous analysis because of its multi-disciplinary approach and predominant focus given to the views of disaster survivors.

Two post-disaster housing reconstruction interventions at settlement scale are selected as case studies:

1. an owner-driven and in situ reconstruction project at Puraini hamlet, following the 2008 Bihar Kosi River floods in India; and
2. government-driven relocation project following the 2010 Mentawai earthquake and tsunami in Indonesia.

Table III summarises the disaster impact and governance setup to highlight some of the similarities and differences between these case studies that were sought for richer perspectives.

<table>
<thead>
<tr>
<th>Location</th>
<th>Hazard exposure</th>
<th>Context</th>
<th>Year and duration of intervention</th>
<th>Overall impact</th>
<th>Implementing agency/CSO</th>
</tr>
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<tbody>
<tr>
<td>Puraini hamlet, Bihar, India</td>
<td>2008 Kosi River floods and dam rupture in embankment</td>
<td>Rural</td>
<td>2008-present</td>
<td>108 households affected in Puraini; complete loss of livelihood (agricultural land lost to 8-10 m of sand deposits); Total deaths (527 people + 19,323 livestock); (GoI and UNDP, 2011); 3 million people affected (PiC, 2010); &gt;2 million houses damaged</td>
<td>Bihar State Disaster Management Authority and ODRC</td>
</tr>
<tr>
<td>Sabeugunggung hamlet, Mentawai, Indonesia</td>
<td>2010 earthquake and tsunami (4-7 m high waves)</td>
<td>Rural</td>
<td>2010-present</td>
<td>64 houses destroyed; 1 school damaged; 1 church damaged (Yulianto et al., 2011) Total 503 casualties; 15,353 displaced and 517 houses heavily damaged</td>
<td>BNPB, BPBD (Provincial Disaster Management Agency), and Local District Government of Mentawai Islands</td>
</tr>
</tbody>
</table>

Table III. Two case study post-disaster reconstruction interventions

Source: Authors
The housing reconstruction project is viewed throughout its life-cycle as per the log-frame approach (during-, post- and long-term after construction completion) (CAPAM 2004; Lizarralde, 2002). Empirical data forms primary data, which are complemented by secondary data as CSO or government institution’s reports and other documentation produced at the time of reconstruction. Thematic content analysis is used for the analysis of qualitative data and is presented as per the six themes of BBB as shown in Table II.

3. The case study description

3.1 Puraini hamlet, Bihar, India

3.1.1 Systems profile. Geographically, Bihar lies at the foothills of Himalayan Ranges, characterised by flat plains and a network of eight rivers including the Kosi. Most of these rivers originate in glacial Himalayas, making them perennial. The state also receives annual monsoonal rainfall from June to October which often causes flooding. The hydrology of the region constantly alters the landform. Yet, people choose to live in the northern Bihar because of its fertile soil, which allows three crops a year. Apart from agriculture, mud-based industry (bricks and tile making) and mining form major livelihood means.

While historically Bihar had witnessed a golden period – being a seat of power, knowledge and spirituality (UNDP, 2014); the state’s economic and political condition has incrementally deteriorated since the eighteenth century (NIOS, 2019). Approximately 80 per cent of Bihar’s population lives below the poverty line (UNDP, 2014). Bihar’s population is also steadily rising with the state being the third most populous state of India (Census of India, 2011). Land is in short supply and thus there is an economic divide between the landless and the landowners.

3.1.2 Hazard profile. In all 73 per cent of the geographical area of Bihar is prone to floods (FMIS and GoB, 2009) and 28 out of 38 districts are at a high risk of earthquake (Zone 5 and 4) (UNDP, 2014). Extensive floods that have caused major devastation have occurred in 1963, 1968, 1971, 1980, 1991 and 2008 (GoB, World Bank and GFDRR, 2010). The flood of 2008 was particularly devastating because the embankment on Kosi River ruptured causing river to change its natural course and inundating regions that had not experienced floods since 1963 (GoB, World Bank and GFDRR, 2010). The 2008 flood was declared a national calamity (GoB and ODRC 2008b). The devastation was massive in Puraini hamlet because of its proximity to the dam that ruptured (Table III and Figure 1).

3.2 Sabegungung hamlet, Mentawai, Indonesia

3.2.1 Systems profile. Geographically, Mentawai district has four main islands – the North and South Pagai, Sipora and Siberut. The island attracts tourists and surfers from around the world. The region is home to a unique and complex ecosystem – rainforests, unique flora and fauna. The ecosystem has suffered damages since 1970s because of unsustainable hunting and logging mainly for conversion of rainforest to palm oil plantations. With entry of the logging companies, land right conflicts are a commonplace between the government and clans who own land based on customary traditions (Tulius, 2012). Such land conflicts have exacerbated with government claiming land through forest management policies.

3.2.2 Hazard profile. Mentawai islands sit above the Sunda megathrust – a seismically active zone, making it at high risk to earthquake and tsunami (BNPB, 2016). Top ten earthquakes (>8.5 Richter scale) causing major devastation occurred in 1979,
1833, 1861, 2004, 2005, 2007, 2010 and 2012. The October 2010 earthquake of 7.7 Richter scale and subsequent tsunami of approximately 7-m-high waves caused major devastation (Yulianto et al., 2011). Sabeugunggung hamlet was one of the most affected and got entirely wiped out (Table III). The devastation was also massive as communities living on coast had no experience of tsunami, having moved from inland a decade ago.

4. Findings: implementation of Build Back Better

4.1 Puraini hamlet, Bihar, India

**Governance:** The Government of Bihar (GoB) formulated a contextually appropriate ODR programme in partnership with the owner-driven reconstruction collaborative (ODRC) (GoB and ODRC, 2008b). To add, the GoB was setup for decentralised governance. However, the government lacked experience in recovery management (GoB and ODRC, 2008a). Therefore, ODRC implemented housing reconstruction in two pilot villages to build government capacity (Stage 1) and to manage up-scaled reconstruction implementation across the state (Stage 2). However, because of reasons unknown, ODRC withdrew during Stage 2 (in 2010) when the World Bank entered, who brought with them the terminology of BBB to be added to the reconstruction programme.

**Economy:** A uniform financial package was provided to all disaster survivors for housing reconstruction. Assistance was also provided for building of services (toilets), amenities (solar lighting) and towards loss or interruption in livelihood caused to farmers from their agricultural land being submerged under 10 m of sand brought by floods. The money was deposited in household’s bank accounts and disbursed in three instalments – foundation completion, walls completion and roof built (Vahanvati and Beza, 2015).

**Ecology:** The GoB acknowledged that the traditional measures of controlling rivers through engineering modes of building embankments or dams were failing (GoB and ODRC, 2008b). Therefore, the government begun investigation and reporting on ways of integrated river basin management (FMIS, 2007). However, neither the reporting on river basin managed was completed before the 2008 floods nor was the land risk analysis.

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**Figure 1.**
Left – location of Puraini settlement in Supaul district, Bihar, affected by the 2008 Kosi River floods (Yulianto et al., 2011); right – location of Sabeugunggung hamlet in Mentawai district, Indonesia, affected by the 2010 earthquake and tsunami (Compare Infobase Limited, 2008)

**Notes:** Compare Infobase Limited 2008; Right – location of Sabeugunggung hamlet in Mentawai district, Indonesia, affected by the 2010 earthquake and tsunami

**Source:** Yulianto et al. (2011)
Human settlement: Disaster survivors were provided with handholding support from ODRC to resolve land right issues facing the landless, design, choose and procure construction materials, employ labour and supervise construction of their own house. Two technical guidelines were prepared, model houses were built and skills-training was provided to the local artisans and households. (Plate 1).

Safety nets and essential services: After housing reconstruction, ODRC also helped build an emergency community shelter to act as a school during normal times, roads, tree plantation, solar street lighting and install water pumps; but house insurance was not put in place.

Vulnerable groups: Irrespective of people’s economic or ethnic backgrounds, almost all disaster survivors got assistance, equally.

4.2 Sabegunggung hamlet, Mentawai, Indonesia

Government/governance: The National Disaster Management Agency (BNPB) announced a BBB policy and an “owner-driven” approach (not mandated) for rehabilitation and reconstruction (GFDRR, 2014). For implementation of housing reconstruction, the national and provincial government (hereby termed as government) took-over from the district government under claims of lack of capacity at district/local level. Participatory processes were at the discretion of CSOs.

Economy: A combination of financial and material assistance was provided to the disaster survivors for housing reconstruction. The forced inland relocation increased community’s dependency on market-purchased staple foods from the mainland. But economic livelihood support was not considered as part of the BBB. Skills training of survivors in alternative livelihood activities were provided by few CSOs.

Ecology: While the government continues to exploit forests, there are some efforts for replanting mangroves and building embankments along the coast to avoid future disaster.

Human settlement: The government mandated (without consultation) relocation inland, approximately 14 km from the coastal land. The government threatened households to lose aid if they resisted relocation, managed through consultants the design of house, technical specifications, construction materials and supervision process. Skills-training was provided to the locals. Communities mainly contributed as construction labour. Because of a strong social network, families came together to build each other’s house. Basic amenities, such as water supply and electricity were not provided. (Figure 2).

Plate 1.
Left – traditional house in Bihar; right – improvised bamboo and brick houses in Puraini settlement after the 2008 Kosi River floods

Source: Author

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Safety nets and essential services: Basic needs such as schools and health clinics were built; however, access to electricity and water was problematic. No housing insurance was provided.

Vulnerable groups: Almost all survivors were given housing assistance. In spite of provision of schools, children suffer because of inadequate education tools and teachers.

5. Discussion: mid-term outcomes of Build Back Better

This section presents a comparative analysis of mid-term outcomes – seven years after the floods in Bihar, India, and five years after the earthquake and tsunami in Mentawai, Indonesia. The findings are discussed in terms of SES resilience characteristics and organised in six thematic areas as shown in Table IV.

This comparative analysis suggests that a lot went well for communities in Puraini hamlet in Bihar; however, that was not the case in Sabeugunggung hamlet in Indonesia. The reasons for such mid-term outcomes are further unpacked and related to the SES resilience framings and BBB implementation approach adopted by governments, CSOs and communities.

At programme/policy level, when BBB was framed narrowly merely from an engineering resilience or physical recovery perspective, in Mentawai, Indonesia. Subsequently, such framing oriented the reconstruction programme towards a top-down approach with limited community participation. In favour of the Government of Indonesia, they followed a certain recovery pathway to align with international agenda, such as, Sendai Framework for Disaster Risk Reduction (SFDRR) Priority 4 on BBB, which recommends not rebuilding in the same disaster-risk area. Such a pre-determined specific hazard-based perspective is once again narrow, which completely disregards considerations of the complex socio-ecological and political backdrop.

On the contrary, in Bihar, the government formulated reconstruction policy as ODR and implemented it in a participatory and empowering manner. To add, the programme was kept agile with piloting prior to policy formulation which allowed the government to tailor it in a contextually appropriate manner and from SES resilience-based framing. Such holistic framing of reconstruction and rehabilitation programme was implemented in a collaborative, decentralised, partnership-based, multi-sectorial and bottom-up approach. While both the governments lacked capacity in terms of experience in recovery management, pre-disaster preparedness and contingency planning, it is noteworthy that a partnerships-based approach in Bihar allowed for the design of SES-resilience based recovery programme, without the use of BBB slogan.

Figure 2.
Left – aerial view of the Sabeugunggung new resettlement; right – improvised concrete and timber housing after the 2010 earthquake and tsunami in North Pagai

Source: Repdeman (2017) and Author
At community level, government and people of Mentawai were familiar with BBB slogan; however, a narrow framing of BBB and a top-down implementation approach took away the power, dignity and resilience from the hands of people and put it in the hands of those in power such as – donors, government and CSOs. Five years since the disaster, majority of households in Mentawai are unsatisfied with the entire reconstruction process. Many of the residents who were resettled inland find themselves stuck amid land-rights conflicts, limited access to water and energy. Women are left feeling disempowered because of men-controlled environment in relocated settlement, which they describe as being “worse than the tsunami itself” (Repdeeman, 2018).

This was contrary to the experiences of communities in Puraini settlement in India. In Bihar, people were not familiar with the term ODR or BBB; however, a system s-based framing of resilience and bottom-up approach meant that almost all residents feel dignified, proud and empowered. Almost all the households in Puraini are satisfied with every aspect of reconstruction process. The reason for success at community scale is that they were given
voice and freedom to choose and were empowered to make informed decisions with social, financial and technological support from ODRC and government. Seven years after the floods, not only are their houses robust and have withstood few floods, many residents have also managed to diversify their livelihood based on newly acquired construction skills during training workshop, and women feel empowered because of their joint-bank account with their husband and being part of women’s self-help-groups (Vahanvati and Beza, 2016, 2017).

Such freedom of choice is termed as “human capabilities” by Nobel Laureate Sen (1997, 1998), which is an important aspect of human development; however, it is neither mentioned in BBB or SFDRR. Having said that, giving power to communities without support is hardly empowering. Hence a combination of “capabilities” or freedom of choice with “capacity building/capacity development” (Vahanvati, 2018; Vahanvati and Mulligan, 2017) are essential requirements for reconstruction to carve pathways for strengthening SES resilience of at-risk communities.

6. Conclusion

In this paper, we questioned the reliability of BBB at contributing to socio-ecological resilience outcomes for disaster survivors, their housing and settlements in the medium- and long-term. The aim of this research paper was to draw out generalizable findings from comparative case study analysis from India and Indonesia to guide future policy and practice for effective recovery. There were nine key generalizable findings (Vahanvati, 2018) based on investigations after seven and five years in India and Indonesia, respectively. Two of these nine findings are of utmost significance and they are:

1. linking capacity building to capacity development; and
2. capabilities-based approach.

Capacity building at government authorities’ scale is an important consideration for effective responses, as outlined by SFDRR under Priority 4; yet, it was missing from both the case studies. Equally important was government’s ability to work with a multi-sectorial and multi-disciplinary partners to frame responses from a contextually appropriate and integrated SES-resilience perspective. Such a partnerships-based approach was evident in Bihar where BBB slogan was not even used. At community scale, capacity building of people is often considered as skills training in new resilient construction; however, rarely are such skills linked to livelihood diversification. It was still early days after reconstruction to see the real long-term impact of skills training on livelihood diversification or improvement in resourcefulness, in both case studies.

Providing survivors with capabilities or “freedom of choice” was also found to have played a major role in promoting increase in awareness and self-confidence, the attributes of resilience, in case of India. On the contrary, in Indonesia, non-participation left people feeling disempowered and bitter. While community-led or ODR approaches are promoted by many international and national organisations, giving people freedom without awareness and support for making informed decisions is hardly empowering (IFRC, 2010; Jha et al., 2010).

It is noteworthy that both these concepts have emerged from fields outside the built environment studies, with “human capabilities” from the field of development studies and “capacity building/development” from the field of ecology. This paper further advances current scholarship on shelter and settlements recovery and resilience by identifying the potential of – strengthening human capabilities and sustaining capacity building – for leading responses (not BBB per say) to resilience building of those living with risk and poverty.
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City-to-city exchange: redefining “resilience” in the Arab region

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Abstract
Purpose – It might seem plausible to argue that effective monitoring of disaster data loss can help achieve progress in reporting to the Sendai Framework for Disaster Risk Reduction (SFDRR) and the global targets of sustainable development goals and associated indicators. Nevertheless, with the lack of climate change and disaster data losses in the Arab region, the integration of risks associated with socio-economic dimensions at the wider scale of displacement is important to shape a regional understanding of resilience terminology and provides the means of translating it. The purpose of this paper is to identify the means of redefining “Resilience” in the Arab region context of climate change, conflict and displacement in association with the theoretical principles of the “fragile city”.

Design/methodology/approach – In an attempt to achieve the SFDRR target (E) “substantially increase the number of countries with national and local DRR strategies by 2020,” this study investigates the use of the (United Nations Office for Disaster Risk Reduction) disaster resilience scorecard as a guiding principle for city-to-city (C2C) resilience-building knowledge exchange between Amman (Jordan) and Khartoum (Sudan).

Findings – Facing similar urban challenges against disaster and violent conflict-protracted displacement, the study findings indicate that the C2C exchange program was useful in understanding the cities’ urban risk profiles, promoting dialogue among local governments and creating a culture of learning organizations for knowledge sharing on DRR governance and beyond. However, the applied resilience assessments overlooked the qualitative and socio-ecological understanding of climate change risk and human security principles among the most vulnerable groups of refugees and internally displaced persons in fragile settings. This is recommended to be integrated into building coherence for resilience across the 2015-2030 Global Agendas reporting and monitoring mechanisms, leaving “no one behind”.

Originality/value – The C2C exchange program for Amman and Khartoum was an opportunity for understanding the cities’ urban risk profiles, addressing challenges and building “decentralized cooperation” beyond the cities’ institutional boundaries (UN Habitat, 2001), with recommendations for “selecting resilience indicators specific to fragile cities” to quantitatively measure disaster displaced persons’ (DDPs) vulnerabilities and current status of “income and social equality, microeconomic security, provision of basic services and social protection” while providing qualitative evidence on “social cohesion, social networks/social support and local government–community cooperation” (Patel and Nosal, 2016).

Keywords Resilience, Arab region, City-to-city exchange, Displacement, Disaster risk reduction, Fragility

Paper type Research paper

This study was carried out by the AUDI in collaboration with the UN Habitat Regional Office for the Arab States, the Road, Bridge and Drainage Corporation of Ministry of Infrastructure and Transportation (Khartoum, Sudan) and GAM (Amman, Jordan) as part of the C2C learning exchanges call for proposals 2016-2017 in the context of Making Cities Resilient Campaign led by the UNDRR. The facilitation of activities of C2C learning exchanges is possible, thanks to the contribution of governmental and institutional donors. This particular call is thanks to support by the European Commission’s Directorate-General for International Cooperation and Development.
1. Introduction
The disastrous impact of climate change on urban livelihoods and natural biodiversity systems has long been observed worldwide (Shaw et al., 2010). The US Department of Defense reported that “climate change can act as a threat multiplier for instability in some of the most volatile regions of the world” (Nordás and Gleditsch, 2007). Taking into account the challenge of monitoring the impact of climate change on human mobility:

There is no universally agreed definition of climate-induced human mobility (Warner, 2010), but broadly it refers to the movement of people driven by sudden or progressive changes in the weather or climate. This can include temporary and permanent, seasonal and singular as well as voluntary and forced movement (Wilkinson et al., 2016).

Exacerbated with fragility, environmental and socio-political degradation, the lack of accurate monitoring of human mobility caused by disasters and violent conflict-protracted displacement are nowhere else so pronounced as in the Arab region, with facts from the Global Report on Internal Displacement (IDMC, 2018) demonstrating that the region accounted for 38 per cent of the global total of 11.8 million internally displaced persons (IDPs) within their own countries, to escape conflict and violence. In 2011, the Arab region witnessed the world’s unprecedented scale of forced migration since the Second World War with the trigger of the Syrian refugees’ crisis caused by droughts and scarcity of natural resources. The Overseas Development Institute (ODI) indicates that 50 per cent of displaced population come from five countries globally, four of these countries are located in the Arab region “Syria, Historic Palestine, Sudan and Iraq” (Cosgrave et al., 2015).

Shaped by the ramifications of the prolonged political instability of the Palestinian refugee crisis since early 1948, the 20th-century ordeals and civil wars in Iraq, Lebanon, Sudan and Somalia, and the Arab Spring turbulence, all increased the scale and magnitude of protected displacement, increasing the fragile State’s vulnerability and exposure to both natural and man-made hazards (HABITAT III Issue Papers – Urban Resilience, May 2015). Taking into account that the Internal Displacement Monitoring Centre (IDMC) does not acknowledge disaster-induced displacement for internally displaced persons (IDPs) in their statistical database, the number affected with protracted displacement as a result of disasters that occurred following conflict in 2018 remains unknown (IDMC, 2018). Thus, evidence shows that climate changes continue to weaken the absorptive, adaptive and transformative capacities of the Arab cities to withstand the impact of natural and human-made hazards, and efforts should take place to tackle the underlying drivers of risk.

There have been various attempts to address challenges related to climate change and disaster data losses in the year 2015, with the launching of the Sendai Framework for Disaster Risk Reduction (SFDRR), COP21 Paris Climate Change Agreement, and the Sustainable Development Summit defining the new Sustainable Development Goals (SDGs). This was followed with concrete steps for shifting the international humanitarian response from emergency to development, by the launch of the first ever World Humanitarian Summit in May 2016; the inaugural High-level Political Forum and the Habitat III New Urban Agenda (NUA) on Housing and Sustainable Urban Development. The UN landmark agreements provide indicators to measure data losses. Nevertheless, quantifying the economic, human and infrastructural impact of disaster losses across the global targets does not measure the level of exposure and vulnerability of disaster and conflict-displaced people. Cutter and Gall (2015) indicated that “existing loss accounting systems vastly underestimate the true burden of disasters, both nationally and globally.” The 2017 Sendai Framework Data Readiness Review – Global Summary Report gave scope to gaps in loss-data availability, accessibility, quality, applicability and the “need to be sufficiently consistent
and comparable to allow meaningful measurement of progress and impact” (UNISDR, 2017; Eltinay and Egbu, 2017). Therefore, there is a need for an evidence-based approach to building coherence in resilience assessments across UN frameworks in the context of “fragile cities.”

Reflecting on John de Boer’s (2015) conceptual framework of the three main components that shape the fragile city – “urban disasters,” “urban poverty” and “urban violence” – this study hypothesizes that the existing toolkits and UN frameworks are based on an objectivist approach, which emphasizes the structural aspects of disaster risk management (DRM) at the global level and ignores the social constructionism of refugees and IDPs’ perceptions and consequent actions as social actors of building resilience at the local level (Boer, 2015). Resilience and the Fragile City: Reducing Vulnerability to Complex Urban Crises, United Nations University Centre for Policy Research Article, New York.” (2015). Moving beyond the “positivist epistemology for resilience research” (Miller et al., 2010), a redefinition of resilience which considers climate change-induced displacement is explored in this study to reflect on the evolution of the resilience operational concept, terminology and understanding in the Arab region. Using the Organisation for Economic Co-operation and Development (OECD, 2014) Guidelines for Resilience Systems Analysis, the associations between climate change-induced migration and displacement (independent/exploratory) variables, and the (dependent/response) corresponding variables of resilience definition (systems, hazards, capacities, time frame and services) are identified as agreed by the United Nations General Assembly in 2016.

To understand the impact of the global agendas in the context of the Arab region fragile states, this study goes beyond the alignment with the SDGs’ global targets and the SFDRR. It highlights the significance of using the UN Habitat city-to-city (C2C) as a methodological approach for knowledge exchange for the resilience-building decision-making process, integrated with the use of the United Nations Office for Disaster Risk Reduction (UNDRR; formerly known as UNISDR) disaster resilience scorecard assessment tool as the main investigation method in the case studies of Amman (Jordan) and Khartoum (Sudan). Equally important, this study provides contribution to climate change migration and internal displacement literature, targeting the challenges faced by fragile cities’ complex urban systems, and helps gain an in-depth insight into the opportunities for building societal resilience for disaster and urban violence-displaced persons, while shedding the light on the role of disaster risk governance in building coherence between the 2015 and 2030 global agendas in the Arab region.

2. Background

2.1 Redefining resilience in the context of the Arab region

“Climate change may not be responsible for the recent skyrocketing cost of natural disasters, but it is very likely that it will impact future catastrophes” (NASA, 2016). Variations of risk drivers between the countries globally reflect the uneven socio-economic and governance construction of hazards, risk and vulnerability. This theory is strongly embedded in the Arab region, with the significant disparities between the developed and least developed states, socio-economic living structures, adaptive, absorptive and transformative capacities for DRR. Divided into four subregions, the Mashreq (Eastern) consists of Egypt, Iraq, Jordan, Lebanon, Palestine (West Bank and Gaza), Syria, Israel and Iran. The Maghreb (Western) consists of Algeria, Libya, Morocco, Tunisia and Mauritania. The Gulf Cooperation Council countries in the Arabian Peninsula consist of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The Southern Tier countries consist of Somalia, Sudan, Comoros, Djibouti and Yemen.
The Arab region’s level of exposure to natural hazards varies between storm tracks and annual variations in rainfall, affecting the Maghreb and most of the Mashreq and the Arabian Peninsula, whereas the Jordan rift valley system places a number of countries (Jordan, Lebanon, Palestine and Syria) and Maghreb regions as areas that are exposed to high risk of earthquakes. With “40 per cent of Arab countries immersed in or have lived through man-made hazards and stresses of armed conflict in the past six years,” contextualizing the definition of resilience in accordance with the variations above is important to understand the interaction between disaster risk, conflict and social vulnerability, that is distinctly outlined in the region’s most fragile states’ settings of urban poverty, human rights violations and incompetent institutional DRM.

The term resilience has been defined as:

[...] the ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UNISDR, 2016a; 2016b).

“Resilience” has also been explored broadly across different research disciplines; yet all agree that to strengthen urban resilience, it is important to understand the role of local communities’ social dynamics in decreasing the scale of risk and the level of vulnerability. With variations in defining resilience between the engineering, psychology and disaster literature, this study builds evidence on Meerow et al.’s literature review of 172 publications. The literature on urban resilience over a 41-year period was identified using the Elsevier’s Scopus and Thompson Reuters’ Web of Science on Holling’s socio-ecological system framework (Walker, Holling, Cartpenter and Kinzig, 2004), applied across the fields of risk management, hazards, climate change adaptation, international development and planning (cited in Meerow et al., 2016; Eltinay and Egbu, 2017).

Taking into account the aforementioned review, the UNDRR definition, from a “hazards” perspective, is associated with John de Boer’s (2015) conceptualization of the fragile city framework that is underpinned by three main components, which are “urban disasters,” “urban poverty” and “urban violence,” to understand the “discrete character of fragile metropolitan units whose governance arrangements exhibit a declining ability and/or willingness to deliver on the social contract” (Muggah, 2015). The Organisation for Economic Co-operation and Development’s (OECD) 2014 Guidelines for Resilience Systems Analysis are applied to help identify the means of redefining “Resilience” in the Arab region’s context of climate change, conflict and displacement as outlined in Table I:

[...] the ability of a system exposed to shocks and stresses, to utilize existing and build upon absorptive, adaptive and transformative capacities to accommodate and recover from disaster impact, through the preservation and restoration of its essential basic structures and functions, according to accurate, valid, reliable, timeless, and relevant data base.

In the case of the Arab region, the society or community units, as outlined in the UNDRR definition, are not excluded from the term “system” but are extended to incorporate the natural environment and built environment physical entities, as applied by the “Sustainable Livelihoods Approach,” considering that the well-being of a community based on six different categories of assets or “capitals” – financial, human, natural, physical, political and social capital (DFID, 1999). The UNDRR definition then limits the system exposure to “hazards,” overlooking the dimension of time and exposure to shocks and stresses. Shocks are sudden events that impact the performance of a system. They can strike at different levels, including disease outbreaks, floods, high winds, landslides, droughts, earthquakes, outbreaks of fighting or violence and severe economic volatility. Stresses are longer term
<table>
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<tr>
<th>UNISDR definition</th>
<th>Key words</th>
<th>Justification</th>
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<tbody>
<tr>
<td>The ability of a system, community or society exposed to hazards to resist,</td>
<td>System</td>
<td>To maintain the integration of sustainability principles into resilience to fill the gap between the humanitarian development nexus, &quot;system,&quot; here includes a unit of society (individual, household, community and state)</td>
</tr>
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<td>absorb, accommodate and recover from the effects of a hazard in a timely and</td>
<td>Shocks and stresses</td>
<td>Hazards are limited to “biological, environmental, geological, hydro meteorological and technological processes and phenomena,” and does not include the wider perspective of shocks and stresses</td>
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<td>efficient manner, including the preservation and restoration of its essential</td>
<td>Utilize existing and build</td>
<td>Absorptive capacity: The ability of a system to prepare for, mitigate or prevent negative impacts, using predetermined coping responses to preserve and restore essential basic structures and functions. This includes coping mechanisms used during periods of shock. Examples of absorptive capacity include early harvest, taking children out of school, and delaying debt repayments</td>
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<td>basic structures and functions (UNISDR, 2016)</td>
<td>new absorptive, adaptive</td>
<td>Adaptive capacity: The ability of a system to adjust, modify or change its characteristics and actions to moderate potential future damage and to take advantage of opportunities, so that it can continue to function without major qualitative changes in function or structural identity. Examples of adaptive capacity include diversification of livelihoods, involvement of the private sector in delivering basic services, and introducing drought resistant seed</td>
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<td>and transformative capacities</td>
<td>Transformative capacity: The ability to create a fundamentally new system so that the shock will no longer have any impact. This can be necessary when ecological, economic or social structures make the existing system untenable. Examples of transformative capacity include the introduction of conflict resolution mechanisms, urban planning measures, and actions to stamp out corruption</td>
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<td>With the lack of data and updates on the duration of service disruption and the number of people affected by the damage and disruption of structures and functions, association with data verification (accuracy, validity, reliability, timeliness, relevance) is essential to insure achieving resilience</td>
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Table I.
Redefining “resilience” in the Arab region
trends that undermine the performance of a given system and increase the vulnerability of actors within it. These can include natural resource degradation, loss of agricultural production, demographic changes, climate change, political instability or economic decline (DFID, 2011). The complexity of shocks and stresses outlined above is strongly embedded in the Arab region owing to the economic and political pressures placed by migration, urbanization and demographic changes on fragile cities’ urban systems and the delivery of basic services. This can be “cumulative and compounding gradually until a tipping point is reached and transformed into a shock” (World Bank, 2015).

With regard to the actions of resistance and absorption, the physical environment’s ability to “resist” the damage imposed by hazards is identified as “resistance” (Norton and Chantry, 1993). As resilience goes, this limits the system’s physical components and ignores the socio-ecological context. Absorbance is more associated with the economic context of resilience, as cited in the Knowledge Platform for DRR. A “country’s resilience depends, to an important extent, on whether the government’s institutional system can absorb financial losses” (UNISDR, 2013). This can be enhanced to accommodate the Arab region fragile cities’ context by utilizing existing, and a new three levels of absorptive, adaptive and transformative capacities. Boundaries of what are to be listed under the terminologies (timely), (efficient) cannot be measured in the context of small scale and slow-onset disasters that are highly undermining resilience efforts in the Arab region. The measures of disruption and quality of response also vary according to local emergency response protocols and national disaster risk-reduction policies, which cannot be generalized to fit a specific time frame. This will require the engagement of stakeholders at all levels (Virginia et al., 2017). Noting the slow progress on previous international agreements in tackling fragile challenges of urban poverty, urban disasters and urban violence, global interest in developing better DRM strategies to tackle the root causes of vulnerability emerged.

3. Methodology: design of the study
The study methodology contextualized the theoretical principles of redefining resilience in the Arab region, using the case studies of Khartoum (Sudan) and Amman (Jordan), with the application of the C2C exchange model to understand how each city is meeting the criteria for the UNDRR global approach for disaster resilience assessment. The selection of the two Arab cities was based on the research hypothesis that IDPs (Sudan) and refugees (Jordan) in urban contexts are “off the radar” of humanitarian aid agencies. By examining the theory outlined by “Under the Radar: Internally Displaced Persons in Non-Camp Settings” report, as part of the Brookings-LSE Project on Internal Displacement, there has been growing awareness of the unique problems facing refugees living in urban areas, but much less attention has been devoted to the particular situation facing those displaced within the borders of their own countries and who live outside of camps (Beyani, 2013).

Facing similar urban challenges against the refugee crisis and protracted displacement, understanding the drivers of disaster risk vulnerability was the main objective for both cities – to build resilience mechanisms and adaptation to climate change strategies. Practiced by local authorities for more than half a century, the C2C exchange program came into global attention following the 1996 Habitat II Second UN Conference on Human Settlements in Istanbul, with the setting of extensive global plan of action, drawn up in an evolving partnership with representatives of local authorities, to support a series of events concerned with C2C cooperation. Twenty years later, the 2016 NUA adopted by the third UN Conference on Human Settlements came with the “Urban System Model Approach” (Figure 1) to advance the understanding and strengthen the practice of C2C principles.
Appling Miller et al.’s (2010) approach in identifying three main shared elements of researching resilience and vulnerability concepts, this study investigated the concepts themselves and their associated theories, the methodologies used for assessing the concepts and the “real-world” practice of addressing social-ecological change in planning, management and governance. Snowball sampling was applied to select participants in the C2C exchange program from agencies operating at the technical resilience assessment process to widen the stratification process beyond local authorities and to ensure the participation of key stakeholders at the local, national and regional levels, with the support of the Road, Bridge and Drainage Corporation of Ministry of Infrastructure and Transportation in Khartoum, Sudan, and the Greater Amman Municipality (GAM), Jordan.

With the support of the European Commission’s DG-DEVCO, the Arab Urban Development Institute (AUDI) in collaboration with UN-HABITAT Regional Office for the Arab States operationalized the C2C concept according to two phased workshops and field trips plan: Phase 1 took place in Khartoum for the period October 3-5, 2017, followed by Phase 2 in Amman for the period November 4-5, 2017, with focus on developing sustainable urban drainage systems and critical DRR institutional management. The disaster resilience scorecard (New Ten Essentials for Making Cities Resilient) (Figure 1) indicators were used as the main resilience measuring tool, to assess the cities progress in reporting to the Sendai Framework at the local level, and recognizing the contribution and collaborations of all DRR local stakeholders. The assessment method used Level 1: preliminary-level scorecard tool, with a total of 47 critical sub-questions/indicators, each with a 0-3 score, applied in three days’ city multi-stakeholders’ workshop structures. Attendance of 30-40 participants in each workshop took place from various governmental organizations, universities, civil society and DRR agencies. Starting with introductions of DRM policies and institutional structures in Khartoum and Amman on Days 1 and 2, briefs about the cities/state localities, total areas, populations, administrative institutions and cities’ urban risk profiles were explored.

Monitoring progress on the impact of these assessments in integrating climate change-induced displacement, it is important to consider the SFDRR international community perspective on conflict-sensitive economics, as “by consensus among UN Member States
there are no explicit references to conflict in the text, which articulates guidance on reducing mortality and numbers of people affected by disasters” (Glasser, 2015). In 2015, the SFDRR was endorsed by the UN General Assembly as the first major agreement of the post-2015 development agenda and adopted by 187 countries as a 15-year, voluntary, nonbinding agreement with four priorities and global seven targets. The SFDRR target (E) is the first target aimed by member states to be achieved by 2020: to “substantially increase the number of countries with national and local DRR strategies,” which is the main scope of this study.

Taken together, these frameworks make for a more complete resilience global agenda; nevertheless, “coordinating actions to be taken to deliver against each framework are recommended, to help avoid duplication, maximize gains and manage trade-offs between different risks and goals” at both the national and local levels, indicating that efforts to deliver on the frameworks at the local level must not conflict: everyone needs to “pull in the same direction” (Peters et al., 2016). Thus, an important contribution to this study is redefining resilience in association with fragility “related concepts of adaptation and transformation, highly influential but somewhat lay different ways of framing our analyses of social ecological change and the challenges of sustainability” (Miller et al., 2010). Accordingly, building coherence between the 2015 and 2030 global agendas is important to frame policy recommendations for integrating disaster and urban violence-displaced people rights into resilience action plans and accommodate the Arab region conflict-sensitive economics without forgetting the region’s diverse geographical, political and social scales.

4. Results
4.1 Disaster resilience assessment – Khartoum, Sudan
Khartoum, the capital city of Sudan, witnessed severe urban floods in 1946, 1988, 1998, 2006, 2013, 2014 and 2018. Exacerbated by the civil war in the west Darfur and South Sudan, a new matrix of “geopolitical political” hazards arose, transferring risk from rural to urban contexts and challenging Khartoum urban resilience capacity to flooding disaster risks. These floods have undermined the impact of humanitarian aid emergency response in informal settlements and urban camp settings in providing support for IDPs beyond food and shelter, to enhance local institutional capacities in coping with the increasing demand for permanent settlements, sustainable livelihoods, access to employment and infrastructural services.

Khartoum city scorecard results shown in Figure 2 indicate the total scoring of 62/141, with the highest scoring achieved for Essentials 6 (Strengthen Institutional Capacity for Resilience), 8 (Increase Infrastructure Resilience) and 9 (Ensure Effective Disaster Response). This reflects the city authority’s prioritization of building skills and providing institutional training on disaster management strategies, but the lack of the shared understanding of risk and knowledge of socio-economic, environmental and political vulnerabilities (Essential 2) impact the city investments in resilience and adoption of innovative financing mechanisms (Essential 3).

The C2C exchange program was an opportunity for Khartoum city to understand disaster resilience risks and challenges while increasing the awareness of the roles and responsibilities of DRR key city stakeholders and enabling the dialogue and consensus between institutional structures at the local and national levels. This was strongly evident in the steps Khartoum city authority of Road, Bridge and Drainage Corporation took following the C2C exchange program, led by the Ministry of Infrastructure and Transportation, in forming a technical disaster resilience committee to verify the results achieved and capture the knowledge gained from the resilience assessment process to be transferred to other cities
in Sudan. Here, this committee provided the training-of-trainers program in April 2018 for the Sudanese states – capital cities of North Kordofan, West Kordofan, Red Sea, Sinar, River Nile Estate, Kassala, Northern State, White Nile, Algedaref. This was followed by applying a detailed resilience assessment for Khartoum in December 2018 using 117 indicator criteria, each with a score of 0-5 in an attempt to formulate the components of Khartoum Resilience Action Plan and identify priorities for DRR budgeting and investment.

4.2 Disaster resilience assessment – Amman, Jordan

Amman, the capital of the Hashemite Kingdom of Jordan, is located in the central west part of the country, which lies in the northern part of the Arabian Peninsula. GAM accounts for more than 42 per cent of Jordan’s population. Its strategic location attracted the influx of refugees and immigrants for decades, starting with the 1948 Palestine war, the 1990 Gulf War, Iraq civil unrest and recently the Syrian crisis. In 2001, Jordan suffered eight successive years of drought with declining rainfall levels and increased demand on water resources. Climate change impact is noted through Amman severe water shortages, earthquakes and more severe weather events, such as floods, heat and dust waves and blizzards. Amman has one of the lowest levels of water availability per capita in the world. Accordingly, Amman was selected in December 2014 to join the second cohort of the 100 resilient cities initiative pioneered by the Rockefeller Foundation (100RC) Network. As one of the only three Arab cities (Luxor-Egypt, Byblos-Lebanon and Ramallah-Palestine), the Amman Resilience Strategy aims to tackle the city development and urban governance challenges, and build critical infrastructure resilience for the underlying disaster risks of urbanization, extensive urban sprawl and demographic growth.

Amman city scorecard results shown in Figure 3 indicate the total scoring of 77/141, with the highest scoring achieved for Essentials 2 (Understanding Disaster Risk), 8 (Increase Infrastructure Resilience) and 9 (Ensure Effective Disaster Response). Building on the opportunities and challenges identified by the Amman 2009 Disaster Risk Management Master Plan, and the experience gained in forming the 100RC Amman Resilience Strategy,
the city authority response to the scorecard resilience assessment showcased a higher level of understanding of the physical, social and economic stresses and shocks facing the city system.

This takes account of the knowledge and competency built in by GAM’s technical governmental institutions, which was considered to be low, with relevance to the city’s physical planning and construction standards, according to the United Nations Development Programme (UNDP, 2009) report for Amman Disaster Risk Management Master Plan. That is not to say that the competency does not exist in the country. In fact, the risk analysis performed in the context of the UNDP study demonstrated that the country has solid expertise in the subject within its research institutions, universities and specialized technical agencies, and it calls for a stronger cooperation and consultation between the technical administrative structure of GAM and other government agencies and the national experts (GAM, 2009). Amman’s history and knowledge of dealing with urban poverty, being a fragile city exposed to major threat to urban safety and security with the urban refugee crisis, witnessed resilient action taken by the General Federation of Jordanian Trade Union (GFJTU). This is a step forward to build resilience social inclusion foundations by issuing the Arab region’s first nonemployer and nonposition-specific work permits for Syrian refugees since the Syria crisis erupted in 2011, taking into account that “the majority of Syrian refugees in Jordan live in urban areas, and over 80 per cent live below the poverty line” (UNHCR, 2018).

5. Study findings
Having the opportunity to accelerate the uptake of innovative and transformational practices through the joint creation of new knowledge between Khartoum and Amman, the use of the C2C exchange program enhanced the cities’ experience for shifting from “reactive learning” and discovery of existing knowledge to “pro-active learning” and “meta-learning,” identifying gaps and developing resilience action plans for continuous monitoring and evaluation. Good practices from the Khartoum land-based financing model for
infrastructure and basic services were useful to understand how regulations and land use laws should be modified and improved to overcome the existing challenges of horizontal urban expansion and informal settlement with the influx of rural–urban displaced people. Amman Emergency Fund introduced innovative practices to help solve the problem of flood drainage systems’ annual maintenance and how to apply successful public private partnerships to attract investors to develop Khartoum’s early warning system and learn from Amman experience in developing the emergency center structure and the city resilience plan as a member of the 100RC Network.

In Figure 4, a comparison between Khartoum and Amman scorecard results for Essential 2 (Understanding Disaster Risk) is presented. The blue central web represents the city’s actual resilience assessment results, with strengths and weaknesses highlighted according to the level of extension to the outside border, when compared with the background layer in gray color. With the lack of guidance by the UNDRR on the approach to analyze the disaster resilience scorecard results, this study proposes that the external boarder stands as an indication for the cities on required steps to establish priorities and develop the city resilience action plan.

As high scoring was shared between Khartoum and Amman for actions and measures available to Increase the Resilience Infrastructure of cities (Essential 8) and Ensure Effective Disaster Response (Essential 9), the comparative analysis applied focused on the results achieved for building on the scenarios in Essential 2 (identify, understand and use current and future risk scenarios) showcasing the lack of data monitoring required in Khartoum to plan for DRR. Taking into account the low scoring for Essential 7 (Understand and Strengthen Societal Capacity for Resilience) for both cities, there is an urgent need to develop mechanisms for community participation in the development and implementation of DRM strategies and introduce policies for integrating DDPs to strengthen social ties and solidarity between various groups and unleash community energies, local knowledge, skills and resources for building societal resilience.

With the lack of societal capacity in Amman and Khartoum urban contexts, the gap between the humanitarian and development agendas is widened, calling for development efforts from the international community to help urban DDPs find better livelihood opportunities and adapt to their new urban environments. The risk of DDPs falling into marginalization, crime and urban violence shall increase, making the DDPs more:

[... ] invisible among the urban poor and may be forced to resort to negative coping mechanisms to get by, where most vulnerable are likely to end up in informal settlements or slums that may be prone to natural hazards (IDMC, 2014).

The sustainability of international community development programs is fundamental to ensure building systematic approaches for community resilience, built upon structural funds and allocated budgets to sustain progress and most importantly monitor the impact of these programs.

6. Conclusions and recommendations
In April 2007, climate change was first established as a security issue by the United Nations Security Council. Evidence from the United Nations System Task Team on The post-2015 development agenda indicates that “migratory behaviours in response to climate and/or environmental change may exhibit considerable variation, ranging from massed forced displacement to gradual anticipatory ‘adaptive’ movement. Precise figures are lacking, but it is believed that the large majority of people whose migration is fuelled by environmental
Figure 4. Disaster resilience scorecard (essential 2) – C2C exchange programme 2017
considerations move over relatively short distances and rarely across borders” (IOM, UNDESA, 2012). Exploring the facts and figures on protracted displacement, an important socio-economic determinant of vulnerability is urban poverty:

[...] where the urban poor are more exposed to crime, forced evictions and natural hazards than the rich, because they are often located on sites prone to floods, landslides and pollution (UN Habitat, 2007).

Evidence from the Overseas Development Institute indicates that:

[...] while the internationally agreed SFDRR exists, it can only be achieved by developing an evidence-base policy and practice on how best to pursue DRR in conflict settings and redirecting spending to those contexts. This will require challenging our existing assumptions and better understanding the relationship between hazards, vulnerability, exposure and types of conflict (ODI, 2018).

Against this background, the study was aimed at achieving the SFDRR target (E) “substantially increase the number of countries with national and local DRR strategies by 2020,” by examining the use of the UNDRR disaster resilience scorecard for cities as a tool to distinguish the C2C from other institutional capacity-building services and technical training, where cities become learning organizations for understanding risk and identifying strategies to build resilience through engaging in city learning networks, integrating the context of DDPs’ physical vulnerability into cities’ DRR spatial planning systems, “leaving no one behind” (SDGs, 2015).

As evaluations are widely applied in the humanitarian context, the methodology applied in this study considered evaluations of disaster resilience assessments in two different contexts of Amman and Khartoum to learn lessons and provide accountability for resilience assessment toolkits in the context of fragile cities in the Arab region. In the aid front, evaluations were first integrated by the OECD programs. Manyena (2009) viewed evaluation as:

[...] a deliberate and systematic process of collecting information about an ongoing or completed programme or project. It is used as a basis for making judgements about the project or programme outcomes and also informs policy, the design and implementation of future programmes (Manyena, 2009, p. 69).

With the consideration of the frequency and severity of climate change (water-related risks – floods in Khartoum and water shortages in Amman), the outcomes of this evaluation should generate “instructive examples” that might be applicable to the regional context rather than limited to specific boundaries (Manyena, 2009, p. 71).

In the process of building coherence between the 2015 and 2030 Global Agendas, boundaries of what to be measured under the indicators and global targets were investigated, taking into consideration the hypothesis that the existing toolkits and UN frameworks act upon an objectivist approach, which emphasizes the structural aspects of DRM at the global level and ignores the social constructionism position of refugees and IDPs as social actors at the local level. This study concludes that United Nations agencies’ protection efforts are mostly provided for conflict-displaced persons in the norms of supporting refugees’ settlement and IDPs’ voluntary return; yet the impact at the city planning level, social integration and access to infrastructural services are only outlined at the broader protection perspective of humanitarian law, overlooking the human rights access to land and security of tenure.
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Further reading


About the author
Nuha Eltinay is a PhD Researcher at London South Bank University, Licentiate Member of the Royal Town Planning Institute and MA holder from University of Westminster, working toward the implementation of the SFDRR in the Arab region. As the Director of Urban Planning and Sustainable Development at the AUDI since 2014, Nuha is working closely with the UNDRR, UNHABITAT and the UNDP offices for the Arab States on mapping the existing assessment frameworks for postdisaster situations in the Arab region, and developing operative regional frameworks to evaluate and disseminate communal and institutional knowledge on strategic sustainable city planning schemes and enhance urban resilience. With focus on DRR, Nuha was able to deliver a comprehensive research and engagement program (MENA Urbanization Knowledge and Disaster Risk Management) at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan 2015, in collaboration with the Centre for Mediterranean Integration – World Bank Group. Nuha was also engaged in the GFDRR 2016 Understanding Risk Event, 2016 Understanding Risk Forum – UN Major Group for Children and Youth side event, the UNISDR Expert Group on developing the indicators for the New 10 Essentials to Implement the Making Cities Resilient Campaign. Nuha Eltinay can be contacted at: nuhaeltinay@gmail.com

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Disaster, reconstruction, and data for social good: the case of wildfires in Portugal

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Abstract

Purpose – This study aims to discuss the role of data in a disaster and important reconstruction process currently undergoing in Portugal.

Design/methodology/approach – The consequences resulting from the wildfires of 2017 and 2018 are the scope of this research paper. The main goal is to understand the role of data, namely, in terms of identifying existing usage, the derived problems and possible improvements. The given topic will be researched targeting secondary sources. The sources include official reports, legal proceedings and relevant newspaper articles.

Findings – In the course of the work, it was possible to identify some important data related pitfalls. Different levels are considered: information prior to extreme events; access to information during the wildfire events; and the problems observed in the aftermath, when tackling reconstruction processes. Civil protection policies in Portugal are failing to integrate population in their socio-technical arrangements.

Research limitations/implications – Important implications can derive by the ongoing investigations and trials enduring in Portuguese justice. This is a process receiving strong media coverage, enacting major revisions to the legal framework and to public policies.

Social implications – Positive social implications may be derived from a stronger focus on transparency and accountability by public authorities. To achieve that data/information must be perceived in a completely different way, aiming at the public good. For the state, data ownership should not constitute the primary goal. Lack of data and transparency has been undermining social relations in the affected areas.

Originality/value – The literature on forest fires is vast, although there are little concerns on the role of data to improve policymaking and to produce positive social impacts, especially in the aftermath of catastrophes. The Portuguese example underlines how information sharing and transparency are important to safeguard social bonds.

Keywords Restoration, Disaster response, Post-disaster reconstruction, Disaster prevention, Crisis management, Extreme weather events

Paper type Research paper

Introduction

During the past century, there is an important track record of natural disasters in the Portuguese territory (Mendes and Tavares, 2009). These extreme events surfaced devastation and human impacts. The floods in the Northern and Central Regions in 1962, Sintra’s forest fire in 1966, the floods in Lisbon during 1967, the earthquake in Angra do Heroísmo, Terceira island and Azores in 1980, the floods in 2010 in Madeira, and then 2017 wildfires in Pedrógão Grande (mid-June) and Central Region (mid-October). In this shortlist,
it should be included data for recurrent heat waves and cold waves. In terms of human impacts, i.e. casualties, technological accidents have been responsible for a far more significant share in the total impacts throughout the past five decades[1].

While forest fires became common-place in the Portuguese continental territory, the events of 2017 are described as a new breed of fires, generating harsher consequences and damage. The wildfires of 2017 were one of the worst disasters to affect Portugal, with more than 275,845 hectares burnt from a yearly total of 424,000 hectares (Departamento de Gestão de Áreas Públicas e de Proteção Florestal, 2017). The death toll reached 112 with 100 of injured citizens. Several communities and landscapes were devastated, with houses, livelihoods and businesses destroyed. A severe drought affecting the territory was one of the root-causes for the events of 2017. Circa 500 houses were reportedly affected. Below, an example of a destroyed house in a rural area, a recurrent scenario in the affected areas (Plate 1).

In 2018, the Southern region in Portugal was the most affected by forest fires. The wildfire in Serra de Monchique has been the biggest fire in Europe, at a time when countries such as UK or Sweden started facing similar problems under the guise of climate change and amplified air temperatures. In Monchique, although the level of destruction has been impressive, the donation campaigns were flawed by the deception in Pedrógão.

Oliver-Smith (1996, p. 309) has shown from a sociocultural perspective that disasters of great magnitude impact on place identity and the sense of loss, mainly when there is loss of formal public places, informal gathering places and other physical features symbolic of community identity. The impact of wildfires on landscape identities has been well documented (Butler et al., 2018), and a multilevel approach to landscape fires as social disasters has been proposed (Gill, 2005).

The case of wildfires in Portugal is significant as the example of a disaster generating severe outcomes. However, the analysis must not be limited to the events itself. The fire represents the beginning of process encompassing several dimensions. In 2017, civil protection failed to protect citizens, and this lack of assistance resulted in increased severity. Many fatalities could have been avoided. On the aftermath of Pedrógão, an important solidarity wave has been triggered in Portugal, with citizens and private companies engendering an impressive chain of relief aid, translated into donations in a total of around €13m (Rainho and Branco, 2017). Shortly after, the idea of mutual trust has been biased when news reporting extensive mismanagement of the funding in reconstruction, a process plagued by numerous problems.

Plate 1.
Destruction site
(Picture by Miguel Mesquita)
Some of the pitfalls are directly associated to data. These circumstances denounce a lack of purposeful data/information not only during the disaster (e.g. absence of mobile phone communications, energy shortage, reduced information from the civil defence system, etc.) but also on the aftermath, i.e. in the long run, when the attempts to register affected houses and businesses faced countless constraints. Two years after the catastrophe, it is accepted that one of the major sources of controversy is given by a lack of transparency, especially in the management of the relief aid (Martins et al., 2019).

Based on the given examples, we are interested in inquiring how purposeful data may improve the described pitfalls. So, by focussing on the context of wildfires and related outcomes in Portugal, it is possible to discuss the role of data, as to pinpoint what is existent and what is missing to foster social good principles. This implies highlighting the success stories: the major donor, Fundaçao Calouste Gulbenkian (FCG), fostered reconstruction activities by funding different realms, including house reconstruction, fighting isolation and loneliness among affected social groups or by supporting local NGOs. FCG example has been very relevant not only because of the budget involved but also for the blueprint it is creating. The latter means good information available, above the average transparency level, including an external audit by outsourced firms (n.d.).

**Extreme forest fires in Portugal and the related outcomes**

The literature related to wildfires in Portugal is vast. More recent contributions have highlighted the social context of affected areas (Oliveira et al., 2017), the reactive nature of public policies and produced legislation (2016) – the latter received a thorough critique by Fernandes et al. (2017), arguing for a more complex institutional and legislative analysis to wildfires in Portugal. A review on the fire regimes and management can be retrieved in Mateus and Fernandes (2014). Forest fires preparedness and community engagement in Portugal has been evaluated by Paton and Tedim (2014).

In 2017, for the first wave of forest fires, most of the registered fatalities occurred when people attempted to flee from their homes by car, being caught by smoke and flames in main roads.

Most of them were running away from their nearby houses. Although more than 250 houses were burned only four persons perished inside their homes, all of them with mobility problems (Viegas, 2018).

This is the very first evidence that by updating policies and by providing good information, eventually the human impact could be lessened.

Across the Pedrógao region, many colourful mourning sites appeared, contrasting to the image of dark burnt land (Plate 2). Survivors paid homage shortly after. In June 2017, a
A considerable number of casualties were from people living outside the region, who were spending a vacation or visiting their relatives when they were trapped by the fire inside their cars.

In Portugal, there is a fire monitoring system with real-time information on forest fires controlled by Portuguese Civil Protection Authority (www.fogos.pt). In a basemap from Portugal, it is possible to find occurrences, to retrieve the number of personnel involved or the status of the fire. This system proves to be ineffective to those directly affected by forest fires as access to internet is often disrupted, there is no information on procedures to undertake, and because an important cohort in population is not using internet. When discussing the role of data, this is a very first example that technology, *per se*, may not produce positive impacts.

Given the severity of these events, immediately the Portuguese Government expressed the willingness to produce official inquiries. As for the event of June and October, controversies arose. The procedures for the enquiry differed to a great extent in the second round of investigation. The event of June received three different reports: Centro de Estudos e Intervenção em Proteção Civil, the independent technical commission, and a third one coordinated by a group of experts in fire research from the University of Coimbra and led by Prof Xavier Viegas. These reports share some important critiques: the command in office could have anticipated some measures to prevent some of the outcomes. An information and alert system working on the right moment to foster awareness among the population to evacuate and/or to stay at home, could have avoided the drama[2]; reaching the places and villages became very difficult. Significant resources were allocated to tackle the fire, although difficulties in communications prevented the command to allocate means to help population and to protect their belongings. The difficulties in communication affected decision making and the alerts (Centro de Estudos sobre Incêndios Florestais, 2017); the SIRESP communication system must be prepared to attend everyone even in the remotest areas, to help people, to defend patrimony and to preserve the environment (Comissão Técnica Independente, 2017).

**Resettling and reconstructing: burdensome experiences**

On the aftermath of the catastrophe of June 2017, one of the main concerns of the Portuguese authorities was to clean up the site and offer a sense of normality as soon as possible, at any cost. For public facilities, namely, roads, road signs and other basic infrastructures. This effort from the Portuguese central state could be seen as a normal attitude from a civil protection standpoint. Although this effort represented a political statement. With so severe outcomes, it was important to redirect the focus, especially when considering the outrageous number of fatalities. This is understandable considering that immediately after the incident, it became obvious that public opinion would be suing responsibilities to, first of all, the Portuguese authorities and the central state based on the news coming from the field (Plate 3).

While arduous experiences were disclosed by the survivors and their relatives, a long reconstruction process started. From the beginning, it became clear that a complex process was underway. Therefore, while some compensations were granted and basic structures were re-established, the biggest challenge consisted of bringing back first housing for affected families. In October, a somehow different scenario emerged as more businesses were affected. These fires occurred in regions with more intensive land use, while some of the affected areas in June corresponded to sparse land occupation.

The return to normality demanded for a long time. At this point, two years after the disaster, not all the houses have been rebuilt. Several reasons were emphasised. The
extension of the damage, with more than 250 houses affected, the novelty of the whole process, the difficult bureaucracy or the lack of resources by those affected to claim for their rights, the pitfalls in coordination between central state bodies and local government. The reconstruction process was, in many respects, overdue by authorities that failed in providing more effective help to countless citizens. More than one year after the events, the mobile communication service remained absent in many areas. In some places, it became clear that landlines and mobile communications will never be replaced, neglecting vulnerable groups in the population. At this point, 2 years after the events, the public debate has been denouncing concerns with the mismanagement of forest areas, considering that affected areas have new trees blooming, generating space for new ignitions and new tragedies in the near future.

During the reconstruction, many controversies arose. A very significant one came into place in August 2018, when it was reported the misuse of relief funding destined to reconstruction. The transgression was uncovered by an investigation conducted by Ana Leal, a journalist from the Portuguese TVI media broadcast. At this time, it became evident that Portuguese authorities had little idea about the conduct of some of those who could apply for funding to finance any sort of dishonourable reconstructions, outside the existing rules (Semanário SOL, 2018). Irregular cases included qualifying additional houses for reconstruction, and not only primary housing or qualifying ruins to refurbishment or applying for funding the refurbishment of houses that were not affected at all but also while some families in need were relegated and were still struggling to rebuild their primary houses. The wrongdoing was based on political ties or other means of influence. Late, in February 2019, a new news report by Ana Leal testified, with pictures and video that an important share of public donations remained stored in a Pedrógão’s municipality warehouse (Leal, 2019). The different cases led to the opening of inquiries by public prosecutors.

When analysing the news media, it became evident that for some of these cases, some citizens and local authorities were aware of the abuses. This is because of, first of all, to rural context, where communities are smaller and the level of anonymity is reduced. This situation recalled for problems in data exchange and sharing. The case of land registry, for instance. The simple activity of identifying primary housing became difficult because the necessary data were unavailable or spread across entities, with little or no integration. This fostered the way to the recorded abnormalities and especially to the lack of control, including by interested parts and citizens. As a result, it is described a context of mutual
distrust, with weaker ties among survivors and affected population, triggered by reparations rewarded by the Portuguese State. The reparations engendered side effects. The same situation happened in the aftermath of Hintze Ribeiro bridge disaster in 2001, a structural failure resulting in 59 casualties.

**Data for social good: little data and marginal advancements in Portugal**

Inside the present data hype, large expectations are produced fuelled by digital technologies. This enchantment affects not only the corporate sector, where many technology companies have centred their business model on data-related activities but also for governments, whose intelligence agencies are adopting ever sophisticated machinery to monitor citizens. The hype is often confounded with big data. The latter refers to the increase in the scale and complexity of data sets. Big data requires new methods and technologies to process qualitative and/or quantitative data to produce meaningful applications (Podesta et al., 2014). Apart from the major controversies, big data are often described as encompassing three central characteristics, namely, huge in volume, high in velocity, and diversity in various type, i.e. being structured and unstructured in nature, often including time and space references (Kitchin, 2014, p. 68). New possibilities for quantification (and control) arise under this new hype, and eventually, we are in face of new uncertainties triggered by the emerging technologies and by data overflow, particularly in terms of privacy and ethics when dealing with forecasted or unanticipated risks and implications (Mayer-Schönberger and Cukier, 2013).

Technology already offers a range of useful options to assist citizens in emergency relief activities. In Portugal, one of the outcomes from the wildfires from 2017 was exactly to expose the fragilities of the existing emergency communication system. The collapse of the aforementioned communication system has been reported, followed by a heated debated concerning its obsolescence. SIRESP (joint emergency and security network system) holds a chequered past. It was set up in 2006 as a partnership between the government and private sector, but it has a negative track record, when it stopped working during a rescue attempt in storms in January 2013 and it was linked to the deaths of two firefighters a few months later. In 2017, at least 10 emergency calls failed to reach firefighters. The government ordered an investigation into the network. At the moment, the final report has not been disclosed, but several failures have been confirmed and preliminary talks are stressing the government’s desire of having the network under public control (Valente, 2019). In June 2019, the Portuguese State became the unique shareholder of the company.

In Portugal, data sharing targeting civil defence has been sparsely improved with trials sometimes coming from individuals using social networks, rather than by authorities. Communication strategies rely very often on traditional media, and it is very reactive, failing to inform population advance. After 2017, Civil protection enacted new policies, including the option to inform citizens using short message service. The tragedy in Pedrógão and later in October highlighted that even fairly basic sociotechnical arrangements that are taken for granted may fail.

From the long list of big data related projects, very often fuelled by “telcos”, some subsidiary concepts emerge. That is, the case of data for social good or data activism. The social good in data are many-times linked to the idea of activism anchored in data, *per se*. Some authors accept the idea of knowledge production fostering community building and knowledge sharing, while providing a way to fruitfully interrogate datafication and democratic participation (Kazansky et al., 2019). In Portugal, the extreme events have been stressing the lack of involvement of the population in civil protection. At this moment,
weather alerts are provided to population, together with information on restrictions to fire
related activities.

Data for social good it is about people using data to improve lives and make the world a
better place.

For many of us, it's an alluring narrative, perhaps because it supports our hope that deep down,
data scientists and statisticians are nice people who value social good over crass materialism
(Barlow, 2015).

When discussing data for social good in relation to forest fires, harnessing information must
be used to tackle the important questions, based on past experience: does the infrastructure
influence safety? How have design and technology innovations really transformed the
preparation to future events? Clearly, there is not a principle of information to foster
democracy and safety in the horizon. Slowly, entities and governmental bodies are adopting
new practices, mostly devoted to issuing alerts to population. Successful advancements in
data for social good normally are grounded on collaboration across organisations and
sectors (Porway, 2017). The aftermath of 2017 and 2018 events and the reconstruction
progression underlines the difficulties in this respect. Owning the data very often is not
directly linked to dissemination policies by governmental bodies and private companies.

Again, in Portugal at this stage, it is impossible to count relevant initiatives fostering the
data for social good principles in civil protection.

General improvements in the relief system: safeguarding future problems
Wildfires are a direct result of different factors. Sometimes trigger effects are combined. From
socioeconomic changes in land use, to the human occupation and management of the rural
areas, to bad policymaking and to climatic change, in the past decades it became clear that
Portugal is facing extreme fires more frequently, with more dangerous conditions together with
the extension of the fire prone days period (Viegas, 2018). Designing complementary systems in
Portugal targeting civil defence imply a number of challenges. First, the infrastructure. One of
the pitfalls is linked to mobile communications disrupting communications for civilians in the
affected areas. Extensive usage of cables over the ground and wiring installations that could
not resist fire properly are reported as problematic. Important structural challenges in the
country include, first of all, the lack of investment in preparation. Other contingencies must be
underlined, including a big share of elderly population facing severe socioeconomic constraints,
the very uneven distribution of the population throughout the territory or the very high
illiteracy rates challenging the activity of issuing alerts to population.

Discussion and final remarks
In this article, it is argued that the availability of good and reliable data can produce
positive societal impacts. Considering the extreme events of 2017 and 2018 as baseline
erexamples, one of the main sources of problems consisted on the lack of participation by
citizens, together with preparation. Under the disruption of communication and given
the dramatic context, too many decided to flee using cars, something that proved to be
incorrect. Under these circumstances, evacuation must be guaranteed in advance. The
option to stay in safe areas should be taken into account, although not many villages
have emergency plans. Citizens had no way to retrieve real-time accurate information,
something confirmed by the interruption of communications in the civil protection
system and the authorities. Hectic scenarios are retrieved when discussing recent
wildfires in Portugal, and citizens repeatedly refer a lack of information or guidelines to
tackle this new breed of fires.
Later, when bearing in mind the reconstruction and all the attempts to restore the living conditions in the affected areas, the lack of data represented an obstacle to the whole process. In other words, in light of the existing problems and especially considering the negative usage of relief aid by involved authorities and citizens, the availability of selected data would foster transparency, scrutiny and accountability amid all the counterparts. Important data for reconstruction remains inaccessible in governmental offices and municipalities, making difficult the tasks of verifying the applicability of funding, even for governmental agencies willing to audit reconstruction. Under these circumstances, the relationship between people in the affected communities has been affected. Weaker ties are reported, with a sense of suspicion and distrust. This has been confirmed in 2018, when campaigns to collect donations to affected people in Monchique received very little contributions, failing to generate, once more, relevant solidarity at a national level in Portugal.

Notes

1. Some infographics on the impacts generated by these extreme events can be retrieved in the following hyperlink: https://is.gd/iFbEle


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Further reading

Fundo de Apoio às Populações e à Revitalização das Áreas Afetadas pelos Incêndios (2019).

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How adapted are built-environment professionals to flood adaptation?

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Abstract

Purpose – The purpose of this paper is to explore how architectural practices have been considering flood-risk adaptation within regular design activities. It relies on the assumptions that floods are hybrid phenomena that require actions in both the anthropic and hydrological domains to be successfully managed, and that floods’ spatial dimension can be subject to design to minimize the impacts of disasters.

Design/methodology/approach – This paper draws on the conclusions of a research focussing on the design of flood-prone urban projects in Europe, within which 22 built-environment professionals (BEPs) were interviewed. The statements of these informants were examined through content analysis, as a means to reveal barriers and incentives that affect their perception and practice of dealing with floods through design.

Findings – Having different experiences with flood-related projects, the interviewees showed uneven degrees of sensitivity to manage floods through design. The analyses pinpoint that for BEPs to be up to the challenges associated with these projects, besides technical expertise, some soft skills are needed such as professional openness and a positive mindset.

Originality/value – This paper explores flood adaptation not only as a spatial challenge but also as a cultural change that needs to be embraced within flood risk management efforts.

Keywords Urban regeneration, Flood adaptation, Architectural practices, Professional competencies, Mindset adaptation, Flood-risk culture, Disaster risk reduction, Built-environment professionals, Design with floods

Paper type Research paper

1. Introduction

Pursuing urban regeneration in flood-prone areas has frequently been blamed as inconsistent with the usual requirements to manage flood risk; nevertheless, this may sometimes be the best option if other less manageable risks are also present (Jha et al., 2012). Moreover, the countering of urban sprawl and the availability of obsolete central areas have been suggested as legitimate reasons to develop hazardous derelict sites in many European cities nowadays (Viganò, 2012). According to Guevara-Viquez et al. (2017), this move represents a “radical and silent change in the paradigm of urban development as regards natural risks”, in which these are also taken as opportunities to rethink the way of designing, building and living with them. The relevance of such stance is even strengthened considering the urban challenges anticipated with climate change.

This study was partially funded by the Portuguese Foundation for Science and Technology (FCT), through a PhD grant (SRFH/BD/73825/2010). The authors are also thankful to all interviewees who generously provided information to this research.
Concerning flood-prone urban areas, authors such as Bauduceau (2014) and Bonnet (2016) have identified a recent European trend of consciously and safely redeveloping them, as demonstrated by contemporary interventions such as HafenCity (in Hamburg, Germany) and Les Ardoines (in Greater Paris, France) (Brun and Adisson, 2011; Serre et al., 2018). Such redevelopments always imply some degree of risk acceptance and the necessity of adaptation, conditions that entail changing the common perspective towards floods. Instead of focussing strictly on defence, these interventions aim to accommodate floods, thus allowing the possibility of living with them without compromising on people’s safety (RIBA, 2007). Living with floods entails, as stated by Rossano (2015, p. 21), “making space for flooding before flooding claims its space”. Tangible experiences recalling that floods' total prevention is unattainable can indeed be valuable to plan for emergencies (Jha et al., 2012).

Yet, such a standpoint does not imply disregarding the accumulated knowledge about the spatial dimension of flood risk management (FRM). Indeed, an array of tested structural and non-structural measures can be geared towards either flood prevention or adaptation, depending on the underlying mindset behind their adoption, i.e. the sociocultural dimension of FRM. For instance, several studies have been carried out about both vernacular and professional flood-related solutions, indicating that it is possible to safely build in floodable zones (Caimi, 2014; CEPRI, 2015). Thus, one may say that the “how-to” of flood adaptation in concrete terms is rather well known. Yet, the “how-come” question, i.e. the conditions that foster the reconversion of degraded floodable areas into liveable and safe ones, is still poorly addressed, as recognized by the European Centre for Flood Risk Prevention (CEPRI, 2015).

The objective of this study was, hence, to explore some aspects related to the “how-come” of flood adaptation, taking urban design as one of the first links to promote the integration of flood risk into urbanism. The paper focusses on how architectural practices have been considering flood adaptation within their regular urban-design activities, based on the experience of some European practitioners. Section 2 discusses key dimensions of flood adaptation, while Section 3 presents the research design. Section 4 then exposes the points of view of the interviewees on dealing with floods through design. Some lessons learned with them are discussed in Section 5, followed by the conclusions in Section 6.

2. Some key dimensions of flood adaptation

2.1 Adapting territories and mindsets to floods

The United Nations Framework Convention on Climate Change (UNFCCC) understands adaptation as the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (UNDRR, 2009, p. 4). Although the need for flood adaptation also derives from faster ongoing human dynamics (Jha et al., 2012), this UNFCCC definition is very useful for the present study as it joins floods’ “natural” and “human” dimensions. Such connection is particularly relevant when considering that since the past decade a hazard-focussed understanding of floods has started to be superseded by one that recognizes them as intricate phenomena in which natural and human processes intertwine (Di Baldassarre et al., 2013). Indeed, not only are fluvial floods the result of the confrontation between the water and exposed people and assets but also river overflows are increasingly induced by interactions between hydrometeorological dynamics and human-driven interventions. Recognizing the interlinkages between anthropic and hydrological processes, socio-hydrology has been developing as a new interdisciplinary field, addressing these relationships though a natural-science standpoint (Sivapalan et al., 2012).

One of socio-hydrology’s interests has been to take into account the feedbacks that follow FRM interventions such as “the flood-defence paradox”, which demonstrates how the use of
structural defences against floods potentially configures an insidious moral hazard (Di Baldassarre et al., 2014). Indeed, these interventions tend to act as “technological blinders” (Rossano, 2015, p. 16) that reduce risk awareness, and thus, hamper timely preparedness while also encouraging the (often haphazard) urbanization of flood-prone areas — in sum, flood risk is eventually increased. Likewise, relying on defensive approaches may hinder the recognition of floods as a hybrid that may positively account for structuring the urban landscape (Hobeica and Hobeica, 2018). This understanding is aligned with UNFCCC’s adaptation definition, which also acknowledges risks’ possible positive outcomes, and thus defies the dystopian scenarios that presently abound (McPhearson et al., 2016).

Given the considerations above, fluvial floods could be considered as “unconsciously designed” human-natural processes under permanent recreation. Accordingly, people are not only among the “elements at risk” but also active actors in producing floods. To properly take into account floods’ anthropic facet, adaptation should thus comprise two interdependent dimensions, namely a territorial and a sociocultural one. Therefore, thorough flood adaptation would imply adjusting both territories and mindsets for accepting floods, so that their possible beneficial opportunities can be exploited, a move that does not need to imply damages and casualties (although some inevitable occasional disturbance has to be tolerated). Flood adaptation may entail intentionally designing minor floods with the pedagogical power of functioning as a “vaccine against the illusion of absolute safety” (Rossano, 2015, p. 22), acting thus on both floods’ territorial and sociocultural dimensions.

2.2 Flood adaptation through design
Considering fluvial floods as unconsciously designed conditions, one may argue that safety can ideally be improved if they become more consciously designed. Such perspective opens new horizons for projects in flood-prone sites. First, floods become as legitimate an issue subject to design as other territorial concerns. Yet, differently from other constraints such as ground pollution or noise that simply demand technical and behavioural solutions, in the case of floods there are also positive environmental, social and aesthetical aspects that can be capitalized upon (Hobeica and Santos, 2016). For instance, minor floods support ecological processes (like enhancing the fertility of swamped cultivated lands) and promote sensitization, thus nurturing flood-risk memory (Langenbach, 2007). Flood adaptation, therefore, offers the opportunity to implement solutions that are essential components of the urban realm.

Acknowledging that floods are perceived differently by urban regeneration’s stakeholders (“as a restriction for local authorities, as a generator of additional costs for developers and as a source of potential damage for inhabitants”), Hubert (2014, p. 226) argues that design offers the possibility of integrating these concerns “into a comprehensive and strategic local vision”. Apprehended as “a complex task of organizing multiple collective intentions, uses, desires, possibilities and constraints in a balanced, sensitive and also inspiring spatial arrangement” (Rossano and Hobeica, 2014, p. 297), design can indeed act as a key tool to convert a known constraint into a renewed resource. Through their potential of coordinating several expertise domains and mechanisms, design practitioners are in a privileged position to explore urban-development alternatives that take floods into account without the resort to simpler preventive mechanisms (Bonnet, 2016). When the design of flood-related projects is performed as a “negotiation platform”, several demands, multiple stakeholders and different territorial scales can be gathered in a dynamic process to redefine perimeters and rules (Rossano and Hobeica, 2014). Such processes may be carried out as a chance for sharing responsibilities and potential costs or damage, and also for
promoting flood-risk culture. In these cases, the actual design outcomes are not limited to new spatial arrangements but also include attempts to transform mindsets.

Undertaken as a flood-adaptation tool, design can successfully combine structural and non-structural measures, while also tackling floods’ sociocultural dimension. Indeed, as the “technological possibilities of flood-defence systems have changed cities’ relationships to their rivers in terms of geography, topography and mentality” (Langenbach, 2007, p. 77), design can support reframing these relationships. Like for other hazards, the role of built-environment professionals (BEPs) is here crucial (Glass, 2008). Nonetheless, for the due incorporation of floods through design, architectural practices need to be better equipped and to challenge some deeply entrenched professional paradigms. Indeed, architecture’s traditional values, as the days of Vitruvius are based on stability and thus on avoiding contingencies (Till, 2009), in sharp contrast with the inherent fluctuations of flood-prone territories. This antagonism and the weight of the mainstream culture of fighting against floods can constitute major barriers to flood adaptation through design.

3. Research design
This paper derives from a research on the design of contemporary flood-adapted urban-regeneration projects in Europe, in the framework of which we interviewed 22 BEPs. The original research adopted the case-study method and focussed on three interventions, namely: an urban park along the Mondego River, in Coimbra (Portugal); a combined civil-civic infrastructure bordering the Scheldt River, in Antwerp (Belgium); and a flood-adapted neighbourhood near the Garonne River, in Bordeaux (France). None of these initiatives can be simply qualified as a “flood-mitigation project”, as other priorities had more weight (in Coimbra and Bordeaux) or an equal weight (in Antwerp) in their respective programmes (the major characteristics of these interventions are synthesized in Table I).

The objective of this study was to capture and discuss first-hand perceptions and attitudes related to dealing with floods within regular design practices. The analysis focussed on key themes identified during semi-structured interviews carried out between January 2013 and July 2016. All interviews were transcribed, validated by the respective informants and then coded, following the content-analysis technique (Bardin, 1977), to unveil major barriers that affect their practices of designing with floods. Some interviewees were experts in flood-adapted design, whereas others were being professionally confronted with this issue for the first time during the project in question (the interviewees are characterized in Table II).

4. Practitioners dealing with floods through design
Having very different experiences with flood-related projects, the interviewees showed uneven degrees of sensitivity to deal with floods through design. While some still perceive flood adaptation as a technical issue outside the scope of architectural practices, to be managed only through hard-engineering measures, others take the opposite vein and embrace floods as actual threads to formulate their designs. The former stance was well demonstrated by an architect when commenting about how floods were accounted for in his project:

If I were extremely cautious I would start with hygiene and safety, but I never start with these issues. For me, the most important issue is the quality of the space and its experience by the user. The rest are constraints to be complied with, one way or another, in order to complement the quality of the space with comfort, safety and other such things.
### Table I. Characterization of the studied urban projects

<table>
<thead>
<tr>
<th>Project period</th>
<th>Commissioner</th>
<th>Main designers</th>
<th>Relationship with FRM initiatives</th>
<th>Main underlying regulatory instruments</th>
<th>Floods in the design brief</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997-2007</td>
<td>Municipality of Coimbra and Sociedade CoimbraPolis</td>
<td>MVCC and PROAP</td>
<td>Project conceived after river-regulation works</td>
<td>REN (environmentally sensitive and risk areas) and PDM (land-use plan)</td>
<td>Indirectly mentioned among the PDM’s constraints</td>
<td></td>
</tr>
<tr>
<td>Since 2006</td>
<td>W&amp;Z and Municipality of Antwerp</td>
<td>PROAP and WIT</td>
<td>Project conceived within a flood-defence initiative</td>
<td>Sigma Plan (flood-management plan) and s-RSA (strategic spatial plan)</td>
<td>One of the three drivers of the project</td>
<td></td>
</tr>
<tr>
<td>Since 2009</td>
<td>Municipality of Bordeaux</td>
<td>YTAA, MDP and Ingérop</td>
<td>No external flood-management initiative expected</td>
<td>PPRI (flood zoning) and PLU (land-use plan)</td>
<td>A crucial site constraint to be necessarily considered</td>
<td></td>
</tr>
</tbody>
</table>

**Parque Verde do Mondego**
- Fluvial-flood type: Slow onset
- Past major floods: 2001 (no casualty) and 2016 (no casualty)
- Existing flood protection: Dams
- Project period: 1997-2007
- Main designers: MVCC and PROAP
- Relationship with FRM initiatives: Project conceived after river-regulation works
- Main underlying regulatory instruments: REN (environmentally sensitive and risk areas) and PDM (land-use plan)
- Floods in the design brief: Indirectly mentioned among the PDM’s constraints

**Scheldt Quays Master Plan**
- Fluvial-flood type: Slow onset and storm surges
- Past major floods: 1976 (no casualty) and 2013 (no casualty)
- Existing flood protection: Quay wall and floodwall
- Project period: Since 2006
- Main designers: PROAP and WIT
- Relationship with FRM initiatives: Project conceived within a flood-defence initiative
- Main underlying regulatory instruments: Sigma Plan (flood-management plan) and s-RSA (strategic spatial plan)
- Floods in the design brief: One of the three drivers of the project

**Plan Guide Brazza Nord**
- Fluvial-flood type: Slow onset and storm surges
- Past major floods: 1999 (no casualty) and 2016 (no casualty)
- Existing flood protection: Quay wall (partially)
- Project period: Since 2009
- Main designers: YTAA, MDP and Ingérop
- Relationship with FRM initiatives: No external flood-management initiative expected
- Main underlying regulatory instruments: PPRI (flood zoning) and PLU (land-use plan)
- Floods in the design brief: A crucial site constraint to be necessarily considered

**Notes:** PROAP: Estudos e Projectos de Arquitetura Paisagista; MVCC: Mercês Vieira e Camilo Cortesão Arquitectos; YTAA: Youssef Tohme Architects & Associates; MDP: Michel Desvigne Paysagiste; REN: Reserva Ecológica Nacional; PDM: Plano Diretor Municipal; s-RSA: Strategisch Ruimtelijk Structuurplan Antwerpen; PPRI: Plan de Prévention des Risques d’Inondations; PLU: Plan Local d’Urbanisme

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### Table II. Characterization of the interviewed BEPs

<table>
<thead>
<tr>
<th>Background</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect-urbanist</td>
<td>11</td>
</tr>
<tr>
<td>Engineer</td>
<td>5</td>
</tr>
<tr>
<td>Landscape architect</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional role</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of a private practice</td>
<td>8</td>
</tr>
<tr>
<td>Senior collaborator in a private practice</td>
<td>3</td>
</tr>
<tr>
<td>Manager in a public body</td>
<td>9</td>
</tr>
<tr>
<td>Senior officer in a public body</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional base</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>4</td>
</tr>
<tr>
<td>France</td>
<td>4</td>
</tr>
<tr>
<td>Portugal</td>
<td>9</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
</tr>
</tbody>
</table>
This quote exemplifies the difficulty of integrating floods into design in a positive manner, for their management is perceived as unable to add to the quality of the project. The somewhat pejorative phrase “other such things” refers to the second-order issues (including floods) that do not constitute more than a thin auxiliary layer added afterward. Conversely, another architect presented a more resourceful standpoint, in which river variations are considered as a very quality to be explored:

Once we started working with the flood-protection system and rethinking the relationship between the water and the city, it was the relationship between water and city; but then it was water as an element that brings in seasonality, tides, the movement, seasons, colours, the weather, so it makes many elements of nature perceivable, and this had to be brought back.

Although floods are not simply river variations, viewing them through a socio-ecological prism encourages their integration as more than just “constraints to be complied with”. These contrasting quotes indeed pinpoint the two major stances vis-à-vis floods as an issue subject to design identified in the study: an external constraint and an intrinsic design object.

### 4.1 Floods as an external constraint

The study revealed that floods tend to be perceived as a constraint external to the design process when there are gaps in terms of risk awareness and low levels of knowledge about floods’ processes by the involved professionals. Indeed, the contents of the interviews indicated that flood-risk perception and awareness are closely associated, as attested by an architect:

> Flood is one part [of the site’s characteristics] but you never feel it while you’re there, never . . .

> This is why I tell you it’s technical for me, because everything else is very powerful, to the extent that you forget flooding.

This aspect was also highlighted by an urbanist when referring to another flood-related project, carried out by her practice in Paris. In that case, her team identified that the involved French Government’s officials completely underestimated flood risk, an issue that, in her account, derives from the absence of floods in the city’s imagery. The low salience of flood risk as a territorial concern is aggravated by the lack of sufficient understanding of the involved hydraulic processes by most stakeholders (commissioners and designers alike), and the required expert knowledge somehow reaffirms floods as a rather technical matter:

> I think that the difficulty when it comes to floods is that they are hard to understand, and that there are few people who know how to deal with them; it’s not easy to grasp the related phenomena – there are many regulations, a lot of modelling, it’s like talking about acoustics or air issues [. . .]. People immediately say: “Oh, no! We will have to make a model; it will be expensive . . .”; so people stay away.

Another drawback in this regard is the fact that floods do not always appear as a concern in the design’s inception phase, implying frequent mismatches and needs for rework. This adverse situation, experienced in some urban projects in Bordeaux, inspired the following statement by an engineer:

> If floods are not integrated in it from the start, the project will not be effective from floods’ point of view. So it has to be done simultaneously; we cannot say: “Let’s start with the master plan, we will deal with the floods later on” – this does not work.

The interviews likewise indicated that the lack of updated flood studies at the project’s scale hinders the incorporation of this risk in the design process, for outdated studies often underrate both the actual floodable zones and potential impacts. Moreover, some
interviewees actually framed floods not only as a physical restriction within design but also as an institutional burden associated to the regulatory framework. A landscape architect made this point clear:

The floods problem was also very specific because it was not only a question of design; it was also very much a question of what is allowed, what is legal.

For another practitioner, the legal requirements in force even represented a “nuisance”, associated to constraints that should necessarily be surpassed:

In the specific case of the Mondego’s flood (it happened once in the last 15 years [interview held in 2013], and it was due to human error), I wouldn’t say that this should really affect the way we work. I don’t think this is something that shapes the project in a significant manner, except when the phenomenon is overvalued and leads to excessive restrictive ideas. So the issue is more how to bypass some restrictions than to comply with some good-behaviour norms [...] You know, the role of designers is to try to do what they are not allowed to. Really, it’s a matter of putting a little more pressure, otherwise we would risk falling into a crafty business of following exactly the rules so that nobody bothers us.

By portraying floods as an avoidable “human error” (referring to the alleged mismanagement of the upstream dam that had caused an important flood in 2001), this interviewee denied design’s role in supporting flood adaptation at the local scale. Moreover, the expressed idea that law restrictions necessarily mean repeating anodyne and seasoned solutions was challenged by another architect, who argued that despite the strict regulations floods did not constitute a limitation for her project:

We were really cooperative with all the rules they gave us; at the beginning we said: “OK, floods should not be an issue; we should adapt to anything they give us related to floods. The important part is to have these negotiations happening between the five typologies of buildings, either with or without floods.” So we took all the constraints positively, but we never compromised on the design, we took them and we tried to have them part of what we have; and then forget about floods and move on.

Being “cooperative with all the rules” was put as a pragmatic attitude to quickly “forget about floods” as a design constraint and not to “disturb” the project’s more important qualities. Moreover, the use of the phrase “they gave us” by the interviewee demonstrates that taking floods as a first-order design issue here was actually conveyed by the clients, not through the designers’ depiction of the site. Conversely, by stipulating that water must be accepted within the sites being regenerated, the French legal constraints were also viewed by some stakeholders as a positive incentive for adequately integrating floods into design from the outset. Accordingly, restrictive legislations were portrayed as a “necessary nuisance” in the framework of flood-adapted urban projects, as expressed by an engineer:

I am convinced that there should be a legal constraint. I would not be able to do my job correctly regarding flood adaptation if I was not backed by the law [...] I would, in some specific instances with some partners, for example, but not in a comprehensive manner.

Nonetheless, some practitioners generally consider that flood-related regulations often take a conservative standpoint that stifles design innovations, thus impacting negatively their projects. Indeed, when containing severe restrictive rules more than stimulating guidelines to support effective adaptation, the legislation in force does not properly dialogue with other involved urban demands. This reasoning seems to motivate a negative stance towards floods by some BEPs, as well as the option for more conventional design solutions in the related urban projects.
4.2 Floods as an intrinsic design object

The interviews underscored that floods tend to be perceived as an intrinsic design object when the involved professionals show a positive mindset and openness to embrace additional challenges as sources of learning. The most compelling argument expressing such a constructive stance was presented by a landscape architect, in a written account of his project. Considering that behind every spatial problem “lies an opportunity to prepare a project, and the bigger and more complex the problem is, the more extraordinary the opportunities are for finding unusual solutions” (Nunes, 2008, pp. 68-69), PROAP envisioned a project in which both city and river could temporarily and plentifully manifest themselves and interact. In the Antwerp case, floods were even perceived as an opportunity for the city to regain its waterfront, as explained by an urbanist: “I think if it would not be the flooding, I would not have the project”. Following such reasoning, “inoffensive” floods are now somehow “desired” to accelerate the implementation of the project, as indicated by a senior officer in the municipal department of urbanism:

Because this is a publicly funded project, I usually joke that I would like to have some more of those floodings [such as the one linked to the 2013 Santa Claus storm, with around 80 cm of water above the quays] to have a higher sense of urgency to have more public funding for the project (not too much that there’s damage, of course) . . .

A similar optimistic standpoint was exhibited by another architect when considering that “constraints are really present in any neighbourhood or city”, and thus in the Bordeaux case floods represented an element that makes the project unique. Floods were, hence, taken as important design input, for “they helped us to be more contextual because if we can construct this anywhere in the world, it will not function”. Likewise, floods were also interpreted as an asset in the Coimbra case. Without floods, the city would have never had that amount of vacant land near its centre to become a park, as recalled by an urbanist:

The Parque Verde do Mondego is an excellent and rare opportunity, since it was offered to the city by the floods of the Mondego. That is, the fact that the river had always been untamed […] hindered the occupation of the riverbanks by constructions: there were only agricultural fields, and no industrial or other urban uses as it is common in most cities.

A positive mindset was also illustrated when floods were managed concomitantly with other project demands, especially taking floods’ temporality into account. Indeed, recognizing the transient nature of riverine urban spaces, some practitioners expressed that they could wisely explore design alternatives foreseeing dry and wet scenarios, and finally propose temporary uses in the concerned project. The anticipation of the water presence in the setting was also considered a means of making risks more perceptible, as explained by an engineer:

Water has to be made visible again in the city . . . . In fact, compared to the past, people have forgotten, they have tried to think that all the water would systematically fit into the pipes and remain behind the dykes . . . . This doesn’t work. So the water has to be seen, so that people are aware of the risk; we must learn again to understand and know the risk.

This engineer actually challenged the perceived limitations of living with floods, by stating that “human beings have always lived in floodable zones […]; we just forgot how to live in floodable zones, but we actually knew how to do it”. Openness to learn was indeed a trait found in some professionals eager to engage with floods, as illustrated by an urbanist in Antwerp, who was for the first time involved in a flood-prone project:
In Belgium it’s not that regular [to work with floods through design], and also because as a problem it’s new in the discipline, and also for urban planners, landscape designers etc., it has become a new subject; and in those years, that’s nearly ten years ago, things were getting invented . . . So I have learned a lot.

A municipal officer involved in the same project even mentioned that this experience has led him to gain valuable expertise, which was subsequently capitalized in other urban-design initiatives. Indeed, the development of flood know-how within public bodies was considered a major asset to favour a proactive attitude towards floods. Such expertise can play a determinant role, as explained by a French urbanist:

We argue that there is a third way: we can build [in a flood-prone zone], under certain conditions, after examining and weighting what is at stake, the exposed assets and the level of risk, since in some territories the risk is small while in others the risk is high, so the approach is not at all the same [. . .]. So each time the weighting of the urban issues at stake will open up ranges of possibilities, to be explored wisely.

5. Discussion
The insights conveyed by the interviewees suggest that, overall, BEPs do not fully realize their potential as “flood designers”, not only because they need to be better equipped in technical terms but also because of the prevailing mindset that portrays floods solely as a burden. The two identified stances vis-à-vis floods are related to the degree of familiarity with this issue prior to the urban project in question, but the interviewees’ statements indicate increasing levels of sensitization, as expressed by an urbanist:

I think flood risk lives and exists as a concern, so that’s sure and that will not change anymore; of course there will also be urban planners and architects who don’t take enough into account those concerns on flooding, but you can’t say that it doesn’t exist at all, that it’s really a kind of black spot in the profession . . . But of course, in many cases, you have to convince the engineers to take another approach, but they are now much more open to it than before.

This account also highlighted that established disciplinary remits may still inhibit a more effective involvement of BEPs to properly deal with floods through design. While the lack of knowledge does not encourage proactive stances, the lack of motivation in its turn represents a barrier to the access to knowledge. As illustrated above, for some BEPs it does not make much sense to invest in understanding floods, considered a “para- or exo-architectonic” concern (Traganou, 2009, p. 179). To duly acknowledge floods’ interacting anthropic and hydrological processes, flood-related urban projects should, hence, be carried out by interdisciplinary teams in which each professional expertise transcends its boundaries to holistically face floods, a challenging requirement given well-established disciplinary specializations. Moreover, to play their expected role in decision-making processes, BEPs need to further develop some soft skills such as openness and mediation, to deal positively with the complexity and contingencies inherent to the hybrid floods.

In sum, this exploratory study identified high flood-risk awareness, understanding flood processes, a positive mindset and professional openness as major incentives for the integration of floods into design as a legitimate input. A supportive institutional framework also appears as an important contextual condition in this regard. Based on our interpretations of the interviews’ contents, a scale of the different understandings of floods as an issue subject to design is proposed in Figure 1.
In the left pole of the continuum, the worst case simply ignores floods, with all the problems (and missed opportunities) that this position entails. In the second situation, floods constitute an external encumbrance, to be “gotten rid of” as soon as possible to allow the design to concentrate on other aspects perceived as more essential to a given urban project. In this stage, characterized by a technocratic stance and a positivistic worldview, a supportive institutional framework plays a key role to “impose” the due consideration of flood risk in the projects. Although this perspective is predominant in the studied contexts, it was also possible to identify some signs of floods starting to be perceived as a legitimate design input, in line with the trend acknowledged in the literature.

In the third scenario, floods are understood as a particularity of the site (just like other limitations and assets), to which constant consideration is given during the design process. In this perspective, floods are a constraint yet really integrated into design. In the more holistic stage expressed in the right pole of the diagram, floods are, finally, understood as an expression of a multitude of “designers” – including the concerned river, taken as a design actor in its own right. Based on a constructivist worldview, it is then possible to embrace floods as an “endo-architectonic concern”, especially when a process-oriented perspective is in place, as advocated by Prominski (2006).

Although the fourth stage may seem too naive to be pursued within FRM initiatives, it is nonetheless aligned with the idea of “integral adaptation” put forward by O’Brien and Hochachka (2011). In any case, the understanding of floods as a design actor should initially be regarded as a provocative image to encourage thinking and designing with floods differently, towards the envisioning of future urban scenarios in which flood damage is mitigated while floods are not prevented, as they are acknowledged as complex and inevitable human-natural processes. To this end, the task of reframing mentalities through design does not concern solely commissioners and other stakeholders; to integrally adapt urban spaces to floods, BEPs also need to reconsider some of their professional certainties to be able to manage more dynamic environments.

6. Final remarks
Our analyses indicated that for BEPs to be up to the flood-adaptation challenges, they need to reframe the way they view floods as a design object, a move that requires, besides technical expertise, the development of soft skills such as professional openness and a positive mindset. Moreover, although floods are not perceived as an appealing design issue, we identified some optimistic opinions as regards the increasing importance they receive within design practices, as illustrated by the following quote:

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**Figure 1.** Floods as a design concern
I think that things are changing. I mean, 15 years ago, we were not good at dealing with the environment, and this has changed—it’s something that is now well integrated in the procedures. I think that it’s floods’ turn now; this is the field in which projects are now going to be improved [. . .]. So my big hope is that the projects will be steadily improving in terms of dealing with floods.

Although this statement sounds encouraging, the next crucial step towards flood adaptation seems to be dealing with them as a hybrid, a composite territorial and cultural subject. Given that climate change, the most ubiquitous hybrid nowadays, “is coming up a little bit with floods as an issue” within design, the adaptation of mindsets is an expected prospect. As such, dealing with floods through design should not only manage their spatial dimension, which is relatively fast and more direct task but also tackle their sociocultural dimension, which is usually a more complex and long-term endeavour. In this context, BEPs are instigated to adapt themselves to be also able to foster overall mindset adaptation through design.

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Effectiveness of early warning and community cooperation for evacuation preparedness from mega-risk type coastal hazard in childcare centers

Abel Táiti Konno Pinheiro
Graduate School of Engineering, Kobe University, Kobe, Japan, and
Akihiko Hokugo
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Abstract
Purpose – This paper aims to investigate the effectiveness of early warning and community cooperation for evacuation preparedness from mega-risk type coastal hazard in childcare centers, focusing in the evacuation of childcare centers from tsunami at the time of the Great East Japan Earthquake occurred on March 11, 2011.

Design/methodology/approach – As the research method, surveys were conducted in public childcare centers affected by tsunami in Kesennuma city in Miyagi Prefecture and Kamaishi city in Iwate Prefecture.

Findings – As the main findings, facilities, where teachers and children started evacuation immediately after the earthquake, could have more conditions to get cooperation from the local community to evacuate children in wide-scale urban environment. Children 3-5 years old tended to be instructed to walk two abreast under the lead of teachers, and children 0-2 years old tended to be carried by the piggyback ride and multi-passenger baby strollers. The destination of evacuation needed to be changed several times because of the risks for higher tsunami and fire outbreaks.

Research limitations/implications – As future issues, it is necessary to analyze the walking capability of children and the transportation capability of multi-passenger baby strollers by teachers, to address strategies to quantify the necessary community cooperation based on the severity of early warning.

Originality/value – Most of the past studies regarding disaster preparedness of nursery children are limited within the facility in case of fire. This work has importance as it focused on the emergency responses that require urban-scale evacuation in ascending route that differ from that which are required in the case of fire.

Keywords 2011 Tōhoku earthquake and tsunami in Japan, Multi-hazard risk, Community partnership, Vulnerable group, Evacuation preparedness

Paper type Research paper

1. Introduction
Childcare centers are facilities that take care of children 0-5 years of age, who have reduced capability on autonomous walking in case of an emergency evacuation. Therefore, it is even more difficult to ensure their safety in case of mega-risk type coastal hazard, such as storm surge and tsunami, in which damages tend to spread widely and evacuation in a wide-scale...
urban environment are required. Especially in case of tsunami resulted by strong earthquake, as the further away and higher the sheltering place, it would take even longer time to complete the evacuation, being exposed to the secondary risks such as aftershocks and tsunami fire (fire outbreaks in the flooded area, reported by Hokugo et al., 2011). A quick decision to start the evacuation, as well as the early-warning for hazards and the availability of community cooperation, can make a difference in these cases, as observed in actual evacuation cases reported by Japan Committee for UNICEF (2013) and Amano (2011). During the 2011 Great East Japan Earthquake (GEJE), occurred on March 11, 2011, 722 childcare centers were affected by the earthquake, of which 78 facilities severely damaged by tsunami in Prefectures of Fukushima, Miyagi and Iwate. Despite the devastating damage, there were only three casualties of children under the care of nursery (Kahoku Shimpo, 2011). To evaluate the evacuation capabilities of childcare centers that are exposed to coastal hazards, it is crucial to understand the survival experiences from past disasters. In terms of research studies related to the evacuation of childcare centers, most of the studies are limited within the facility in case of fire, such as studies conducted by Murozaki and Ohnishi (1985) and Larusdottir and Dederichs (2012). In the case of coastal hazards, nursery teachers need to lead children along long-distance ascending route, resulting in evacuation responses that differ from that which are required in the case of fire. This paper aims to investigate the situation of the evacuation of childcare centers from tsunami at the time of 2011 GEJE, to understand the effectiveness of early warning and community cooperation for the successful evacuation.

2. Methods
As the research method, surveys were conducted in all public childcare centers affected by tsunami at the time of GEJE in Kesennuma city (Miyagi Prefecture) and Kamaishi city (Iwate Prefecture), conducting interviews to the teachers who were involved in the evacuation. The interviews took place at the childcare centers where they were relocated after the disaster. Table I shows the list of childcare centers in which surveys were conducted.

3. Results
According to the interviewees (teachers involved in the evacuation of childcare center at the time of GEJE, hereinafter referred to as teachers), not all facilities were able to receive appropriately tsunami warnings announced by authorities. Table II shows the overview of

<table>
<thead>
<tr>
<th>Nursery (location)</th>
<th>No. of stories</th>
<th>Altitude above sea</th>
<th>Distance from seaside/river</th>
<th>No. of teachers</th>
<th>No. of children (age)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (Shiomicho) *1</td>
<td>1</td>
<td>0.5 m</td>
<td>0.2 km/0.3 km</td>
<td>12</td>
<td>71 (0-5 years of age)</td>
</tr>
<tr>
<td>U (Unosumai) *2</td>
<td>1</td>
<td>3.5 m</td>
<td>1.2 km/0.1 km</td>
<td>21</td>
<td>73 (0-5 years of age)</td>
</tr>
<tr>
<td>K (Owataricho) *2</td>
<td>2</td>
<td>1.0 m</td>
<td>0.6 km/0.2 km</td>
<td>29</td>
<td>75 (0-5 years of age)</td>
</tr>
<tr>
<td>S (Shishiori) *1,*3</td>
<td>1</td>
<td>0.7 m</td>
<td>0.8 km/0.3 km</td>
<td>2</td>
<td>8 (3-6 years of age)</td>
</tr>
<tr>
<td>N (Hongo) *1</td>
<td>2</td>
<td>2.1 m</td>
<td>1.2 km/0.2 km</td>
<td>9</td>
<td>37 (0-5 years of age)</td>
</tr>
<tr>
<td>H (Hajikami) *1</td>
<td>1</td>
<td>6.8 m</td>
<td>0.5 km/0.4 km</td>
<td>3</td>
<td>20 (3-5 years of age)</td>
</tr>
</tbody>
</table>

Notes: *1 Kesennuma city, Miyagi Prefecture (surveyed in November 2012).  *2 Kamaishi city, Iwate Prefecture (surveyed in September 2016).  *3 All facilities were nursery schools, except Nursery S that was an after school children’s center.

Table I. List of surveyed childcare centers
the pre-existent evacuation plan and the actual evacuation behavior that occurred during GEJE.

In all cases, it was possible to do a successful evacuation, without resulting in human losses. However, facilities that had previously agreed with children’s parents to designate the emergency parents meeting place to hand over their children in case of major disaster (hereinafter referred to as “emergency parents meeting place”) outside the childcare centers such as nurseries I, U and K, had relatively more conditions to initiate wide-scale evacuation in urban environment earlier, as well as receiving tsunami warning properly and getting cooperation of local community, than other facilities that designated “emergency parents meeting place” inside the childcare center. Aiming to understand the effectiveness of early warning and community cooperation, the first part of the analysis will focus on the facilities where people started evacuation in the urban environment relatively earlier, and the second part will focus on facilities where people were relatively delayed to start evacuation in the urban environment.

3.1 Facilities where people started evacuation in the urban environment relatively earlier

3.1.1 Evacuation of nursery I. According to the teachers, a three-storey reinforced concrete building (a community center), designated as tsunami evacuation building (T.E.B.) by municipal government, located 60 m from childcare center, had been chosen as destination of the evacuation of teachers and children in the case of both earthquake and tsunami, conducting evacuation drill to there twice a year with participation of local community. The earthquake occurred when 12 teachers were taking care of 71 children 0-5 years of age. The evacuation was initiated immediately after the quake. All teachers and children get together in the playground, then they did the primary evacuation to the second floor of the T.E.B. Details of the evacuation response are shown in Table III and Figure 1.

3.1.1.1 Overview of the primary evacuation (to the second floor of tsunami evacuation building). As soon as a strong earthquake happens, the director of the facility ordered all teachers to start the “emergency evacuation due to the risk of tsunami,” and evacuation to the T.E.B. was initiated even as the earthquake continued, started by each class group,

<table>
<thead>
<tr>
<th>Nursery</th>
<th>Damage by tsunami</th>
<th>Pre-existent evacuation plan</th>
<th>Emergency parents meeting place*</th>
<th>Destination of evacuation at the time of GEJE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Swept away</td>
<td>Both earthquake/tsunami: tsunami evac. building</td>
<td>Outside facility (tsunami evac. building)</td>
<td>Tsunami evac. building (second floor → third floor → rooftop)</td>
</tr>
<tr>
<td>U</td>
<td>Swept away</td>
<td>Earthquake: playground tsunami: daycare center Y</td>
<td>Outside facility (day care center Y)</td>
<td>Day care center Y → stone store N → elementary school</td>
</tr>
<tr>
<td>K</td>
<td>Swept away</td>
<td>Earthquake: playground tsunami: hill (park Y)</td>
<td>Outside facility (elementary school)</td>
<td>Park Y in top of a hill → hospital N</td>
</tr>
<tr>
<td>S</td>
<td>Swept away</td>
<td>Earthquake: playground tsunami: nearest hill</td>
<td>Inside facility (playground)</td>
<td>Nearest hill → elementary school</td>
</tr>
<tr>
<td>N</td>
<td>Partially flooded</td>
<td>Both earthquake/tsunami: second floor of facility</td>
<td>Inside facility (second floor of facility)</td>
<td>Second floor of facility → junior high school</td>
</tr>
<tr>
<td>H</td>
<td>Partially flooded</td>
<td>Earthquake: playground tsunami: Jr. high school</td>
<td>Inside facility (playground)</td>
<td>→ Junior high school</td>
</tr>
</tbody>
</table>

Table II. Situation of childcare centers at the time of GEJE

Note: *Emergency parents meeting place to hand over their children in case of a major disaster
separated by age, they were ready to leave the facility: a group formed by children 5 years of age going forward, followed by a group of children 4 years old, and another formed by children 3 years old, walking in two abreast under lead of teachers (positioned in front, middle and final part of each group), and at the end, teachers carried children 0-2 years old by piggyback ride and three multi-passenger baby stroller (each vehicle carrying about four children and being handled by one teacher). Plate 1 shows a multi-passenger baby stroller similar to what was used during the evacuation. As the previous drills, three employees of a handicapped childcare facility located in the same childcare center site went to support the evacuation of children 0-2 years of age. Besides that shortly leaving the facility, nursery teachers could receive assistance from employees of other nearby companies to handling heavy multi-passenger baby strollers in unpaved surfaces. Arriving at the T.E.B., children 2-5 years old walked under the lead of teachers to climb stairs, and children 0-1 year old were carried by piggyback ride to reach the second floor. On the second floor, teachers and children got together with other evacuees, including about 60 children’s parents and some dozens of neighborhood residents.

3.1.1.2 Overview of the secondary evacuation (to the third floor of tsunami evacuation building). Some minutes after arriving on the second floor, evacuees received the alert of “major tsunami warning” through J-alert (satellite-based Japanese nationwide warning system) that was broadcasted via public loudspeakers, television, radio, email and mobile phones, triggering the secondary evacuation, from the second to third floor of T.E.B. Some parents of children, thinking that there was no real risk of tsunami, tried to return home with their children, but were prevented by the teachers from leaving the evacuation building.

3.1.1.3 Overview of the tertiary evacuation (to the rooftop of tsunami evacuation building). About 30-40 min after arriving on the 3rd floor, the first wave of tsunami was

<table>
<thead>
<tr>
<th>Evacuation</th>
<th>Destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>To the T.E.B</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route, measured in the horizontal direction: 60 m*</td>
</tr>
<tr>
<td></td>
<td>Cumulative elevation gain: less than 1 m*</td>
</tr>
<tr>
<td>Secondary</td>
<td>From the second to the third floor of T.E.B</td>
</tr>
<tr>
<td>Tertiary</td>
<td>From the third floor to the rooftop of T.E.B</td>
</tr>
</tbody>
</table>

**Note:** *Measured with cartographic data of Geospatial Information Authority of Japan (GSI)*

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**Figure 1.** Evacuation route of nursery I

**Table III.**
Evacuation of nursery I
observed, and warnings for even higher successive waves were announced by authorities, triggering the tertiary evacuation to the rooftop. After arriving there, it was verified that the childcare facility was completely destroyed by tsunami and the T.E.B. was flooded up to the second floor. Some hours after arriving on the rooftop, it begins to snow, and at 17:15, some oil tanks of industrial facilities were dragged by tsunami until the proximity, occurring numerous explosions in contact with debris and starting a fire outbreak over the flooded surface surrounding the building. When sparks began to fly over the rooftop, it was decided to return to the third floor for safety. The external facade was partially burned, but there was no fire spread inside the building, thanks to the effort of evacuees in pushing floating flammable debris away from the building all through the night. On next day, helicopter rescues teams arrived at the building, taking two days to rescue all evacuees.

3.1.1.4 Post-disaster considerations. In nursery I, the primary evacuation was concluded about 10 min after the earthquake, being “faster than the time registered during drills.” Following factors contributed to the quick response: having a single destination in any disaster scenario, without having to wait for tsunami warning; having agreed with parents in designating the T.E.B. as “emergency parents meeting place”; having implemented shortcut route from childcare care site to adjacent facilities; having initiated evacuation quickly, which made it possible to avoid traffic jam and get support from community. Furthermore, there was an elevated ground in a hill located 1.4 km away, however, according to the teachers, as it was not possible to know if they were capable of managing evacuation in roads with steep inclination (that include segments with 200 m of distance with inclination over 10 per cent), the possibility of going to the hill had been discarded, having the nearest T.E.B. as destination during GEJE. However, they needed to change the
sheltering place inside the building several times due to the increase in the risk of higher tsunami and fire outbreaks. Some doubt has arisen, as follows:

At the time of the earthquake, it was difficult to handle the multi-passenger baby strollers even on the flat route to the Tsunami Evacuation Building, therefore, the evacuation to the hill would probably have failed if it depended only on the human resources that were available. However, considering the adversities we suffered in the evacuation building, the possibility of evacuation to the hill, with the cooperation of local community, should have been studied in advance.

3.1.2 Evacuation of nursery U. According to the teachers, before GEJE, the facility was conducting once a year a wide-scale evacuation drill to the day care center Y, where was the place designated by the municipal government as the nearest evacuation place from the nursery. The earthquake occurred when 21 teachers were taking care of 73 children 0-5 years of age. Immediately after the earthquake, all teachers and children got together in the playground, then they did the primary evacuation to the day care center Y, secondary evacuation to the stone store N and tertiary evacuation to the Kamaishi elementary school. Details of the evacuation response are shown in Table IV and Figure 2.

3.1.2.1 Overview of the primary evacuation (to the day care center Y). Teachers perceived “a real danger of tsunami because of the seismic shaking that was extremely stronger than usual,” and decided to start the evacuation until day care center Y immediately. They could listen to the announcement of “major tsunami warning” that was broadcasted by public loudspeakers when they were already preparing to leave the facility. The evacuation was started by class group separated or combined by age, in the order they were ready to leave the facility: a group formed by children 5 and 3 years of age going forward, followed by a group of children 4 years of age, and another formed by children 2 years of age (holding teacher’s hands). Four employees that work in an afterschool children’s center located adjacent to the childcare center assisted the evacuation of part of children 2 years of age. In the end, children 0-2 years of age were carried by the piggyback ride and two multi-passenger baby strollers (each vehicle carrying about eight children and being handled by two teachers). Teachers had difficulty in handling baby strollers in roads with steep inclination, however, some of the children were handed over to parents that came to pick up during the evacuation, which contributed to reduce the weight and facilitate the evacuation.

<table>
<thead>
<tr>
<th>Evacuation Destinations</th>
<th>Details</th>
</tr>
</thead>
</table>
| Primary To the day care center Y | Distance along the walking route, measured in the horizontal direction: 568.4 m*1  
Cumulative elevation gain, measured in nine segments: 10.8 m*1  
Inclination of the steepest segment: 7.6%*; and average inclination of ascending segments: 2.1%*1 |
| Secondary To the stone store N | Distance along the walking route, measured in the horizontal direction: 510.2 m*1  
Cumulative elevation gain, measured in nine segments: 28.7 m*1  
Inclination of the steepest segment: 10.8%*1  
Average inclination of ascending segments: 5.6%*1 |
| Tertiary To the Kamaishi elementary school | Height/inclination of retaining wall on the back of the stone store to reach the expressway: 5.3 m/61%*1  
Distance to the Kamaishi elementary school: about 7-10 km to south*2 |

Notes: *1 Measured with laser scanning survey. *2 Estimated with cartographic data of GSI Japan

Table IV. Evacuation of nursery U
Figure 2. Evacuation route of nursery U

Figure 3. Representation of the steep route with access to the day care center Y during evacuation

handling of strollers. Figure 3 shows the situation of steep route with access to the day care center Y. Along the evacuation route, a severe traffic jam was taking place. Teachers and children had to move around on the pedestrian’s side, diverting from paralyzed vehicles, and it was difficult to move in part of segments without raised curbs that separate footpath from the road.

3.1.2.2 Overview of the secondary evacuation (to the stone store N). About 5 min after arriving in the day care center Y, it was observed that the surrounding area was flooded by tsunami. Considering the risk of inundation in the day care center, it was decided to evacuate to the higher place of stone store N. Shortly after start leaving the day care center, students and teachers of an elementary school reached there, and some of students assisted the evacuation of children by holding their hands and walking together, and school teachers supported the transportation of multi-passenger baby strollers. Arriving at the stone store,
they could get together with parents of some children, residents of neighborhood and employees of medical facilities.

3.1.2.3 Overview of the tertiary evacuation (to the Kamaishi elementary school via expressway). In the stone store, there was a risk of falling stone artifacts by aftershocks. Around 16:30, firefighters came to the store and oriented nursery group to move to the Kamaishi elementary school. Teachers and children needed to climb a retention wall with more than five meters high that was on the back of the stone store site, to reach higher ground, where there was an expressway that was not affected by tsunami. Employees of stone store secured access to the retaining wall by cutting and removing the fence between the wall and store site, and teachers of elementary school climbed the wall to fix ropes until the guardrail of the expressway. Posterity, nursery and school teachers started carrying children one by one along the rope until the expressway, where the nursery group could hitch rides to move by car to the Kamaishi elementary school. The last children were handed over to their parents in the school two days after the earthquake.

3.1.2.4 Post-disaster considerations. In nursery U, the evacuation drill to the day care center that was done one month before the earthquake took about 13 min, however, at the time of GEJE, they were able to complete in about 10 min. According to the teachers:

The rapid response was possible since teachers and children were able to keep unity as a group, without interrupting movements while walking, and the cooperation of teachers and students of elementary school was indispensable to the success of evacuation in routes with severe slope.

3.1.3 Evacuation of nursery K. According to the teachers, before GEJE, the facility was conducted once a year a wide-scale evacuation drill to the “park Y” located at the top of a hill, where was the place designated by the municipal government as the nearest evacuation place from the nursery. On the day of the earthquake, 29 staff were taking care of children 0-5 years of age. The evacuation was initiated immediately after the quake. All teachers and children get together in the playground, then they did the primary evacuation to the park Y located in an elevated ground, and the secondary evacuation to the hospital N located adjacent to the hill. Details of the evacuation response are shown in Table V and Figure 4.

3.1.3.1 Overview of the primary evacuation (to the park Y located on the top of a hill). Immediately after the earthquake, teachers recognized the risk of tsunami and guided children to the playground. One of the oldest staff, who had already experienced tsunami calamities in the past, alerted other staff, saying “with absolute certainty, a huge tsunami...”

<table>
<thead>
<tr>
<th>Evacuation</th>
<th>Destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>To the begging of hill access stairs/slopes (to reach the park Y on the top of a hill)</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route measured in the horizontal direction: 148 m*</td>
</tr>
<tr>
<td></td>
<td>Elevation gain: +0.4 m*; inclination: +0.3%*</td>
</tr>
<tr>
<td></td>
<td>To the park Y</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route measured in horizontal direction: 190 m*</td>
</tr>
<tr>
<td></td>
<td>Cumulative elevation gain measured in 14 stairs segments: +28.2 m*</td>
</tr>
<tr>
<td></td>
<td>Cumulative elevation gain measured in 10 slope segments: +11.6 m*</td>
</tr>
<tr>
<td>Secondary</td>
<td>To the hospital N located adjacent to the hill (via bridge connected to the fifth floor of the hospital)</td>
</tr>
</tbody>
</table>

Note: *Measured with laser scanning survey

**Table V.**

Evacuation of nursery K
is coming.” This alert triggered to initiate the evacuation to the park Y, as soon as children could get together in the playground. Before starting the evacuation, some of the parents came to the childcare center to pick up their children. Parents were also oriented to evacuate together. The evacuation was started by each class group, separated by age, in the order they were able to get together in the playground and complete the preparation to leave the facility: class of 5 years of age going forward, followed by class of 4 years of age and class of 3 years of age, walking in two abreast under the lead of teachers; and at the end, teachers carried 0-2 years of age children by piggyback ride, baby wrap rope and 3 multi-passenger baby strollers. At the time of GEJE, all of three multi-passenger baby strollers were parked next to the classroom of children 0-2 years of age, as a precaution for an eventual emergency. Before GEJE, these vehicles were being used as recreational rides, each stroller transporting six children with one teacher as a conductor, however, during GEJE, each stroller carried 10 children and was conducted by two teachers. Due to the excessive transportation weigh, teachers were having extreme difficulty in maneuvering strollers. However, when they were leaving the facility, they could get together with employees of neighboring companies who ended up supporting in handling strollers. Immediately after starting evacuation outside childcare center, teachers listened to the alert of “major tsunami warning” that was broadcasted by public loudspeakers. Traffic congestion has occurred along public roads, which cross the evacuation route, making it difficult to cross intersections. To secure the evacuation route, it was necessary to block the intersection temporarily and force vehicles to stop. When arrived at the edge of hill access stairs/slopes, nursery teachers and children could get together with residents of the neighborhood who were also evacuating. With the cooperation of these residents, all children could be evacuated in safety through the stairs and severe slopes to the park Y. Figure 5 shows an overview of the hill where park Y is located.

3.1.3.2 Overview of the secondary evacuation (to the hospital N). At around 17:00, government officials and firefighters came to the park, and oriented nursery group and other evacuees to move to the hospital N, located adjacent to the hill. The evacuation of nursery children has become a priority, and they were moved through the bridge that connects the intermediate part of the hill access stairs with the fifth floor of the hospital. The emergency parents meeting place with children’s parents that had been preventively designated was the Kamaishi elementary school. As the school staff came to visit the hospital in the evening, nursery teachers requested them to announce at the school the situation of children in the
hospital N, ready to be handed over to their parents. The last children were handed over to
their parents two days after the earthquake.

3.1.3.3 Post-disaster considerations. In nursery K, the evacuation to the park Y was
concluded in 19 min after the earthquake, and 15 min before surrounding area being flooded
by tsunami. According to the teachers:

The traffic congestion was the biggest problem, and the cooperation of community to handling
multi-passenger baby strollers and assisting children in stairs and slopes were considered crucial
to the success of evacuation.

3.2 Facilities where people were relatively delayed to start evacuation in the urban
environment

3.2.1 Evacuation of nursery S. According to the teachers, before GEJE, in this facility, they
had conducted once a year an evacuation drill to the nearest hill with parents and local
residents. At the time of GEJE, three nursery staff were taking care of eight children, and the
quake occurred just after one teacher ended working and two children left the facility.
Remaining children were evacuated to the playground, and some parents came to pick up
them. After handed over four children 3 years of age to their parents, teachers listened to the
“major tsunami warning” broadcasted by public loudspeakers, announcing that there was a
risk of “waves with six meters of height,” triggering the primary evacuation to the nearest
hill, and secondary evacuation to the Shishiori elementary school. Details of the evacuation
response are shown in Table VI and Figure 6.

3.2.1.1 Overview of the primary evacuation (to the nearest hill). Because of the
announcement of “major tsunami warning,” it was decided to start evacuation to the nearest

<table>
<thead>
<tr>
<th>Evacuation</th>
<th>Destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>To the nearest hill</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route measured in the horizontal direction: about 780 m*</td>
</tr>
<tr>
<td></td>
<td>Elevation gain: about +5.9 m*</td>
</tr>
<tr>
<td>Secondary</td>
<td>To the Shishiori elementary school</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route on train rail measured in horizontal direction: about 940 m*</td>
</tr>
</tbody>
</table>

Note: *Estimated with cartographic data of GSI Japan
hill. The preparation to leave the facility took 5 min, and during this time, two remaining children were handed over to their parents. However, teachers got together again with them in an intersection located 150 m along the route. As soon as they arrived at the hill together, they noticed that the surrounding area was already being flooding by tsunami.

3.2.1.2 Overview of the secondary evacuation (to the Shishiori elementary school). It began to snow on the hill, and they needed to look somewhere for shelter. However, it was difficult to find other places, as potential shelters such as nearby houses, were already full of evacuees. They decided to go down the hill, to reach a raising train rails and walk along the rail to get to the Shishiori elementary school. The tsunami had flooded the train rails, however, as the waves already pulled back, it was possible to proceed with the evacuation. The surrounding areas were severely destroyed by tsunami and a fire outbreak, with the risk of exposure to smoke and sparks, but they could get to the school with safety.

3.2.1.3 Post-disaster considerations. In a subsequent reconsideration after the disaster, some doubt has arisen, as follows: “if parents did not come and children 3 years of age remained, maybe it would not have been possible to evacuate to Shishiori elementary school”; “maybe it was better if we had previously planned the destination of secondary evacuation, after arriving at the hill.”

3.2.2 Evacuation of nursery N. According to the teachers, there was no specific evacuation plan in the urban environment in case of risk of tsunami. In case of a strong earthquake, in which seismic intensity is greater than JMA-5 (Japan Meteorological Agency seismic intensity scale), there was a plan to evacuate children to the second floor and parents should come and pick up their children, as previously agreed in case of emergency. The earthquake occurred when nine staff were taking care of 37 children 0-3 years of age. All teachers and children did the primary evacuation to the second floor of the facility. After the first floor was flooded by tsunami, they did the secondary evacuation to the non-flooded area and reached the Kesennuma high school. Details of the evacuation response are shown in Table VII and Figure 7.

3.2.2.1 Overview of the primary evacuation (to the second floor of childcare center). Immediately after the quake, all children were evacuated to the second floor, staying there to wait for their parents. Teachers were overwhelmed to attend dozens of parents who came to pick up their children, and no one could notice if any tsunami warning was being announced or not. According to the local tsunami hazardous map, the childcare center was located outside of flood-prone area, but nearby hazardous boundary. When parents of the last two remaining children arrived on the second floor, the first floor was flooded by tsunami, and
the area surrounding the facility was filled with debris. Innumerable vehicles from a nearby car store were dragged, colliding and knocking down electricity poles, and part of this debris invaded the outer staircase of the nursery building. Without conditions to escape from the nursery, two children 0-1 year of age, one parent, nine nursery teachers and another two teachers that went to the childcare center to support the nursery after the earthquake (they were outside the facility at the time of earthquake), totaling 14 people, have become isolated on the second floor.

3.2.2.2 Overview of the secondary evacuation (to the non-flooded area to reach the Kesennuma high school). Later, at 17:30, a large smoke caused by fire outbreaks in flooded areas was seen at a remote place, causing safety concern at the childcare center. Also, considering that emergency stocks for foods and heating equipment were insufficient, they decide to escape from the facility and initiate secondary evacuation in the urban environment. Deviating the accumulated debris in stairs, the nursery group went to the first floor, which was partially flooded up to 1 m height. They found a window facing the parking lot, where there was relatively less amount of debris, through which they could escape outside. At that time, two remaining children were carried by the piggyback ride. The multipassenger baby strollers were found submerged and broken next to the entrance. In the urban environment, they managed to move about 250 m to reach an intersection where the flood area ended, walking carefully to avoid accidental falls in gutters below flooded areas. They initially tried to reach the nearby municipal hospital to shelter, however, they were informed that the hospital was completely full of evacuees. In the end, they needed to move to the Kesennuma high school, where the safety of the nursery group was guaranteed. While they were moving to the school, it happened to get together with father of one of the last remaining children, for whom the child was returned.

<table>
<thead>
<tr>
<th>Evacuation</th>
<th>Destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>To the second floor of the childcare center</td>
</tr>
<tr>
<td>Secondary</td>
<td>To the non-flooded area to reach the Kesennuma high school</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route measured in horizontal direction: about 1.13 km*</td>
</tr>
<tr>
<td></td>
<td>Elevation gain: about +35.9 m*</td>
</tr>
</tbody>
</table>

Note: *Estimated with cartographic data of GSI Japan

Table VII. Evacuation of nursery N

Figure 7. Evacuation route of nursery N
3.2.2.3 Post-disaster considerations. In a subsequent reconsideration after the disaster, some doubt has arisen, as follows: “if having chosen the second floor of the childcare center was really adequate or not”; “if the tsunami was even stronger, the childcare center could have been dragged by waves.”

3.2.3 Evacuation of nursery H. According to the teachers, the earthquake occurred when three staff were taking care of 20 children 3-5 years of age. Immediately after the quake, all children were evacuated to the playground, according to the evacuation planning and drills that were carried out periodically, then they did the primary evacuation to the Hashikami junior high school. Details of the evacuation response are shown in Table VIII and Figure 8.

3.2.3.1 Overview of the primary evacuation (to the Hashikami junior high school). When the earthquake occurred, children initially did not obey the guidance for evacuation, standing still. While the earthquake continued, children 3-5 years of age began to walk to go outside after teachers shouted, and children 3 years of age had to be carried by teachers to leave the building. Shortly after arriving at the playground, some of the children were handed over to their parents who came to pick up them. One child 4 years of age remained at the facility, and at that time, they recognized the risk of tsunami, when teachers noticed that students of nearby high school were doing massive evacuation in proximity, going in the direction of the Hashikami junior high school, located in the elevated ground. Three teachers decided to leave the childcare center and started evacuation to the junior high school with a remaining child. However, two teachers those were already on the way of evacuation needed to return to the childcare center to place the notification about the destination of evacuation in the garden gate. One teacher and one child continued walking for evacuation through the route surrounded by many old houses. Because of continuous aftershocks, they had to stop many times to protect from the tiles that fell from these houses. Most of the local residents of surrounding area had been evacuated earlier, and it was not able to see those residents

<table>
<thead>
<tr>
<th>Evacuation</th>
<th>Destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>To the Hashikami Junior high school</td>
</tr>
<tr>
<td></td>
<td>Distance along the walking route measured in horizontal direction: about 1.25 km*</td>
</tr>
<tr>
<td></td>
<td>Elevation gain: about +23.2 m*</td>
</tr>
</tbody>
</table>

Table VIII. Evacuation of nursery H

Note: *Measured with cartographic data of GSI Japan
walking for evacuation along the route. When the teacher and the child were walking along the route, they were alerted by other people who were driving cars for evacuation that “the tsunami has already reached the area nearby,” but they did not let them ride on their cars. After walking 600 m and arriving in the area next to the train rail, it was possible to get a ride from a resident who was evacuated by car, taking them safely to the junior high school. Posterity, other two nursery staff were also able to ask to ride on another car. Around 1600, all three teachers, one child and his parents were able to get together at the school.

3.2.3.2 Post-disaster considerations. In a subsequent reconsideration after the disaster, some doubt has arisen, as follows: “some residents found that our childcare center was a designated evacuation shelter in case of tsunami, and one elderly came there to evacuate by mistake”; “if the relatives of this elderly had not come to get him immediately, perhaps, our evacuation could have been compromised.”

4. Conclusions
This study addressed the effectiveness of early warning and community cooperation as factors that contribute to strengthening the resilience of childcare centers from mega-risk type coastal hazards, by investigating evacuation cases of childcare centers that were affected by tsunami at the time of the 2011 GEJE in municipalities of Kesennuma and Kamaishi. Figures 9 and 10 show the overview of nursery group formation for wide-scale evacuation.

Figure 9. Overview of nursery group formation for wide-scale urban evacuation at the time of 2011 GEJE

Figure 10. Overview of destinations of the evacuation of nursery teachers and children at the time of 2011 GEJE

Effectiveness of early warning
evacuation in urban environment and the destination of evacuation at the time of 2011
GEJE. Main findings are as follows:

- Facilities located near seaside tend to be more concerned about the risk of tsunami,
  and there was a tendency to start evacuation even before the announcement of
  tsunami warning by authorities (broadcasted via public loudspeakers, television,
  radio, email and mobile phones through nationwide warning system “J-alert”).

- Facilities that had been preventively designated as the emergency parents meeting
  place outside childcare centers tend to initiate evacuation more quickly, while
  facilities that had been designated as the emergency parents meeting place within
  the facility tend to delay response.

- Facilities, where nursery teachers and children started evacuation immediately after
  the earthquake, could have more conditions to receive tsunami warnings
  appropriately and decide the destination of evacuation according to the severity,
  and get more cooperation from the local community to evacuate children.

- Children 2 and 3 years of age or higher tended to be instructed to walk two abreast
  under the lead of teachers, and children 2 years of age, 1 year of age or younger
  tended to be carried by the piggyback ride and multi-passenger baby strollers, with
  the capacity to carry four to eight children (Figure 9).

- The destination of evacuation that had been indicated in pre-existent evacuation
  plan needed to be changed several times, to areas located in higher places and even
  far from the flood-prone areas according to tsunami hazard map released by the
  local government, because of the increment of risks for higher tsunami and fire
  outbreaks (Figure 10).

Considering these findings, as disaster preparedness effort for the potential mega-risk
coastal hazard in future, if a childcare center is located near seaside, designating a shelter in
elevated places even far from the flood-prone areas should be considered as a priority
(except when T.E.Bs. within flood-prone area remain as the only alternative place for
shelter). This may imply in more steep and distant evacuation routes in an urban
environment, as well as in longer time required to complete the evacuation – a situation,
which tends to worsen even more in case of lack of human resources to recognize risks, start
the evacuation and guide children to the shelter. Therefore, the receptivity of early warnings
and the availability of community cooperation should be considered as essential factors for
the effectiveness of evacuation. As future issues, it is necessary to understand the walking
capability of children under the lead of teacher, as well as the transportation capability of
multi-passenger baby strollers by teachers, to address strategies to quantify the necessary
community cooperation based on the severity of early warning, contributing to the
development of wide-scale urban evacuation plans that are more effective in their
conditions.

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Risk and resilient architectural practices in informal settlements – the role of NGOs

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**Abstract**

**Purpose** – The purpose of this paper is to understand the role played by small-size non-governmental organisations (NGOs) in slum upgrading, building and incremental housing processes in Brazil and Guinea-Bissau, focusing, in particular, on actions to reduce vulnerabilities and enhance community resilience.

**Design/methodology/approach** – The research method relied on literature review and fieldwork. It included surveys, activities with the communities, interviews and questionnaires. The data collected were subject to cross-disciplinary and comparative analysis.

**Findings** – The paper analyses the innovative methods and solutions used by NGOs in informal settlement upgrading and housing improvement works related to disaster risk reduction, namely, community mapping and design, and show how they end up building community resilience.

**Research limitations/implications** – Grasping the impacts of NGOs’ work whether in slums of Brazil or Africa requires staying with communities for a significant amount of time. However, those stays raise many practical problems regarding security, health and related costs.

**Originality/value** – The existing literature misses to address from a comparative perspective, the methods used by social workers and designers teams in slums. This paper aims at filling this gap in slum studies. Its originality and value rely on the particular experience of the authors, who were personally involved in the NGOs actions and could deepen the connections between vulnerabilities, risk and successful aid-self-help practices.

**Keywords** Risk and resilience, Guinea-Bissau, Incremental housing, Slum upgrading, Favelas, Informal settlements

**Paper type** Research paper

1. **Introduction**

According to UN official numbers, in the global South, the urbanisation phenomenon thrives and cities keep growing (UN-HABITAT, 2009, 2014). In the big and mega cities, the informal settlements grow exponentially, accentuating longstanding problems and posing old and new challenges to policy-makers, social workers, designers and the academia. Notably, how

The authors would like to thank the communities of the Morro Vital Brazil and of the Escola Catolica de Santa Clara, in Freguesia de Brá, Bissau, for their collaboration and welcome. Also, the Instituto Vital Brazil, the University of Lisbon/Faculty of Architecture/CIAUD, Research Centre for Architecture, Urbanism and Design; the FCT, Foundation for Science and Technology and the NGOs Soluções Urbanas and Building 4Humanity Design and Reconstruction Communities Association.
to reduce urban vulnerability, accommodate the flux of city newcomers, mitigate disaster risk and enhance communities’ resilience are the questions that need immediate attention. Despite the increase in the number of alternative solutions proposed by visionary practitioners, often backed by research and literature (Turner, 1976; Hamdi and Goethert, 1997), massive housing programs tend to dominate the political agenda regarding both adequate housing shortage and response to urban disasters (Lizarralde et al., 2010). Clearly deviating from this trend of top-down and mass-orientation in the supply and recovery of housing stock, local non-governmental organisations (NGOs) have been prioritizing bottom-up approaches and work within the local communities. In some cases, they aid families along with individual processes of self-help building and incremental housing (George et al., 2011) or they provide assistance in community-building regarding housing and disaster resilience (Tauber, 2015). To illustrate these alternative approaches, question the role played by NGOs and ultimately try to influence urban and housing policy, two case studies were selected.

In Rio de Janeiro, with beginning in 2009, the NGO Soluções Urbanas (Urban Solutions, SU) assisted about four hundred families residing in a favela (slum) occupying a hilly and landslide-prone area in the peripheral area of the satellite-city of Niterói. The NGO provided them urban and housing services, in particular related to public health, mobility and safety. The NGO also supported the householders in micro-credit, solidarity economy and empowerment in building techniques. The field research included interviews with key informants, direct observation and survey to householders.

In 2015, in Bissau, the capital city of Guinea, an interdisciplinary team of the Portuguese-based NGO Building 4Humanity (B4H), worked within the community of the Parish of Bra, near the Bairro Militar, a suburban fringe without urban facilities where people live on the edge of poverty, facing on a daily basis several challenges. The fieldwork comprised different workshops, interviews, architectural and social surveys. All activities were meant to support the construction of the new facilities for the Catholic School of Santa Clara while raising awareness on urban disasters issues.

Maybe given the rise of poverty in peripheral areas of the fastest-growing cities in developing countries, in recent times, a significant amount of research has been done on informal settlements (Davis, 2006; Davis, 2014; Mahabir et al., 2016; Mayne, 2017; Mitlin and Patel, 2010). In Brazil, the slums, locally called favelas, have been the focus of on-field-based research that joins academics, architects, humanitarians and the communities, focusing on housing inequality and community efforts to improve living conditions (Doherty and Lino e Silva, 2011; Jauregui, 2003; Lara, 2012; Magalhães and Villarosa, 2012; Pearlman, 2010). The goal of this research is to understand the role played by NGOs in resettlement, building and incremental housing processes placed in different geographical and social contexts, focusing, in particular, on disaster risk and community resilience issues (Sanderson, 2009). The common thread among the NGOs taken as case studies is the approach to social innovation (Martins and Guedes, 2015) and the community participatory design methods to work within informal settlement communities (Hamdi and Goethert, 1997). Both examples selected present patterns, achievements and failures in this approach. Through a comparative analysis, the research highlights how local NGOs are incorporating in their work social innovation tools such as community mapping, design and building. Despite their differences, the case studies emphasize methods and solutions to informal settlement upgrading and building community resilience (Bosher, 2010).

There are several methods of doing comparative analysis and Tilly (1984) distinguishes four types: individualising, universalising, variation-finding and encompassing. Individualising comparison contrasts “a small number of cases in order to grasp the
peculiarities of each case” (idem, p. 82). This basically involves describing fully the characteristics or features of each of the cases being studied. This helps to broaden our knowledge and gives insight to see cases in depth. This method cannot be said to be truly comparative but makes use of comparison in a small aspect of the research (Fredrickson, 1997).

2. Methods: approaching the communities

In general terms, the research adopts a multiple case study (Yin, 2009), following an architectural viewpoint that allows for putting in a comparative perspective the different outcomes of each example (Groat and Wang, 2002). However, the focus of the research is on the processes rather than on the products that resulted from them. Therefore, it discusses an interdisciplinary view, seeking a cross-analysis of community design and resilience issues (Doucet and Janssens, 2011). The comparison concept adopted is the one suggested by Tilly (1984) using in particular the individual approach: investigating a small number of cases, fully characterizing and contrasting them through their features and trying to understand their peculiarities (idem, p. 82). Although keeping the social approach to the resettlement, building and rebuilding processes, given the different access to the information, various strategies and actions were considered for each case study.

In the case of Morro Vital Brazil, the selection of the eight key informants comprised two NGO technicians, the director of a semi-public institution that sponsored the project, an architect, a social worker, a local contractor, a representative of the cement firm that is the partner of the project and a faculty member who participated in laboratory research works. The interviews provided detailed and personalized information about the process. This information suggested the topics and main specific issues to address in a questionnaire later applied to householders. The sample of ten householders was randomly selected after a larger selection previously made by the NGO SU.

In the case of B4H in Guinea-Bissau, semi-structured interviews with stakeholders comprised local and national representatives, both technicians and politicians, such as architects and national departments directors, local community leaders, men and women, local builders and three teachers. The information collected in these interviews feed a questionnaire focusing on housing conditions, community resilience and disaster risk issues, that was later presented to a set of ten households. These questionnaires were administrated personally, in the respondents’ homes, with the assistance of local professors for translation and communication issues, and were digitally recorded. Whenever possible, the visit to the houses included architectural surveys and photograph register.

In both cases, the subsequent phase consisted of analysing the answers to the questionnaire and cross-matching the responses with the oral statements in the light of the main goals of the survey: searching for deeper meanings and individual perceptions of stakeholders and residents in relation to risk and community resilience practices, in particular.

3. The case of Soluções Urbanas, in Morro Vital Brasil in Niterói, Rio de Janeiro

The NGO SU was created in 2002 by an interdisciplinary group of young professionals led by the architect Mariana Estevão, with the goal of developing works in the public and private spaces thanks to community actions. Householders were engaged and participated in targeted interventions that aim to increase local mobility while reducing disaster risk and improving housing conditions.

In 2009, with support of the public Institute Vital Brasil and sponsorship of the world’s leading cement producer Lafarge-Holcim, the NGO started the process in the favela Morro
(name locally given to a slum placed in a hill) Vital Brasil by making a social and economic census of householders. Together they empower men and women of the community with building techniques to be used in their own houses. Another private partner was Leroy-Merlin, who donated building materials later traded in the solidarity market where people exchange goods for building materials. The third partner was TetraPack, who provided recycled tiles after receiving UHT milk boxes collected in the market. The building materials most commonly traded and used were cement, sand, crushed stone, iron rebar and wood for the roofs, as well as doors and windows.

This market was a part of the *Arquiteto de Família* (architect of the family) project in which one architect, assisted by an interdisciplinary team, was assigned to provide assistance for houses’ improvement or extension. This project was carried out in parallel with the doctor of the family program conducted by the municipality and which it seems inspired by. Every architectural intervention begun with an architectural survey and an assessment of the house. A technical report pointed out the pathologies observed, the risks detected and three pressing interventions to reduce them. Next, the architects designed the architectural project and established a plan for the whole operation. There was a constant and constructive dialogue between the architect and the householder throughout the process to achieve consensual and feasible solutions.

Additionally, during the week of the market, there was a meeting involving the members of SU and the community to discuss problems related to the living conditions of the neighbourhood as well as family houses’ issues. On a regular basis, the NGO organised thematic workshops on topics such as mapping of risk, garbage and organisation of the community’s waste collection actions and civil protection issues.

The main stages of each operation were as follows:

- diagnosis;
- identification of which interventions were necessary and which of those were a priority;
- technical survey of the building and the immediate surrounding area where the intervention would take place;
- planning and design of correction of problems;
- access to the building materials through the solidarity market; and
- definition of the management system: organisation of community action, self-building, aid-self-help building or contract, planning and preparation of the works, building supervision, post-evaluation and adjustments.

In parallel, some actions were taken within the community, to enable the works: micro-credit management, building materials collection and the solidarity market, empowerment of women in savings issues and construction, raising awareness on environmental and disaster risks, as well as organisation of collective housing construction works.

So far, 130 houses in the Morro Vital Brasil have been subject to intervention; the average number of inhabitants per house was 3.5, and the most current works were the following: drainage ditches; water and weatherproof works to prevent capillary humidity (Plate 1); the opening of windows to increase transversal ventilation and natural light (Plate 2); roofs, including the introduction of insulation materials; structural reinforcements; retaining walls and contention of slopes as well as the pavement of the access to the houses.

The majority of the dwellings had one floor, between one or two rooms and a surface area from 30 to 50 m². The precariousness of the urban infrastructure increases the vulnerability...
of the houses and households to the risk of disasters, given the impact of the rain and water system leaks.

The actions usually took place at the request of householders. The empowerment programs involved masons, bricklayers and many of them self-builders who would later participate in the building works of their own houses and those of their neighbours. When there was paid work, something that happened frequently, the families could afford it thanks to micro-credit. The housing improvements provided by the Family Architect project consist of construction work to correct failures of the self-built dwellings. These failures and the overall poor sanitation conditions adversely replaced the health and security of the families which are particularly exposed to floods, landslides and environmental risks.

3.1 The interviews
In the case of work developed by the NGO SU, the research method comprised a set of semi-structured interviews with stakeholders who were identified by the NGO leaders. The selection of interviewees included: NGO members directly involved, both architecture and social assistance technicians, representatives of the sponsor cement firm, a professor from the Energy and Thermal Comfort Laboratory of the Universidade Federal Fluminense who led research on new materials used; and finally, a community leader.

In these interviews, it was possible to understand the method applied by the NGO, which was systematised as follows:
- social census of the community;
- community mapping of the risk areas;
- identification of the houses to be intervened;
- survey on the building pathologies and definition of urgent works;
- empowerment of the households;
- the design of interventions in dialogue with the family members;

Plate 1.
Waterproofing works in the back a house involved in the architect of the Family project (before, during and after the works)

Plate 2.
Incremental housing intervention assisted by Soluções Urbanas non-governmental organisation team (Before and after the works)
• discussing and developing solutions with the firm Lafarge-Rocim and the University Laboratory of Materials; and
• a collection of building materials in the solidarity market.

3.2 Analysis of the interviews
During the interviews, the stakeholders pointed out the role played by different stakeholders in the various stages of the interventions and the obstacles that had to be overcome in each of them. Among the most common difficulties reported appears the criminality, as the favela features drug trafficking and sheltering of active criminal groups. This reality conditioned the NGO activities, the constructions works as well as the present research, making it difficult to approach the households given the well-known restrictions to access the favelas posed by delinquent groups.

Nevertheless, the NGO SU established a set of social practices that made it possible to work within the community in a peaceful and seemingly secure environment, for instance, the solidarity market, the training activities and the mutirões: building works through collective efforts that involved dozens of community members. As described by different stakeholders, the mutirões served not only the purpose of developing building tasks, such as eliminating housing vulnerable points, thanks to volunteer work but also strengthening the social network.

The dialogue between the architects of the NGO SU, the firms and academics that developed technical solutions is seen as globally productive by everyone involved. Further, households recognised it as one of the principal outcomes of the project the incremental housing and disaster risk reduction measures implemented. Conversely, the different actors involved report some difficulties of communication that conditioned the processes, causing uncertainties, hesitations and unnecessary delays. Interviewees refer to the small size of the NGO and an eventual centralisation of decision-making as possible constraints that should be overcome in future actions.

4. The case of non-governmental organisation Building 4Humanity in Guinea-Bissau
4.1 Characterisation of the country regarding vulnerability and disaster risk
According to unofficial numbers, Guinea passed 1,700,000 inhabitants. Nearly one-quarter of the population lives in the capital city, Bissau, with a very high percentage of families occupying squat and often overcrowded houses. In addition to several non-defined and claim roads subject to a long process of erosion, rain drainage gutters are in many cases obsolete, systematically blocked by solid waste or just non-existent. The houses are built without foundations and adequate care regarding flood-prone areas, thus facing rapid deterioration and collapse.

Bissau is located on the Geba River estuary and is a very flat conurbation, reaching a maximum of 40 m of altitude, while the whole country never passes the 300 m of altitude with the vast majority of the territory situated under 60 m. The low altitude added to a uniform topography and a tropical climate with a pretty steady rain season lasting from June to November and, finally, to a significant level of poverty and vulnerability of people and houses, favouring the impact of natural hazards. In 2013, the World Risk Index of 2013 (WRR, 2013), calculated by the United Nations University for Environment and Human Security (UNU-EHS), positioned Guinea as one of the 15 countries more exposed to disasters in the world. The UN ranks Guinea among the poorest less developed countries in the world with a per capita income of no more than US$200 (UN-Habitat, 2014) and that may explain
why so little has been done in the past few decades to reduce disaster risk to houses and cities.

4.2 Specific disaster risk issues, at the building and street level

The surveys addressed general urban daily living conditions but mainly focused on housing and building issues, exposure to natural hazards, construction skills and prevention measures to reduce the impact of rains, storms, winds and floods, in general. Comparing the actual situation with the one described by Davila (1987) and Acioly (1992) at the end of the 80s, besides the advent of modern communications, which has undoubtedly contributed to reduce the isolation of the country and citizens, and also the implosion of Bissau's population, which has doubled, one finds little difference between the two. Indeed, now, as then, neighbourhoods feature neither sewage nor water supply systems, and the water is still collected from traditional wells; there is no public lighting except in very few main streets, and domestic electricity connection remains an exception. Several environmental problems were observed: numerous dumping areas, trash infrequently collected and consequently accumulating near houses and, even more dangerous, shaky dry pit latrines, usually shared by several houses, becoming saturated. The Bairro Militar, the most populous of Bissau, with several tens of thousand inhabitants, has no health centre, with the result that people take between half an hour and one hour to arrive at a public hospital, and no community services are provided.

Some 30 years ago, it was estimated that almost 80 per cent of the population of Bissau lived in informal settlements known locally as bairro(s), meaning popular neighbourhoods (Davila, 1987; Acioly, 1992, 1994). In this bairros, roads are usually not paved. Dwellings are built with adobe bricks according to a local building type of one-storey house with a rectangular, sometimes square shape (10-15 m side) surrounded by a wide balcony (around 1,80 m deep) and with four to six rooms. The balcony, locally called varanda, works as a place for preparing the meals, socialising and resting. These houses usually have a four-sided roof covered by cheap corrugated zinc sheets, covering an area equal to 180 m² and sometimes even larger, that includes the varanda so that the overhang protects the adobe walls from the rain. The bathroom is constructed outside, at a short distance from the home, as it is a traditional latrine, often shared between several families. Houses are grouped with more or less density depending on the location; for instance, on the main roads with local commerce, they tend to be closer and more aligned, whereas in the peripheral residential areas, they respect some distance, allowing some communal spaces in between and apparently observing no order. These types of settlements seem to replicate the traditional rural tabancas.

4.3 The non-governmental organisation activities

The activity of B4H includes the study and implementation at the urban scale of measures aimed at reducing the impact of floods and their effects on buildings. The project of a new school and the reinforcement of the existing private houses served as a laboratory to essay construction techniques that might improve resilience to the effects of rains at the building and street level as well as improve incremental housing. The first observations indicate that many works and enlargement of family houses, to accommodate more family members, ends contributing to increased vulnerability.

Within the school community, a NGO team composed of a small group of architects and a psychologist, carried out various meetings, mapping, modelling and designing workshops, interviews and questionnaires involving students and their parents (Plate 3). These activities registered high levels of participation, thanks to the involvement of some teachers
who volunteered as all-purpose personal assistants and impromptu translators. Despite Portuguese being the state’s official language, the Guineans typically prefer Creole, a common mother tongue among a population that belongs to more than 20 different ethnicities, each of them with their dialect.

4.4 Contrasting resilient and increasing vulnerability practices
At the urban scale of the neighbourhood, some disaster risk measures adopted by the residents were reported. For example, temporary barricades made with earthbags protecting entrances, surrounding houses or strategically aligned in crossroads (Plate 4). Other actions to protect from the rain include homemade mud plaster (Plate 4), executed in a rudimentary way by family members and the tying of the zinc sheets (Plate 4). The reinforcement of the adobe or rammed walls with steel bars is almost unknown, while the replacement of the varanda pillars and the roof frame, both made in Sibe, the traditional local wood, by reinforced concrete are increasing, although still too much expensive for the majority of the population (Correia Guedes et al., 2011).

On the one hand, there are some urban and architectural endeavours to mitigate the impact of disasters; on the other hand, the enlargement of houses, to accommodate more family members and newcomers, become an issue. These extensions of the residential units are often made at the cost of the space of the varandas and somewhat would not constitute a problem, as these have ample surfaces (Plate 4).

Nevertheless, the new rooms are often built with walls aligning with the edge of the roof and, as such, are exposed to rain and wind, receiving water directly from the gutter. When the enlargement surpasses that alignment, to gain some more space and achieve a more comfortable bedroom or kitchen, susceptible points appear, such as construction joints and leaks. These incremental hosing works are done without a permit, involving no specialists, being entirely executed by members of the family, instead. As a result, rather than
improving weakness, incremental housing ends contributing to increasing vulnerability (Plate 4).

4.5 Analysis of interviews and observations: identification of the local perception about the exposure to risk
Poverty also explains why the locally called “precarious constructions” remain for a long time, despite their fragility and lower resistance to natural agents. Householders seem to be aware of the risk that they are facing, and despite the traditional African relaxed attitude, they do fear that a great storm or flood would damage their homes and harm their relatives. Under this concern, they corroborate the necessity of changing their situation, improve their houses, rebuild, perhaps, build a new one.

The houses in the peripheral informal areas of Bissau are of low quality and comfort standards but can reach a considerable size. Householders hardly seem to be aware of these deficiencies and oversize. Areas of almost 200 m² or even 300 m² more can easily be found in the peripheral informal areas. These houses begin with a core unity, a single bedroom for a couple, usually a recent married one. As the family grew, so did the house. The current oversized houses are, thus, the result of successive enlargements made over one or more decades to accommodate new family members. The interviews allowed for uncovering the incremental housing process, informing about its stages and peculiarities as seen through the eyes of householders. Notably, they show some lack of awareness about the incremental process, not that they did not participate in it; on the contrary, they undertook it as a self-help building task, but somehow they underestimated it, not valuing it as real change or improvement of their living conditions. A visit to the interior of one house revealed at least a dozen different small expansions that led to a total area of more than 400 m² and 12 bedrooms to shelter 42 family members. Regarding construction standards, when interrogated about any critical problems, the chief of the family responded “none” and rated the quality of the house as “very good.” Nonetheless, the inside visit exposed acute fragilities, such as leaks in the bedroom, not mentioned during the interview but denounced by a big piece of plastic hanged over the bed protecting from the heavy rains that fall in the six-month wet season.

4.6 Considering disaster resilient solutions with practical feasibility
Practical solutions applied to reduce the damages provoked by floods can be studied both on the urban and the building scale. On the urban scale, the principal vulnerabilities include the lack of a drainage system and the shape of the roads, which lead to poor draining rainwater. The observations in the field show that people usually protect their houses placing earthbags into rows along the unpaved roads. By examining how the rainwater flows among the buildings, the households adjust the earthbags to achieve predetermined goals, such as to prevent water from concentrating in proximity to the houses, damaging the building ground floor platform and to decreasing its flow speed throughout the spaces between houses. Thus, through empirical findings and local-based material preventive routines, households reduce vulnerability, enhance disaster preparedness, mitigate disaster risk factors and eventually strengthen community resilience (Plate 4).

On the building scale, the vulnerabilities of the houses often include the inefficient connections between structural elements such as the main walls at the corners, the main walls at the top (absence of the bond beam) and the varanda pillars with the roof. Another weak point observed was the non-existence of plaster on the external walls that were moved...
from the original position and aligned with the roof edge. These new walls respond to housing needs, such as the addition of a new room or the extension of an existing one. When it rains, and in the event of floods, these walls are subjected to dangerous surface runoffs (Plate 4).

Bad quality corrugated zinc sheets is an omnipresent feature of the precarious family houses that these days can also be considered as an indicator of vulnerability, as it makes the living conditions inside the buildings substantially worse. The best building practices that in the past produced long-lasting buildings, based in local resources, are often lost (Correia Guedes et al., 2011).

5. Discussion

Instead of imposing design solutions or providing design guidelines, both team of the NGO B4H and SU decided to act as facilitators. Therefore, the NGO architects sought to involve the community by organising meetings, workshops and pedagogic activities. The B4H workshops with children and informal dialogues with the parents showed how the former could learn good building practices through play and the latter could be sensitised to architectural and raise awareness of the risk issues through the eyes and handmade work of their sons and daughters. Both in Rio de Janeiro and Bissau, the meetings held with adults aimed at gathering information about their skills, needs and expectations concerning (re) building processes. Throughout the interaction within the school and favela communities, numerous men, but particularly women, reaffirmed their willingness to be involved in the design and building process. Sketching, mapping and drawing proved to be useful to study technical proposals regarding disaster risk reduction and thermal comfort. They also demonstrated their potential for effectively communicating with the community, both with children and adults.

The case studies focusing on the work of two NGO highlighted distinct but somehow convergent approaches to the upgrading process of informal settlements. In Morro Vital Brasil, SU not only tried to engage the community through joint work and solidarity actions but also proposed to walk hand in hand with each of the families challenging them to embark on a close relationship with an architect that would assist them throughout the entire intervention, from diagnosis, to surveys, design and building. In turn, in Guinea-Bissau, B4H emphasised the role played by education for disaster risk reduction and community design towards a humanitarian approach to architecture (Charlesworth, 2014). The case of NGO SU in Morro Vital Brazil stressed the employment of environmental principles and novel techniques, bonding householders, the community, architects, social technicians, firm representatives and academics in individual incremental housing projects. The case of B4H in Guinea-Bissau emphasised children and community involvement and the use of vernacular principles and local materials-based design to achieve long-term goals (Raport, 2006). Despite their specificity, which refers to goals and methods, the two cases reveal a common pattern of enduring actions instead of immediate and likely ephemeral results.

Work within communities, educating to risk and involving the population in the mapping of vulnerabilities and resilient local practices seem to be useful tools to raise awareness of exposure to risk as well as mitigate impacts of urban disasters (Hamdi and Goethert, 1997; Hamdi, 2014; Sanderson, 2009)

6. Final remarks

Beyond literature and previous findings on the successful experience of NGOs, the research is based on fieldwork, surveys and interviews addressed to the stakeholders and
householders. It attempted to illustrate how low-profile NGOs can play a crucial role in rebuilding and building issues of low-income families in the contexts of communities living in informal areas facing precarious conditions and adversity at diverse levels. Despite their particularities, these examples suggest that social innovation tools addressing the communities, in savings, rebuilding, design and disaster risk issues can make a substantial contribution to enhancing the sustainability of humanitarian approaches to architecture and urbanism.

The experience on the field attests that a reasonable strategy to increase the resilience of the community is to co-develop strategies and co-design actions that people are really going to implement, according to their experience, traditions and current expectations. The challenge of the designers and researchers of low-profile NGOs engaged in long-term humanitarian assistance is to provide suggestions about practical measures aimed at driving people to adopt the correct solutions from the technical point of view. A theoretical conception of improvement of local responses must, therefore, be grounded in local architectural culture and resources with consideration of the peoples’ perception of the exposure to risk.

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Further reading


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Traditional agro-ecosystems in Southern Philippines

Vulnerabilities, threats and interventions

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Abstract

Purpose – Sarangani, a province in Southern Philippines, is inhabited predominantly by tribal groups who depend on traditional rice farming for subsistence and livelihood. The purpose of this study is to identify current pressures to these upland communities and the interventions instituted to address them or mitigate their effects.

Design/methodology/approach – This is an exploratory and cross-sectional research using the emic approach. Rapid rural appraisal techniques (i.e. focus group discussion, key informant interviews, community immersion and field observation) were concurrently undertaken in 15 farming villages in the Sarangani uplands.

Findings – Results revealed that many upland families inhabited disaster-prone areas under conditions of hardship and abject poverty. Prevalent problems in these areas have largely arisen from the encroachment of modern agriculture, environmental degradation and changes in the socio-political and economic spheres. Consequently, food insecurity, cultural and genetic erosion and biodiversity losses have resulted in lowered Sarangani agro-ecosystem resilience. While policies and programs had been instituted to address these problems, positive results still remain to be realized.

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Social implications – Weak social networks in the Sarangani upland communities are attributable to their isolation and the disruptive influences of modernization. Agricultural modernization, in particular, caused the disintegration of community social structures and undermined overall well-being of the farmers. Sustainable strategies which harmonize modern and traditional systems of food production and environmental management are warranted to attain food security, environmental preservation and biocultural preservation.

Originality/value – This study contributes to the present body of knowledge about threats to vulnerable agro-ecosystems inhabited mainly by indigenous tribes. And while only 15 farming villages were covered by the study, these results can serve as a microcosm of what is happening in traditional agro-ecosystems worldwide. The study is also expected to provide inputs to policymakers, which they can use in crafting policies to address problems in the Sarangani uplands.

Keywords Philippines, Threats, Vulnerabilities, Sarangani province, Traditional agro-ecosystems, Upland communities

Paper type Research paper

Introduction
Sarangani province, which is found in the southernmost part of Mindanao Island in the Philippines, lies between a latitude of about 5°33' 41" – 6° 32' 4" North and a longitude of about 124° 21' 39.6" – 125° 35' 11" East. An oddly shaped province cut into eastern and western halves by General Santos City, Sarangani, is composed of 7 municipalities, namely, Malapatan, Alabel, Glan, Malungon, Maasim, Kiamba and Maitum (Figure 1). The overall terrain of the province consists primarily of flatlands, rolling hills and steep mountains. Of its total land area of 3,986.64 km², 52.73 per cent (or 2,101.99 km²) fall within the altitudinal range of 300-1,000 m above sea level (masl). Moreover, only 14.5 per cent (or 578.01 km²) lie within 0-100 masl and can be categorically classified as lowland (Sarangani Province, 2011).

Approximately 45 per cent of the Sarangani population belong to the Lumads (tribes with non-Muslim ethnicity). Settling of Mindanao by these tribes (early 1,500 s) predated Spanish colonization of the Philippines by Ferdinand Magellan in 1521. Repulsed by Muslim forces, the Europeans were unable to colonize Mindanao and the island remained autonomous despite occupation of the rest of the country. In an attempt to preclude agricultural overcrowding in the Luzon mainland during the post-Second World War period, the Philippine Government subsidized resettlement of migrants to different frontier areas in Mindanao (Wenstedt and Simkins, 1965). In Sarangani province, the first migrants were Cebuanos who settled in the coastal town of Glan in 1914. This was followed by
migration of Ilocano settlers in Kiamba and Ilonggo settlers in Malungon in 1918 and in the 1930s, respectively (Sarangani Province, 2011). This post-war settling of Mindanao drove the Lumads away from their ancestral lands and into the upland areas where they can be found nowadays.

Even during these present times, some Lumads still remain marginalized and have difficulty in owning land in which to establish homes, raise their families and to plant crops (Lopez et al., 2012). Because of the remoteness of their villages, no official census in their areas has been undertaken and their exact numbers are not presently known. In 2015, Sarangani province was certified as the third poorest province in the Philippines, with 70 per cent of its households determined to be living below the poverty threshold (PSA, 2015). In the uplands, the dominant ethnic groups are Blaans, T’bols, and Tagakauls. Blaans represent the largest minority in Sarangani and are mostly found in the municipalities of Malapatan, Glen, Alabel, and Malungon. T’bols inhabit Maitum, Kiamba and Maasim, while Tagakauls reside exclusively in Malungon and Datal Anggas in Alabel (Sarangani Province, 2011).

Research location and methods
The study was carried out in 15 upland barangays (villages) in Sarangani province in Southern Philippines (namely, Datal Bukay, Kari, Small Margus and New Aklan in Glen, sitio Mutu Ladal in Maasim, Kihan and Kinam in Malapatan, sitios Ihan, Cabnis, Glamang in Alabel, itio Lamlifew and Malabod in Malungon, Upo and Batian, Maitum and Maligang and Malayo in Kiamba. Shown in Table I are the visited villages, as well as pertinent information about them.

Essentially exploratory and cross-sectional in nature, this study used a wide array of RRA techniques such as focus group discussions (FGD), key informant interviews (KII), community immersion and field observation. FGD was purposely done in areas where considerably large numbers of households were found. A total of 20 participants consisting of sitio officials, male and female farmers across a wide age spectrum, were chosen for the activity. Special priority was given to elderly farmers during selection of participants. For KII, 47 farmers were interrogated using a previously prepared interview guide. Farm profiling and field observations were also undertaken to lend credence to farmers’ perceptions and knowledge obtained during FGD.

Results
The Sarangani upland communities
The transformation of the Sarangani upland landscape during the past decade can be ascribed to emerging political and socio-economic pressures in the area. Of late, the tribal groups have participated in the electoral process and have become integrated into the mainstream Philippine society (Zapico et al., 2015). Many ancestral lands were declared as public lands, classified as watershed areas or sold to lowland people who used them for commercial scale cultivation of coffee, corn and abaca. Deprived of their homesteads, tribal farmers either shifted to sedentary agriculture or migrated higher into the mountainous areas to establish new homes and farms. Field visits also revealed that tribal families belonging to higher economic strata inhabit relatively accessible areas while poorer families can be found in very remote areas with very steep terrain. Such mountainous areas can be reached using a weapon (a six-wheel jeepney with truck engines), a habal-habal or skylab (single motorcycle with extended seats to accommodate six passengers) and horses. When the terrain is extremely prohibitive, the locals are presented with no options but to walk for very long hours. In areas such as Kiamba and Malungon, farm to market roads (albeit not
<table>
<thead>
<tr>
<th>Municipality</th>
<th>Sitio (village)</th>
<th>Altitude (masl)</th>
<th>Topography</th>
<th>Tribes present</th>
<th>Main agricultural produce</th>
<th>Other remarkable features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glan</td>
<td>Datal Bukay</td>
<td>&gt;337</td>
<td>Plain to mountainous</td>
<td>Blaan</td>
<td>Rice, corn, coconut</td>
<td>Beside a flood-prone river</td>
</tr>
<tr>
<td></td>
<td>Kari, Small Margus</td>
<td>&gt;399</td>
<td>Rolling to mountainous</td>
<td>Blaan</td>
<td>Rice, corn, coconut</td>
<td>Remote</td>
</tr>
<tr>
<td></td>
<td>New Aklan</td>
<td>&gt;430</td>
<td>Plain to mountainous</td>
<td>Blaan</td>
<td>Rice, corn, coconut</td>
<td>To be developed for tourism (waterfall)</td>
</tr>
<tr>
<td>Malapatan</td>
<td>Kinam</td>
<td>&gt;273</td>
<td>Plain to mountainous</td>
<td>Blaan</td>
<td>Rice, corn</td>
<td>Remote</td>
</tr>
<tr>
<td></td>
<td>Kihan</td>
<td>&gt;222</td>
<td>Plain to mountainous</td>
<td>Blaan</td>
<td>Rice, corn</td>
<td>Rebel-infested</td>
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<td>Alabel</td>
<td>Ihan</td>
<td>~975</td>
<td>Rolling to mountainous</td>
<td>Blaan, Kaolo</td>
<td>Rice, corn</td>
<td>Remote</td>
</tr>
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<td></td>
<td>Cabnis</td>
<td>~896</td>
<td>Rolling to mountainous</td>
<td>Blaan, Kaolo</td>
<td>Rice, corn</td>
<td>Remote</td>
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<tr>
<td></td>
<td>Glamang</td>
<td>&gt;421</td>
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<td>Blaan, Kaolo</td>
<td>Rice, corn</td>
<td>Remote</td>
</tr>
<tr>
<td>Malungon</td>
<td>Lamifew</td>
<td>&gt;298</td>
<td>Plain to mountainous</td>
<td>Blaan, Kaolo</td>
<td>Rice, corn</td>
<td>Accessible/progressive</td>
</tr>
<tr>
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<td>Malabod</td>
<td>&gt;350</td>
<td>Plain to mountainous</td>
<td>Blaan, Kaolo</td>
<td>Rice, corn</td>
<td>Accessible</td>
</tr>
<tr>
<td>Maitum</td>
<td>Upo</td>
<td>&gt;591</td>
<td>Rolling to mountainous</td>
<td>Tboi</td>
<td>Rice, corn</td>
<td>Remote/denuded forests</td>
</tr>
<tr>
<td></td>
<td>Batian</td>
<td>&gt;496</td>
<td>Rolling to mountainous</td>
<td>Tboi</td>
<td>Rice, corn</td>
<td>Remote/denuded forests</td>
</tr>
<tr>
<td>Kiamba</td>
<td>Malayo</td>
<td>~499.9</td>
<td>Plain to hilly</td>
<td>Tboi</td>
<td>Corn, coffee</td>
<td>Accessible/denuded hills</td>
</tr>
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<td></td>
<td>Maligang</td>
<td>~279</td>
<td>Plain to hilly</td>
<td>Tboi</td>
<td>Abaca, corn</td>
<td>Accessible/progressive/denuded hills</td>
</tr>
<tr>
<td>Maasim</td>
<td>Mutu Ladal</td>
<td>~1,016</td>
<td>Mountainous</td>
<td>Tboi</td>
<td>Rice, abaca</td>
<td>Remote/no basic services/denuded forests</td>
</tr>
</tbody>
</table>
extensive) had been constructed by the local government. Where roads are non-existent, the locals volunteer their services to make very narrow foot trails and pathways along mountainsides using rudimentary tools such as shovels and hollowed out coconut shells to clear the pathway of debris. Traveling along these pathways, however, can be fraught with danger especially during nighttime.

In distant areas, poverty-stricken tribal people live in small thatched huts made of bamboo with a local grass (cogon) as roofing. No nails are used in constructing the huts and component parts are held together by Manila hemp (abaca) strips [Figure 2(e)]. A great majority of these houses do not have toilets or latrines and have very scanty water supply. In contrast, houses in more accessible communities use building materials from hardware stores (i.e. lumber, cement, nails). These households usually have electricity and a constant supply of water from a reservoir constructed for the collection of rain water or water from a free-flowing spring (tubod).

The Sarangani tribes usually establish communities along river banks and in the vicinity of their rice farms, which are mostly situated along hilly or steep mountain slopes. Because surrounding mountains are mostly denuded, these areas are prone to flash floods and landslides. During torrential rains, flood waters rush down and dump soil and all sorts of debris in low-lying areas. Farmers reported that in two instances, two villages (Kyondog and Centro in Malapatan) had to be physically transferred to other locations after being

**Notes:** (a) A sige-sige field; (b) sitio Kyondog after a massive landslide; (c) timber slabs found beside the road; (d) widening river banks; (e) a typical upland house; (f) after slash and burn
submerged in thick mud in the aftermath of landslide and flashflood events, respectively [Figure 2(b)].

Sarangani upland agroecosystem

Of the total land area of Sarangani, 68 per cent is classified as forestland, of which a significantly large portion is situated in the first district of the province or the MAKIMA (Maasim, Kiamba, Maitum) district (Sarangani Province, 2011). By 2014, however, approximately 10 per cent of this area had remaining forest cover (FMB-DENR, 2014). Globalforestwatch.org (2017) reported of forest cover losses of 10.3 kha in 16 years in the MAKIMA watershed (2001-2017). Maitum town likewise reflected highest tree cover loss of 7.0 per cent during this same period. This remaining forest cover is expected to shrink further owing to slash and burn (kaingin) activities by landless farmers in preparation for planting rice [Figure 2(f)]. SAAD (Special Areas for Agricultural Development) farmer beneficiaries received rice seeds and livestock support as inducement for planting traditional varieties in the uplands. These farmers, having no farms in which to plant SAAD seeds, razed remaining forests in preparation for rice farming. Cursory inspection of a kaingin field revealed burning of endangered tree ferns and big trees. In Mutu Ladal, Maasim, forest cover was also sparse because of unregulated logging and slash and burn activities in forested areas [Figure 2(c)]. This destructive type of farming followed by the harvesting of remaining saplings for commercial charcoal production had totally transformed the Sarangani uplands into unproductive grasslands dominated by cogon (Cylindrica imperata). Consequently, landslides, widening of river banks, flash floods, desertification, food and water scarcity and prolonged drought had become consistently recurring problems in the Sarangani uplands since the past decade [Figure 2(d)]. And while outsiders criticize them for this unsustainable farming practice, Sarangani upland farmers disclosed that they will continue doing slash and burn farming rather than face the prospect of starvation for their families.

Another factor which has transformed the Sarangani upland landscape is the recent introduction and subsequent proliferation of recycled glyphosate-resistant corn varieties (sige-sige corn) in farmers’ fields [Figure 2(a)]. Grown by tribal farmers as a cash crop, sige-sige corn requires heavy use of herbicides to clear the field of weeds. Farmers however observed that long term use of herbicides especially along steep mountain slopes loosens the soil and makes it prone to erosion especially during heavy rains.

Community responses and actions

Shown in Table II are policies, programs and grants instituted/released for the upliftment of living conditions of tribal families and for environmental rehabilitation in the Sarangani uplands.

Programs undertaken to help the Sarangani upland tribes were essentially funded by the Philippine Government, although external funding sources (World Bank and Asian Development Bank) were also availed. National programs such as Upland Agroforestry Program, SAAD, National Greening Program, Upland Development Program and Bantay Kalikasan were implemented at the local level to address problems relating to environmental degradation in the Sarangani uplands. To supplement household income in economically depressed areas, conditional cash transfers and livelihood projects were granted by 4Ps and KALAHI-CIDDS, respectively, to selected beneficiaries.

However, expected successes of implemented projects were purportedly thwarted by various circumstances and factors. As revealed by upland communities, project implementation usually stops when finances run out. Another factor leading to poor
<table>
<thead>
<tr>
<th>Year</th>
<th>Agency responsible</th>
<th>Policy/program</th>
<th>Activities</th>
<th>Funding source</th>
</tr>
</thead>
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<tr>
<td>2005</td>
<td>DENR/LGU</td>
<td>Upland Agroforestry Program</td>
<td>Environmental Protection/reforestation</td>
<td>Government</td>
</tr>
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<td>2008</td>
<td>DENR/LGU</td>
<td>Upland Development Program</td>
<td>Reforestation/agroforestry</td>
<td>Government</td>
</tr>
<tr>
<td>2013</td>
<td>DENR/LGU</td>
<td>Sustainable Resource Management</td>
<td>Reforestation/imposition of fines for Kaingin</td>
<td>Government</td>
</tr>
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<td>2011</td>
<td>Provincial Government</td>
<td>Adopt a Watershed Program</td>
<td>Forest land use plans</td>
<td>Government</td>
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<tr>
<td></td>
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<td></td>
<td>Solid waste management</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Watershed rehabilitation</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>LGU</td>
<td>Bantay Kalikasan</td>
<td>Anti-illegal logging task force</td>
<td>Government</td>
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<tr>
<td></td>
<td></td>
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<td>Moratorium on cutting of timber in forests</td>
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<td>1992</td>
<td>Provincial Government</td>
<td>Network of Integrated Protected Areas System (NIPAS)</td>
<td>Declaration of Mt. Matutum as protected landscape</td>
<td>Government</td>
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<td>2013</td>
<td>DENR/DILG</td>
<td>National Greening Program</td>
<td>Planting of endemic tree species</td>
<td>Government</td>
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<td></td>
<td>Maitum and Glan/NCIP</td>
<td>Preservation of Philippine Eagle Habitat</td>
<td>Permit to cut for trees</td>
<td>Government</td>
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<td></td>
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<td></td>
<td>Fines for Kaingin</td>
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<td></td>
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<td>Distribution of seedlings</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Education of locals about ecosystem protection</td>
<td></td>
</tr>
<tr>
<td>2007-2013</td>
<td>Provincial Government</td>
<td>Mindanao Rural Development Program (MRDP)</td>
<td>Land use and ecosystem protection</td>
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<td></td>
<td>LGU</td>
<td></td>
<td>Rural Infrastructure</td>
<td>World Bank</td>
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<td>Agricultural development</td>
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<td>Natural resources management</td>
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<td>KALAHICIDDS/DSWD</td>
<td>Poverty alleviation program</td>
<td>Social services delivery</td>
<td>Asian Development Bank</td>
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<td></td>
<td>Poverty reduction</td>
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<td>Good governance outcomes</td>
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<td>LGU</td>
<td>Disaster Risk Reduction and Management Act</td>
<td>Enhance disaster resilience in IP communities</td>
<td>Government</td>
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<td>2008</td>
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<td>Pantawid Pamilyang Pilipino Program (4 Ps)</td>
<td>Conditional cash grants to the poor</td>
<td>Government</td>
</tr>
<tr>
<td>2017</td>
<td>DA/LGU</td>
<td>Special Areas for Agricultural Development (SAAD)</td>
<td>Distribution of rice seeds for upland food security</td>
<td>Government</td>
</tr>
</tbody>
</table>
performance on the ground was project unsuitability due to lack of groundwork preparations, consultation with beneficiaries and the outright lack of concern for the sustainability of the project. A case in point is the Bantay Kalikasan Task Force, which failed to achieve its goal of ecosystem protection because of poor law enforcement and unsatisfactory performance of the task force. Another was the SAAD project which actually resulted in wide scale decimation of forest cover in some areas in Maitum. Furthermore, farmers divulged that a significant volume of the seeds distributed by SAAD did not germinate, performed poorly in the fields or were inferior to local varieties. Another program, the Disaster Risk Reduction Management Act reportedly fell short in terms of enhancing resilience capacities of marginal IP communities in the Sarangani uplands (Espesor, 2018).

Discussion

Driving factors leading to loss of resilience in the Sarangani uplands

The transformation of the Sarangani traditional upland agro-ecosystem can be ascribed to the incursion of lowland people into the upland areas. Unregulated resource extraction stripped the Sarangani uplands of forest cover and transformed them into grasslands which are of minimal ecological and economic value. Slash and burn farming and the subsequent harvesting of remaining saplings for charcoal production prevented forest regrowth transforming once verdant forestlands into proverbial dust bowls. With the shrinking of watershed areas, water deficit problems in the Sarangani uplands became heightened especially during prolonged periods of drought. Continuous use of upland soils for rice farming with shortened fallow periods also negatively impacted soil structure and quality. Consequently, desertification, forest denudation, flash floods, landslides, siltation, extreme weather events, transformation of lush forests to grasslands and loss of soil fertility have made Sarangani farmers extremely vulnerable to climate change and the devastation that follows in its wake.

Problems on losses of soil quality became exacerbated by the shift to modern agriculture and all changes associated with it. The introduction of modern varieties, cash crops and lately, recycled transgenic corn transformed the Sarangani uplands from lush forests with occasional slash and burn farms into expansive fields of sige-sige corn. Moreover, intensive use of herbicides had been observed by farmers to loosen the soil, making it more prone to erosion. These erosion problems became further compounded by the tribal practice of planting rice along steep slopes without adopting soil conservation measures. Elauria et al. (2017), Prokop and Poreba (2012) and Sen et al. (2009) reported of similar observations in Negros Oriental in the Philippines, Northeast India and the Himalayas, respectively. Dubbed as the most serious environmental problem in upland areas, soil erosion is more attributable to improper land use than the actual physical features of the landscape (Yao and Garcia, 2002; Prokop and Poreba, 2012).

In the Sarangani uplands, the shift from transient to sedentary agriculture resulted in shorter fallow periods stripping the soil of its inherent fertility. Guillemin (1956) and Mertz (2002) maintain that fallows are essential for soil regeneration and that shorter fallow times result in a decline in fertility. Similar views were advanced by Sen et al. (2009) who reported that soil loss problems can be aggravated by subsistence agriculture, deforestation and fire.

Based on a priori observations of the deleterious effects of anthropogenic pressures on the environment, Wackernagel et al. (1999, 2002) coined the term “ecological overshoot” to describe these effects. In support of these views, Kesavan and Swaminathan (2008) revealed that the world is facing serious ecological and social problems, growing damage to life
support systems provided by ecosystems as well as the devastating effects of global climate change.

Furthermore, the arrival of lowland migrants resulted in a paradigm shift especially among the tribal youth. Older farmers lament that the young generation have completely lost interest in farming and in remaining in the uplands. To escape the drudgery of upland farming, the youth migrate to towns and cities to find jobs or to get an education. When they graduate, these tribal youth usually remain in the lowlands because of better economic opportunities. At present, many upland fields have remained untilled because tribal men choose non-farming jobs (i.e. driving a habal-habal) over rice farming. This abandonment of the Sarangani uplands has resulted in genetic erosion of traditional crops (especially upland rice) and the indigenous knowledge that go with these. Occurrences of cultural erosion are further compounded by the death of tribal elders who are the ultimate keepers of traditional knowledge. Eventually, bio-cultural losses will result in food scarcity and in the lowered resilience of Sarangani tribal communities owing to losses of traditional crops and their valuable genes which could otherwise have been used to solve future problems in agricultural production.

Another factor that has severely impacted community resilience in the Sarangani uplands is the nutritional and health status of the smallholder families in the area. The basically carbohydrate-based diets of these upland families and the lack of diverse food sources resulted in widespread protein malnutrition especially among the children. Chubby cheeks, bloated bellies and growth stunting (symptoms of kwashiorkor) were commonly observed during field work. Moreover, water scarcity in the uplands, along with a lack of knowledge of personal hygiene, caused an outbreak of Hepatitis B, diarrhea and other water-borne diseases (personal communication with Dr Roel Cagape, a volunteer doctor). There are also anecdotal reports about young children from consanguineous marriages who apparently manifest symptoms of recessive genetic disorders.

**Policies and interventions instituted**

In the Sarangani uplands, forest management and soil conservation practices are not integral aspects of tribal culture. Unlike the Ifugao in Northern Philippines to whom the forest-farm interrelationship is deeply ingrained in their traditional belief systems (Aguilar, 2018), there is a lack of awareness among Sarangani tribes about the importance of sustainable forest management in maintaining the healthy state of the upland agro-ecosystem. It can therefore be seen in Table II that most programs and financial grants are geared toward environmental rehabilitation primarily and poverty alleviation and food security secondarily.

Unfortunately, only accessible communities were able to avail of financial and technical assistance. Remote areas, where the poorest families can be found, still remain practically unreached by social services and other forms of assistance. In certain instances, projects conceived with good policy intentions actually end up creating more problems for the community. The SAAD project, for example, was conceptualized to address problems on food security through agricultural expansion in the marginal uplands. As was revealed by some farmers, SAAD implementers and beneficiaries unwittingly aggravated soil erosion problems especially in steep and sloping areas. Similar observations were reported by Price (2007) in the Manupali watershed in Bukidnon, Philippines, while Coxhead (2000) revealed that the Philippine Government’s policy of promoting a yield-driven approach to rice production also accelerated land degradation.
Future directions

The implementation of sustainable forest management practices is essential if the Sarangani upland agro-ecosystem and the tribal peoples who depend on it are to be saved. This can be done through the declaration of a moratorium on slash and burn farming and logging through local ordinances. Strict enforcement of the moratorium, regular monitoring by forest rangers and penalization of erring individuals should be carried out. For upland farms, Styger et al. (2007) proposed that increasing of fallow length with each fallow-cropping cycle is necessary to restore fertility of the soil. Soil-conservation measures should also be done to preserve whatever topsoil that is left in the Sarangani upland farms.

Sustainable management practices are envisioned to improve rural livelihood while preserving forest ecosystems in the Sarangani uplands. In reality, however, enforcement of an anti-logging moratorium has proven difficult in many areas of Sarangani province. In a community-based forest enterprise in Cambodia aimed at preserving timber-rich forests, Davis (2005) likewise discovered that enforcing forest management practices can be challenging. In contrast, apparent successes were experienced by communities in the Ixtlan de Juarez community in Oaxaca, Mexico, and in Sri Lanka. Legal protection of indigenous peoples’ rights, granting of autonomy to local people as regards the use of their resources and the presence of an equitable benefit-sharing scheme for resource use have contributed to the success of forest management initiatives in Mexico. In Sri Lanka, policy shift toward the promotion of traditional farming practices for food security and for livelihood purposes also effected substantial changes in the community (Gu and Subramanian, 2014).

Revitalizing upland agriculture in Sarangani province using an appropriate combination of policies, technological advances and traditional knowledge will make possible attainment of food security goals while preserving tribal culture, resources and the environment. Reintroduction of crop landraces and endemic flora in the Sarangani agro-ecosystem coupled with the use of appropriate in situ conservation strategies will ensure that priceless tribal resources will be preserved for the coming generations. To achieve these goals, there is a need to harmonize frontier knowledge with IK because the latter may not be sufficient by itself to address problems wrought by emerging socio-economic scenarios and global climate change (Kesavan and Swaminathan, 2008). Tribal farmers should also be encouraged to take part in policy-related activities and in crafting solutions to encountered problems. Finally, the delivery of social services to remote communities in the Sarangani uplands should be given utmost consideration. Presently there are burgeoning health and malnutrition problems to reckon with in these areas and unless interventions are instituted, the succeeding generations will be ill-equipped to face problems, leading to lowered resilience in these communities. Consequently, these upland families become defenseless against the vagaries of a global climate gone awry.

Conclusion

Unregulated application of Green Revolution strategies with no regard for ecological, socio-economic and genetic consequences, especially in third world countries, has led to soil impoverishment, agro-biodiversity losses and in socio-economic downturns in the Sarangani uplands. Because of weak adaptive capacities, these upland peoples become vulnerable to the ravages of climate change and other socio-economic, political and ecological perturbations. Especially vulnerable are subsistence farmers who rely chiefly on rain-fed upland agriculture for daily sustenance. Currently, the Sarangani agro-ecosystem is being threatened by productivity-driven agriculture, the shift to a cash-based economy, upland degradation, an ageing population of farmers and their declining health and well-
being. Interventions to address these problems are therefore warranted to avert further biocultural losses, environmental degradation and to improve health status of the tribal families. Multidisciplinary, bottom-up and participatory approaches which blend frontier technologies with local knowledge in relation to food production and environmental preservation are therefore warranted to save the Sarangani agro-ecosystem, its peoples and resources for posterity.

References


Further reading

Internet source

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Abstract

Purpose – The extreme flood event of 2010 in Pakistan led to extensive internal displacement of rural communities, resulting in initiatives to resettle the displaced population in model villages (MVs). The MV concept is quite new in the context of post-disaster resettlement and its role in building community resilience and well-being has not been explored. This study aims to assess the role of MVs in building the resilience of relocated communities, particularly looking at the differences between those developed by governmental and non-governmental organizations (NGOs).

Design/methodology/approach – Four MVs, two developed by government and two by NGOs, were selected as case studies in the severely flood-affected province of Punjab, Pakistan. A sample of 145 households from the four MVs was collected using a structured questionnaire to measure improvements in social, economic, physical and environmental domains and to form a final resilience index. Supplementary tools including expert interviews and personal observations were also used.

Findings – The analysis suggests that NGOs are more successful in improving the overall situation of relocated households than government. Core factors that increase the resilience of communities resettled by NGOs are provision of livelihood opportunities, livelihood skill development based on local market demand, training on maintenance and operation of different facilities of the MV and provision of extensive education opportunities, especially for women.

Practical implications – The results of this study can guide policymakers and development planners to overcome existing deficiencies by including the private sector and considerations of socioeconomic development whenever resettling communities.

Originality/value – In resilience discourse, resettlement of communities has been extensively debated based on qualitative arguments. This paper demonstrates an approach to quantify community resilience in a post-disaster resettlement context.

Keywords Relocation, Flood disaster, Risk reduction, Resilient communities, Punjab, Pakistan

Paper type Research paper

1. Introduction

The frequency of disasters has increased throughout the globe during the past two decades. Floods have become a perpetual phenomenon around the world, causing widespread economic...
losses and displacing millions of people (Kundzewicz et al., 2013; Jongman et al., 2018). The international displacement monitoring center indicates that about 200 million were on the move due to natural hazards between 2008 and 2015, of which 64 per cent were displaced by floods (Bilak et al., 2016). Several strategies have been adopted to increase capacities of hazard-affected populations and mitigate future flood risk. Post-flood resettlement is one measure adopted by several countries in the aftermath of flooding to relocate affected people to safe locations (Jamshed et al., 2018). Resettlement aims not only to limit exposure to hazard but also provide social and economic development opportunities to people (Correa, 2011). If not handled carefully, it can also invoke new vulnerabilities and risks due to lack of access to land, livelihood insecurity and cultural consequences (Badri et al., 2006; Birkmann et al., 2013; Bang andFew, 2012). Nevertheless, these resettlement schemes, if properly organized and managed, provide opportunities to “build back better” by developing resilient and sustainable communities (Fan, 2013). Priority 4 of the Sendai Framework for Disaster Risk Reduction (SFDRR) calls for “building back better” in recovery, rehabilitation and reconstruction (UNISDR, 2015). Similarly, Goal 11 of the sustainable development goals (SDGs) calls for “making cities and human settlements inclusive, safe, resilient and sustainable” (United Nations, 2018). Around the world, local and national governments are formulating strategies for resettlement programs as a measure to improve the resilience of their counties to disasters and other disturbances (Keraminiyage and Piyatadsananon, 2013). Against this background, it is imperative to assess the impact of post-disaster resettlement on community resilience.

Pakistan is prone to several hazards but floods are the most commonly occurring. Out of 145 districts, 113 districts are declared at high flood risk (National Disaster Management Authority NDMA, 2012; Rana and Routray, 2018). In the past, the country has experienced several extreme flood events, causing life and material losses and displacing millions. In 2010, Pakistan faced a devastating flood that resulted from heavy rains in monsoon season. The World Bank estimated that more than 2,000 people lost their lives, 20 million were severely affected and more than 1.6 million housing units were destroyed due to this flood (The World Bank, 2010). The province of Punjab, where a large portion of the poor population lives in vulnerable (illegal) and unplanned rural areas, was affected massively (Jamshed et al., 2017). Flooding in the province severely impacted more than 3,000 villages, leaving 6 million people homeless and destroying 5.32 million acres of cropped area (Provincial Disaster Management Authority Punjab PDMA, 2013; Provincial Disaster Management Authority PDMA, 2014; Jamshed, 2015). Exposure, damages and huge population displacement due to the 2010 flooding highlighted the need for building resilience in communities.

In the aftermath of the 2010 floods, the Punjab Provincial Government devised a strategy to resettle extremely vulnerable populations from highly exposed areas in “model villages” (MVs). MVs were defined as planned and resilient rural settlements with basic amenities. These amenities included quality housing, electricity, safe water supply, sanitation and drainage systems, health and education facilities, veterinary services and better livelihood opportunities. The idea of MVs was to provide modern facilities for vulnerable and marginal sections of the affected rural population to raise their living standards. The Government of Punjab with mutual cooperation of non-governmental organizations (NGOs) planned development of more than 200 on-site and off-site MVs all over the province (Tasleem, 2010). Research has been conducted on flood resettlement strategies in Pakistan (Nadeem et al., 2014) and the role of public participation in MV development (Jamshed et al., 2018). However, the impact of resettlement on the lives of relocated households and its influence on their resilience has not been explored. Therefore, this paper assesses the role of post-disaster resettlement in building community resilience.
2. Linking post-disaster resettlement and resilience

Extreme events and disasters have displaced millions of people. Such displacement becomes permanent when people are unable to return to their homes due to massive disruptions and forces them to resettle (Keraminiyage and Piyatadsananon, 2013). Resettlement (voluntary or involuntary) has negative and positive consequences (Birkmann et al., 2013). Birkmann et al. (2013) contend that resettlement can form new socioeconomic vulnerabilities. Social fragmentation, loss of privacy, political marginalization, landlessness and unemployment are possible vulnerabilities that could result from resettlement (Cernea, 1997; Usamah and Haynes, 2012). On the other hand, resettlement can bring development benefits by providing close proximity to social, economic and infrastructural services and increasing community resilience (Godschalk et al., 2009; Cummings et al., 2012; Arnall, 2018). It is necessary to properly plan and manage the resettlement process for building community resilience and long-term sustainability. Arnall (2018) suggests that if a process is to increase resilience and adaptation, then resettlement must be developmental and those who have been resettled should be better off in their new location compared to in their place of origin.

The concept of resilience is multifaceted, with varying meanings in different contexts and disciplines. With roots in ecological sciences and psychology, the term is now used in the fields of climate change adaptation, disaster risk reduction and sustainable development (Leichenko, 2011; Birkmann, 2013; Alexander, 2013). Numerous interpretations and definitions by scholars and institutions exist in the literature (Holling, 1973; Klein et al., 2003; Folke, 2006; United Nations International Strategy for Disaster Reduction UNISDR, 2009). The IPCC defines resilience as, “the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation” (IPCC, 2018, p. 557). Building resilience has become a holistic approach to prepare communities, organizations, and systems to absorb, adapt to, and transform in the face of future shocks and threats.

The relationship between post-disaster resettlement and community resilience is important to understand, especially considering priorities of the SFDRR and SDGs. It is important to understand whether post-disaster resettlement follows the principles of “building back better” and “resilience.” Resilient and safe reconstruction of settlements is integral for effective disaster risk reduction. It is an essential part of the recovery process in a conventional disaster risk management cycle (Oliver-Smith, 1991). Sometimes, disasters wreak irreversible damages meaning that communities need to settle elsewhere. Mega floods often displace a large population, which becomes a serious challenge for local institutions, especially for developing economies. Some researchers deem this voluntary or involuntary post-disaster resettlement more complex than traditional settlement development (Oliver-Smith, 1991; Correa et al., 2011). Many researchers have asserted that post-disaster resettlement should inherently enhance overall resilience (Correa, 2011; Karunasena and Rameezdeen, 2010; Vahanvati, 2018). However, these resettlements must not only include physical resilience against future hazards but also social economic and cultural factors such as better livelihood opportunities, liveability and quality of life (Keraminiyage and Piyatadsananon, 2013; Carrasco et al., 2017; Jamshed et al., 2018). In this regard, observing communities living in post-disaster resettlement schemes and their perceptions on such factors can show the level of disaster resilience. Therefore, this study assesses whether the resettlement in Punjab was developmental and helped build community resilience. In this case, the extreme flood event was the primary factor, which lead to the resettlement process of the highly exposed, extremely vulnerable and displaced population. The impact of resettlement determines the level of resilience in various domains.
This paper conceptualizes resilience through social, financial, physical and environmental domains of resettled communities.

3. Methodology

Several model villages were constructed by the provincial government of Punjab and the private sector (NGOs, donors and companies) together. Most of them were constructed in district Muzaffargarh, which was most affected by the 2010 flood (Nadeem et al., 2014; Jamshed et al., 2018). For this study, four MVs (two developed by the NGOs/donors and two by the provincial government) were selected. Ittehad and Pakpur MV were developed by NGOs/donors, whereas Jalwala and Ehsanpur MV were constructed by the provincial government (Figure 1). The details of the case study are provided in Table I.

3.1 Sampling and data collection

A total of 470 families were living in the four selected case study areas. It was challenging to survey each household due to time and financial constraints. Moreover, not all of the households were present at the time of the survey and only those households were interviewed who willingly participated in the survey. Considering these restrictions, 50 households from Ittehad MV, 32 from Pakpur MV, 41 from Jalwala MV and 22 from Ehsanpur MV were interviewed, resulting in the total sample of 145 households. The size of the sample represents 30 to 32 per cent of the population of each selected case study. Face-to-face interviews were used for collecting data. A structured questionnaire was prepared to collect information on the socioeconomic situation in the MV, planning and development of the MV, and on MV facilities, as well as on the situation in the place of origin to compare the pre- and post-resettlement situation.

3.2 Community resilience index

The empirical data collection resulted in a wealth of information about the situation of the community living in each MV relative to the situation of these communities pre-flood in their places of origin. The subsequent categorization, scaling and normalizing of this information resulted in a set of indicators that describe the increase (resilience index value of above 0) or decrease (resilience index value of below 0) of community resilience of each MV community as compared to their resilience in their place of origin.

A composite index was used to assess the role of post-disaster resettlement in building resilience of relocated households. Initially, 25 indicators were selected for four selected dimensions of resilience, namely, social, economic/financial, physical and environmental/ecological resilience. Indicators, which represented high collinearity were dropped, which resulted in a total of 17 indicators (Table II). These indicators were divided into four resilience dimensions (social = 6, financial = 2, physical = 5 and environmental = 4). All the questions related to the indicators were mapped on a scale of five values from −1 to 1 (−1, 0.5, 0, −0.5 and −1), where 1 equals the best situation, −1 the worst situation and 0 represents the situation before relocation at the place of origin (Table II). One of these five values was assigned to each indicator for each household and these results were then combined according to equation (1), to calculate a composite index for each dimension of resilience (social, financial, physical and environmental). The resilience index was calculated by taking an average of the composite index of each resilience dimension [Equation (2)]:

$$CI = \frac{W_1 + W_2 + W_3 + \ldots + W_n}{n} = \frac{\sum_{i=1}^{n} W_i}{n}$$  (1)
Resilience Index = \left( \frac{SI + FI + PI + EI}{4} \right)

Where:
- $CI$ is the composite index;
- $W_1$ to $W_n$ are respective weights assigned to indicators.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>NGO/donor driven</th>
<th>Government driven</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of MV</td>
<td>Ittehad</td>
<td>Jalwala</td>
</tr>
<tr>
<td></td>
<td>Pakpur</td>
<td>Ehsanpur</td>
</tr>
<tr>
<td>Location</td>
<td>30°38'25.30&quot;N 70°58'23.52&quot;E</td>
<td>29°50'7.92&quot;N 71°4'25.07&quot;E</td>
</tr>
<tr>
<td>Sub-district</td>
<td>Kot Addu</td>
<td>Muzaffargarh</td>
</tr>
<tr>
<td>Distance from sub-district headquarter</td>
<td>15 km North</td>
<td>12 km South-west</td>
</tr>
<tr>
<td>Area of MV (acres)</td>
<td>23.5</td>
<td>8</td>
</tr>
<tr>
<td>Housing units</td>
<td>166</td>
<td>99</td>
</tr>
<tr>
<td>Population (approx.)</td>
<td>1,100</td>
<td>655</td>
</tr>
<tr>
<td>Household size (avg.)</td>
<td>7.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Family income (avg.) in Pakistani Rupees (PKR)</td>
<td>9,400</td>
<td>12,200</td>
</tr>
<tr>
<td>Distance to the place of origin (km)</td>
<td>24</td>
<td>11</td>
</tr>
</tbody>
</table>

Table I. Profile of selected MVs and their households
<table>
<thead>
<tr>
<th>Sr#/code</th>
<th>Indicators</th>
<th>Classes</th>
<th>Weights</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Social resilience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. SR1</td>
<td>Access to education facilities</td>
<td>Much better</td>
<td>1</td>
<td>Better education facilities help to build human capital can improve risk perceptions and can encourage the undertaking of precautionary measures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>2. SR2</td>
<td>Access to health services</td>
<td>Much better</td>
<td>1</td>
<td>Better health services improve the well-being of households and help in recovery from injuries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>3. SR3</td>
<td>Safety/security</td>
<td>Much better</td>
<td>1</td>
<td>A secure environment is key to human well-being and ensures the safety of various assets of the relocated communities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>4. SR4</td>
<td>Relationship with neighboring/host communities compared to the place of origin</td>
<td>Much better</td>
<td>1</td>
<td>Social relationships with host communities enhance social networking and social capital</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>5. SR5</td>
<td>Access to information</td>
<td>Much better</td>
<td>1</td>
<td>Information on general issues and potential threats can increases awareness and improve preparation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
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<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>6. SR6</td>
<td>Improvement in lifestyle</td>
<td>Much better</td>
<td>1</td>
<td>A perceived improvement of lifestyle indicates an overall improvement in the condition of households</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Financial resilience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. FR1</td>
<td>Income after relocation</td>
<td>Much improved</td>
<td>1</td>
<td>Improved income results in better capacities to deal with future hazards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
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<td>Worse</td>
<td>−0.5</td>
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<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>8. FR2</td>
<td>Better/enough income opportunities near the MV</td>
<td>Strongly agree</td>
<td>1</td>
<td>More income-earning opportunities increase the economic resilience of households</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agree</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>Neutral</td>
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<tr>
<td></td>
<td></td>
<td>Disagree</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Physical resilience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. PR1</td>
<td>Housing</td>
<td>Much better</td>
<td>1</td>
<td>Brick and cement housing is much more resilient than traditional adobe or semi-adobe housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
</tbody>
</table>

*Table II.* Indicators for index development with respect to dimensions, their classification, weights and explanation (continued)
$n$ is the number of indicators used for computing the composite index; 
SI = Social resilience index; 
FI = Financial resilience index; 
PI = Physical resilience index; and 
EI = Environmental resilience index.

<table>
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<tr>
<th>Sr#/ code</th>
<th>Indicators</th>
<th>Classes</th>
<th>Weights</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. PR2</td>
<td><strong>Electricity</strong></td>
<td>Much better</td>
<td>1</td>
<td>Households with better access to infrastructure facilities are more able to cope and adjust in a crisis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>11. PR3</td>
<td><strong>Streets and roads</strong></td>
<td>Much better</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
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<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>12. PR4</td>
<td><strong>Telecommunication</strong></td>
<td>Much better</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
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<tr>
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<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
<td>Worse</td>
<td>−0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>13. PR5</td>
<td><strong>Public transport</strong></td>
<td>Much better</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
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<tr>
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<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
<td>Worse</td>
<td>−0.5</td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>14. ER1</td>
<td>Safe water supply</td>
<td>Much better</td>
<td>1</td>
<td>A safe and clean water supply, improved sanitation services and protects the environment and improves health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td></td>
<td>Worse</td>
<td>−0.5</td>
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<tr>
<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>15. ER2</td>
<td>Sanitation facilities (sewage, treatment and waste management)</td>
<td>Much better</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
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<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td>Worse</td>
<td>−0.5</td>
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<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>16. ER3</td>
<td>Green open spaces and tree plantation</td>
<td>Much better</td>
<td>1</td>
<td>Green spaces and tree plantations can provide resilience against floodwater and reduce heat stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td>Worse</td>
<td>−0.5</td>
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<td></td>
<td></td>
<td>Much worse</td>
<td>−1</td>
<td></td>
</tr>
<tr>
<td>17. ER4</td>
<td>Relocation in reducing future flood risk</td>
<td>Much better</td>
<td>1</td>
<td>Perceived risk shows a possible reduction in future flood risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Better</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as before</td>
<td>0</td>
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<td>Much worse</td>
<td>−1</td>
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</tbody>
</table>

Table II.
4. Results and discussion
The community resilience index and its four dimensions – social, economic, infrastructural and environmental – of each MV are depicted in Figure 2. The indicators that describe each of these resilience dimensions for each MV can be seen in Appendix (Figure A1). How the resilience of each MV changed after resettlement will be described in more detail in the following sub-sections.

4.1 Social resilience
Social resilience differs significantly among the four case studies. The highest value of social resilience was in Ittehad MV with a value of 0.65 compared to Jalwala MV with the lowest value of 0.32. The resilience values in Pakpur and Ehsanpur MV were 0.42 and 0.38, respectively (Figure 2). It was found that the households in all the case studies were more socially resilient after relocation as the index values are above 0. Better education, health and sense of safety, and strong social networking within communities were primary reasons that communities had become socially more resilient. Primary and vocational education facilities were provided within and near to MV sites, which facilitated children, as well as adults through vocational training to improve livelihood opportunities. In Ittehad MV, adult literacy programs were carried out where elderly men and women were given basic school education. Health dispensaries were established to provide first aid and basic health services, which according to the residents improved the overall health of their families. The quality and level of these services varied among MVs, where those developed by NGOs/donors provided better services compared to the public sector. Consequently, MVs established by the NGOs/donors were found to be more socially resilient as compared to those of the public sector.

4.2 Economic resilience
Most of the MVs showed poor economic resilience, except Ittehad MV, which received a positive score of 0.23, whereas Pakpur, Jalwala and Ehsanpur had scores of 0.15, 0.10 and −0.25, respectively (Figure 2). These negative scores indicate that relocation did not help them economically and their situation was worse compared to their place of origin. This

![Figure 2. Resilience index values of case study areas with respect to the social, financial, physical and environmental dimension](image-url)
could be because the majority of relocated households were landless farmers at the place of origin and as the farmland was flooded they could not continue farming. Moreover, after relocation, these households could not find a suitable livelihood because of a lack of skills so their incomes levels declined. In contrast, in Ittehad MV livelihood and skill development programs were initiated for beneficiaries at the time of MV development. These local market-oriented programs were launched for both men and women. As a result, the livelihood situation improved in Ittehad MV, making them more resilient. In Jalwala and Ehsanpur MV, livelihood and skill development programs were not introduced at all. Overall, there was limited financial resilience among households of Ittehad MV, while none in the other MVs. Results imply that proper livelihood training and skill development can improve the economic resilience of relocated households.

4.3 Physical resilience
The physical or infrastructural situation of relocated communities was much better compared to their place of origin. The scores were highest in Ittehad MV (0.73) and lowest in Ehsanpur MV (0.44). Pakpur and Jalwala MV scored 0.62 and 0.57, respectively (Figure 2). Housing condition was greatly improved after the relocation. Almost, all the relocated households were living in adobe and semi-adobe houses that were extremely vulnerable and completely destroyed by the flood event of 2010. In MVs, houses were constructed with bricks and mortar with proper deep foundations that are more resilient to flood hazards. Moreover, roofs were constructed using various layers of mud and mortar, and large windows were provided along the walls to account for the hot temperature in summers. In this way, the houses were deemed resilient against extreme temperatures. The situation was better in Ittehad and Pakpur MV where windows across the walls provided cross ventilation. Houses were designed keeping in mind the local rural character with open kitchens and bath/toilets separated from the living area. Streets and roads in and around all MVs were constructed with brick soling. All the MVs were well connected with village access roads; however, the quality of access roads was much better in Ittehad and Ehsanpur MV and moderate in Pakpur and Jalwala. Regarding electricity services, Ittehad MV was powered by solar energy where solar panels were installed on the roof of each house proving 24 h of electricity to the residents. In Pakpur and Jalwala MV, solar panels were provided only for lighting the houses, whereas other appliances were powered by electricity from the national grid. In Ehsanpur, neither solar nor electricity connections from the national grid were provided. As a result, people were using candles, gas lamps and private generators for their energy needs. Telecommunication services were found adequate in all MVs as compared to their place of origin. Access to public transport was found to be best in Ittehad MV compared to the other three case studies, as it has better access roads and is located closer to other villages.

4.4 Environmental resilience
In the environmental domain, there was a substantial difference between the MVs. All case studies saw improvements in the environmental domain. Ittehad MV had the highest value of 0.93, followed by Pakpur with 0.39, while Jalwala and Ehsanpur both scored 0.13. Ittehad MV is extremely resilient in terms of environmental aspects (Figure 2). This can be attributed to adequate safe drinking water, sanitation facilities and the provision of green spaces.

Households in Pakpur and Jalwala MVs both reported that drinking water was not safe to drink due to peculiar odour and colour. Moreover, they were experiencing various diseases and had to travel far to collect drinking water. They stated that at the place of
origin they had sufficient safe drinking water. In Pakpur, donors installed a water filtration plant in the community but it was not functional, possibly because of lack of maintenance.

In terms of sanitation facilities, Ittehad and Pakpur had better facilities compared to the place of origin, whereas the other two case studies reported worse conditions compared to the place of origin. In Ittehad and Pakpur MV, underground sewerage systems with proper sewage disposal were constructed, whereas in the other two study areas, an open drainage system was provided. Moreover, proper waste disposal systems were provided in Ittehad and Pakpur MV, which allowed people to segregate organic and inorganic waste, whereas no such system was seen in Jalwala and Ehsanpur MV. In Ittehad MV, an organic wastewater treatment plant was constructed to treat the wastewater.

Playground, parks and tree plantation were provided in Ittehad MV, whereas only parks were provided in other three study areas. Except for Ehsanpur, the rest of the MVs indicated that open spaces and plantations are much better in MVs compared to the places of origin.

Regarding the role of relocation in reducing future flood risk, households in all the case study areas were extremely positive about this aspect. They further reported that relocation has not only reduced future flood risk but also risk from extreme temperatures due to better housing quality.

4.5 Overall resilience
Overall, the study areas all received a resilience index score of above “0,” which suggests that resettlement projects have built resilience among relocated communities. Nevertheless, the level of resilience varies among the case study villages. Ittehad MV scored highest (0.62), followed by Pakpur (0.32), Jalwala (0.23) and Ehsanpur (0.17). Relatively, Ittehad MV successfully improved the social, financial, physical and environmental aspects of the relocated communities especially compared to the two government-driven MVs, Jalwala and Ehsanpur. In addition to the factors mentioned earlier, the MV development process also played a key role in building resilience. Multi-hazard assessments of the project site were conducted to reduce the risk of various hazards in each of the MVs. In Ittehad and Pakpur MVs, beneficiaries were involved in the planning, design and construction, as well as operation and maintenance phase of project development. This resulted in the main concerns and demands of relocated communities being incorporated into the plans. Moreover, it caused increased awareness of the community members regarding various hazard related and other general issues. Jamshed et al. (2018) also identified that community involvement in the whole resettlement process brings better outcomes. Livelihood programs and skill development was a key to building community resilience, especially in Ittehad MV. In summary, NGO-driven resettlement projects followed a more comprehensive process of MV development, which resulted in more significant improvement of relocated communities in social, economic, physical and environmental domains compared to government-driven projects. Even though several households are financially and economically less well off after relocation, good health, education, housing, infrastructure, and environmental services outweigh these economic disadvantages.

5. Conclusion
Post-disaster resettlement as a measure to build community resilience is an important part of disaster recovery and rehabilitation. However, the success of building resilience through resettlement heavily depends on how it is carried out and which aspects are focused on. Results indicate that the community resilience of resettled households can be improved by ensuring greater access to education, health, safety and hazard information. Generally, in resettlement strategies, the infrastructure and environmental domains are given more
importance than improving socioeconomic conditions. This was found true also in MVs, where infrastructural and geographical factors fared better than other dimensions. Based on this key finding, decision-makers involved in future resettlement projects are advised to not only consider infrastructural and environmental aspects when planning and implementing resettlement but also to pay particular attention to how the project can improve the community’s level of socioeconomic development.

The second key finding of this study is that NGOs were more successful in improving the overall situation of relocated households than the public sector. This was because, in the NGO-driven MVs, effort was invested into the provision of livelihood opportunities, livelihood skill development, maintenance and operation of different facilities, and provision of extensive education opportunities. This result shows the benefits of integrating NGOs and other private sector donor and actors into the process of resettlement projects. This should serve as a guide for policymakers and planners as one way to overcome existing deficiencies in project results. Resettlement processes should be based on incremental and participatory planning approaches such as those used by the NGOs, to provide a sense of ownership, safety and comfort to successfully build community resilience.

References


Appendix

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