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**Jason von Meding, Jamie Mackee and
Thayaparan Gajendran**

SPECIAL ISSUE: POST-DISASTER RECONSTRUCTION

Includes: Regular Refereed Papers

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EDITORIAL: BUILT ENVIRONMENT PERSPECTIVES ON POST-DISASTER RECONSTRUCTION

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Overview

It is with great pleasure that we would like to introduce this special issue of IJAR, a compilation of cutting-edge research that covers many of the key themes relevant to built environment researchers in disaster-related areas. This knowledge area is by its very nature absolutely multi-disciplinary and for this reason it is difficult to quantify built environment impacts, drivers and outcomes in isolation and disaggregate them from non-built environment factors.

However, regardless of certain limitations to research carried out from a built environment perspective, as would be the case from any specific disciplinary perspective, a significant body of work has emerged and is constantly growing and evolving in parallel with the research agenda. Built environment researchers around the globe are now, more than ever, exploring various problems that threaten humanity in the way of dire vulnerability and more frequent and powerful hazards.

This collection of papers will look specifically at one area of disaster management, post-disaster reconstruction. Reconstruction projects primarily occur during the recovery phase of the disaster cycle, playing a key role in bringing vulnerable communities back to normalcy, integrating disaster risk reduction and preparedness measures to increase resilience to future hazard events.

The special issue is broken into four thematic areas; Context and Culture, Theory, Resilience and Risk Reduction and Design. The three papers in *Section 1- Context and Culture* deal with the impacts of disasters on places and the people that inhabit them, investigating the extent to which reconstruction projects can address social and cultural problems. Meanwhile, the two papers in *Section 2- Theory* put forward new theoretical perspectives with regards to stakeholder engagement and management, representing the growth of alternative points of departure in this area. The three papers in *Section 3- Resilience and Risk Reduction* explore various approaches to building in targeted measures to reconstruction projects that enhance risk reduction and resilience outcomes for communities. Finally, the two papers in *Section 4- Design* are concerned with the delivery of low-cost sustainable housing solutions and the decisions that are made, leading implementing actors to certain shelter approaches.

Section 1- Context and Culture

Over the past decade, natural disasters and civil conflicts have had disastrous effects on many regions of the world. Whilst the impacts of natural hazards and conflict on social, economic and environmental variables have been well documented, the impact that human- and nature-led catastrophic events have on cultural heritage remains relatively unexplored (Taboroff 2003, Jigyasu 2013). Catastrophic events brought about as a result of natural hazards pose a particular type of threat to cultural heritage due to its immediate and abrupt consequences. Preparedness for, and response to, such catastrophic events is a difficult and fraught issue, and the impacts of natural hazards on cultural heritage will be a reflection of preceding decisions that have been made over an extended period of time.

This section on Context and Culture looks at this issue from a number of perspectives. The first paper by Rohit Jigyasu builds upon a body of work that has looked at the impact of catastrophic events on cultural heritage. His paper explores the nature of decision-making in the post disaster phase in extraordinary circumstances that can have destructive effects. It is based on the case of Marathwada in Maharashtra, India after the 6.5 level earthquake in 1993 and the decisions taken to rebuild. His conclusions highlight the problem with cultural heritage in the face of disasters, that poor short-term decisions made can lead to long term vulnerabilities and risks while creating new problems, as was found to be the case in Marathwada. This is a situation that underlies the real impact on cultural heritage with much more that must be done to protect our heritage particularly in the most vulnerable areas such as in Asia.

Bernadette Devilat Loustalot has investigated one method of trying to address the problem of poor decision-making, in her paper looking at the impact of earthquakes on built heritage in Chile. Her idea is to look to the past for solutions when trying to reconstruct the past after a disaster that is by adopting sustainable building traditions. Loustalot reinforces her argument using case studies where buildings have been reconstructed after a catastrophic event losing much of the heritage character for which they were recognised. This is another serious problem facing the historic environment after a disaster. The reconstruction process throws up a number of issues regarding authenticity and significance that are often comprised when rebuilding after a disaster. Loustalot's solution to this is based on her argument of utilising traditional construction techniques with modern materials and techniques. However there is still the need to have in place some strong policies regarding the general approach to the reconstruction of built heritage after a disaster.

Finally Yilmaz, Von Meding and Erk in their paper explore the issues in the development of an appropriate survey instrument for post-disaster reconstruction projects. The research focuses on the development of appropriate indicators for the post-earthquake permanent housing projects built by the state in the last two decades in rural eastern Turkey. There were 65 indicators from 30 studies for investigating research into post-disaster reconstruction. This extensive list covered a range of social, planning and constructional issues associated with housing. The idea behind this exhaustive list is that these then were to become the Selected Success Factors (SSFs) for the study with some of these becoming Critical Success Factors (CSFs). Their work in developing these SSFs and CSFs for post-disaster housing while extensive and enlightening provides lessons for the areas explored by all three papers in this theme. The problems of social and cultural issues overlap and are both impacted by early and poor decisions made in haste. The underlying issue of this final paper, that of evaluation, highlights the potential of the need to be able to evaluate to support decision-making that would improve the situations explored in these papers.

The message from this section is twofold; firstly that there is a lack of work dedicated to understanding the impact of disasters on culture and society and secondly that work in the area of decision-making and evaluation can significantly improve the situation should be regarded as a valuable contribution to best practice.

Section 2- Theory

The two papers in this section explore the application of alternative theoretical approaches, specifically 'institutional transformation' and 'actor network' processes, to analyze stakeholder relationships in the context of post disaster management. This is paramount in the light of calls for more active stakeholder engagement and community consultation in managing disasters, that demands better understanding of relationships between human and non-human elements in a system.

The paper by Camilla Cociña Varas and Camillo Boano bring complex formal and informal transformation concepts together - in the context of political process, policy environment, market orientation, and social order - to analyse the housing provision in post disaster environment. In this context they pool diverse concepts for a unique and complex analysis of intuitional and civil

society transformation process and review the changes to the post disaster housing policy in Chile, with specific reference to the post 2010 Chilean earthquake. They discuss the changes in housing policy over a 2010-12, and its association to changes in social order and roles of actors'. This study employs a case study approach focused on post 2010 Chilean earthquake the disaster events.

They suggest the relationships among different actors/stakeholders require rethinking in a post disaster environment as it provides unique conditions for emergent political process that may generate momentum for institutional transformation. Their findings suggests the observed trend was that citizens to act collectively, even if institutions promote the contrary. This means that the civil society can capitalize on this trend and force of radical transformation, through the organisation and creation of collective intelligence, in reciprocity and self-determination.

This form of analysis develops further understanding into the implications of transformations 'led by civil society' and 'government led institutional responses', and the influence of such transformation on the potential opportunities for housing policy. This is a very valuable contribution to the theoretical discourses into understanding roles of two key actors in the transformation process approached from multiple angles.

Brewer, McVeigh and von Meding explore the suitability and usefulness of Actor Network Theory (ANT) in exploring relationships among actors/actants during post disaster aid deployment in order to illuminate and tame the inherent complexities encountered during disaster relief and beyond, in relation to building resilience and minimising vulnerability. They propose that applying ANT based analysis of aid distribution network has the potential to improve effectiveness post-disaster aid distribution to achieve maximum benefit to recipients.

The point of departure for this paper was to investigate the suitability of ANT for deployment in a disaster-related context. By analysing the relationships between human actors and non-human actants, ascribing characteristics such as motives and behaviours, the authors postulate that we can ultimately better explain the worldly consequences of their interaction. The research methodology is based on two case studies (disaster events in Haiti and Cuba), analysing the accounts of key actors, specifically selected individuals who had been pivotal in designing and directing the implementation of aid programs.

The findings of the study suggest that ANT analysis of disaster aid distribution situations, that led to both success with failure outcomes, can inform better practice in future recovery and reconstruction events. However, they identify three operational challenges in applying ANT: difficulty in defining the problem boundaries due the complex and dynamic nature of disaster situations; the vulnerable and disfranchised nature of disaster victims making it hard for full engagement as informants; potential for turf defending and lack of cooperation by NGO's, government authorities and other organisations leading to less than desirable engagement in the ANT process.

In summary this section provides alternative theoretical points of departure to analyse relationships among different stakeholders during the post disaster reconstruction phase. First approach is based on developing a theoretical discourse for analysing transforming relationships among stakeholders, in this case between the civil and institutional stakeholders, leading to possible change. The second approach uses the actor network theory to analyse the relationships between different human actors and non-human actants to identify the critical relationships that impact on effective delivery of aid. These two theoretical approaches provide different theoretical lenses to create meaningful understanding into stakeholder relationships into complex post disaster environments.

Section 3- Resilience and Risk Reduction

The three papers in this section explore aspects of 'resilience building' specifically in the phase of reconstruction for improved built environment outcomes. A clear understanding of the processes underpinning the reconstruction phase will enable practicing managers to seek out alternative processes if necessary.

Ernst and Edwards explored ‘workshops’ centred the pedagogical aspects for educating for reducing disaster vulnerability and risk and as a catalyst for positive change. They suggest that the evolving pedagogy based on the Architecture Sans Frontières-UK (ASF-UK) workshop model can be used as a primary tool to explore international development issues and built environment related professional skill development. The authors have used a case study approach based on a reconstruction project in Almora, Uttarakhand explore the their proposition. The case study workshop marked the inception of a three year project which aims to facilitate improved building practices in symbiosis with disaster mitigation and wider development agendas through education, capacity building and prototype development.

Although such workshops have long-term implications for participants, they provide opportunity for immediate exposure to a real and challenging context issues through the exposure to other stakeholders and their experiences. It is only through the development and delivery of the longer-term programme that the impact on the vulnerability and risk within shelter construction in the area can be assessed. The results of this study suggested that the most effective way to build capacity and facilitate knowledge transfer would be through two platforms; an online, virtual building centre, and a physical centre.

Mannakkara and Wilkinson evaluate the extent of incorporation of “Building Back Better” (BBB) in the reconstruction during of post Tsunami recovery phase in Sri Lanka. BBB is an approach for resilient recovery, promoting collaborative approach to improve the physical, social and economic conditions of a community. Their study analysed multiple data sources including reports, and primary data collected from disaster sites. Although they identify a number of good BBB practices currently in effect, the absence of legislative support to implementation of BBB is seen as a practical hindrance. They suggests that recovery process did not execute non-BBB approach in the recovery process, despite stakeholders recognized the principles of BBB approach. However, it was encouraging to find that the lessons learnt from shortcomings recognised and improvements are made to disaster management practices.

Alireza Fallahi, in his technical report, reviews the status of the shelter and reconstruction progress, a year into the 2010 East Azerbaijan Province Earthquake in the North-West of Iran. This disaster affected 327 villages and impacted approximately 250,000 people, leaving more than 300 residents dead, 4500 injured and 72,000 with damaged or destroyed properties. This technical report reviews on the initiatives and processes adopted for shelter provision using data collected a year after the disasters through qualitative field work based on the author’s observations.

Fallahi suggests that a “transitional accommodation” initiative using a “multi-functional shelter unit” provided much-needed protection for earthquake survivors from the cold weather during the reconstruction process. This initiative enabled accelerated support for earthquake survivors, minimizing the threats posed by the harsh climatic and topographic conditions of East Azerbaijan Province during the reconstruction phase. The report concludes that, despite significant progress in the reconstruction of permanent housing and social infrastructure, some survivors are still struggling with recovery from the impact the disasters had on their lives.

In summary this section provides valuable context specific accounts of three post disaster initiatives focused on disaster risk reduction and resilience building, focused on built environment. These three initiatives, ‘workshop pedagogy based education’, ‘build back better’ approach and accelerated ‘multi functional shelter’ support, can provide a sound basis for further development in the disaster risk reduction and resilience agenda in the built environment domain.

Section 4- Design

This section of the special issue explores an aspect of post-disaster reconstruction that resonates strongly with many built environment disciplines, the design of housing/shelter. The two papers that appear draw out some of the key issues facing actors implementing projects in such complex disaster scenarios, such as the budget restraints within the humanitarian sector, donor pressures and the lack of a professional skill base within agencies. Both papers recognize the responsibility

of post-disaster actors to engage with the core problems facing societies and causing vulnerability to hazards; economic, social, political and cultural factors among others.

In the first instance, Bruen, von Meding and Hadjri present a case study of the design decision-making of an international NGO in post-tsunami Sri Lanka. A mixture of interview analysis and observational data are presented, culminating in a process flow chart, representing the design and delivery decision-making. This paper gives us an interesting look at the mechanisms that occur within an organization that is committed to both design and project management excellence.

The paper advocates for long-term engagement of beneficiary communities, allowing a detailed process to play out from pre-commencement stage, through research and feasibility, to design and implementation. As has been noted in literature (refs), post-disaster actors do not often implement projects in similar fashion to commercial construction firms, in the process losing out on overall quality, efficiency and budgetary know how. Experienced humanitarian actors are meanwhile more assured when managing the complex nature of disaster scenarios. In the case described in this study, the organization observed displays the best of both camps and sets a precedent for future NGO implementations.

The authors focus on the importance of delivering low cost housing options in developing nations and the essential need to embed long-term sustainable housing strategies that will be replicated beyond the duration of the operation. The paper also highlights the potential for post-disaster reconstruction to act as a catalyst for socio-economic recovery, providing a solid platform for vulnerability reduction, building resilience and disseminating knowledge.

While echoing the call for low-cost housing solutions that address post-disaster needs while contributing to broadly based positive outcomes, Fayazi and Lizarralde present a unique theoretical perspective using general systems theory to underpin a study that is devised to further our understanding of resilience and vulnerability. They develop a 'Process of Enhancing Resilience (PER) Model', defining subsystems and scales by which resilience might be measured.

Using a case study design, the authors go on to compile evidence regarding four typologies of housing reconstruction implemented in Bam, Iran, following the 2003 earthquake. Each housing approach is measured based on specific outcomes that impact resilience and vulnerability. By utilizing this framework, the strengths and weaknesses of each housing approach can be clearly documented.

This paper strongly supports the argument that housing should be conceptualised as a potential catalyst for the transition of communities from vulnerability to resilience. Fayazi and Lizarralde go on to present evidence that links particular housing strategies to elements of their 6 dimensions of resilience. The successful attainment of resilience indicators is discussed as a vital factor in developing adaptive capacity and increasing social capital within an affected community.

A common attribute of successful projects in both papers is owner-driver solutions, and the authors assert that such approaches should be preferred in most post-disaster scenarios. Various studies have provided evidence to demonstrate the positive impact of participatory process on outcomes (refs). All efforts must be made to allow beneficiaries to take ownership of projects and assume leadership roles in recovery. Bruen, von Meding and Hadjri further highlight the importance of local partnering, detailed assessment and contextual appreciation prior to any decisions being made.

Conclusion

We trust that you will enjoy all ten papers included in this special issue, and that you will be both challenged and informed as you read. Within this body of work new applications of theory have been explored and compelling evidence has been produced to support significantly bold arguments. This issue will enhance the discourse on post-disaster reconstruction by challenging the way that we think in its underlying philosophical messages and providing evidence from the field to potentially enhance practice.

We would like to thank each author who has contributed to this compilation for their dedication and cooperation over the past 12 months. In addition, we appreciate the faith shown by IJAR and its Editor-in-Chief, Ashraf Salama, in providing the platform for a publication of this nature to a relatively new audience. We hope the readers of IJAR will receive it with enthusiasm.

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Dr. Gajendran has worked on a number of research grants and has published more than 60 journal and conference articles. He has received numerous awards for his research and teaching work and is a reviewer for a number of academic journals and is also regularly invited to review conferences. He is the program convenor for the Masters of Disaster Preparedness and Reconstruction program.

LONG-TERM CULTURAL IMPACTS OF DISASTER DECISION-MAKING: The Case of Post Earthquake Reconstruction in Marathwada, India

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Abstract

Emergency situations are special since they present decision makers with a context that is characterized by extraordinary constraints on resources, need for urgency of actions and a critical psychosocial state that is markedly different than the normal situation. However, actions taken under these extraordinary situations can have a profound bearing on the long-term recovery of the community and its heritage. This paper considers the critical aspects of decision-making in emergency situations that need to be considered for sustainable long-term recovery of cultural heritage. It is difficult however to judge these essential considerations beforehand without evaluating the impacts of these decisions in hindsight. These considerations will be illustrated through case study of post-earthquake reconstruction in Marathwada in India by assessing the long-term impact of rehabilitation policies formulated in the immediate aftermath of the earthquake. Patterns of adaptation and change in these areas demonstrate how small decisions taken during emergency can have wider socio-economic and physical implications. These cases will also show the importance of understanding the local context, especially with respect to local vulnerabilities as well as capacities, skills and resources while making decisions. These would also emphasize the necessity and ways of engaging various stakeholders, especially the local community, not as passive recipients but as important actors in the decision-making process. These considerations are significant for conservation professionals making decisions during emergencies, especially with regards to immediate protection, repairs and long-term recovery of cultural heritage, while we largely remain at the periphery of the reconstruction process.

Keywords: decision-making; heritage; culture; reconstruction; earthquake.

BACKGROUND

A crisis or emergency is a threatening condition that requires urgent action. Effective emergency response can avoid the escalation of an event into a conflict or disaster. However, emergency does not exist as an exclusive phase. Rather it is part of a longitudinal process that is closely linked with pre-disaster preparedness and post disaster recovery meant not only for bringing a place back to its normal situation but also for reducing vulnerabilities that led to the disaster in the first place.

It is important to understand the context within which emergency decisions are taken because it is markedly different than normal situation. It is characterized by fear and stress, urgency and unpredictability. Moreover in such situations, limited resources are at disposal, which call for prioritization. Also many new stakeholders such as international donor agencies and NGOs come into play during emergency phase.

Therefore to understand the nature of decisions taken during emergency, one needs to find answer to the following questions:

- Which actors were involved in decision-making? Who had the final authority?
- What were the predominant constraints?
- What priorities were set by the decision makers and on what basis?
- What process of implementation was conceived and how it got translated on ground?

Based on the findings of a research on long-term impacts of Post earthquake reconstruction in Marathwada region in western state of Maharashtra in India, the paper will investigate how decisions taken under such extraordinary circumstances can have far reaching consequences on the cultural heritage of the area. These impacts extend much beyond the emergency phase and if long-term consequences are not taken into consideration, the results can be catastrophic; turning a natural disaster into a cultural one.

Cultural Heritage of Marathwada

The cultural heritage of Marathwada is predominantly rural and is characterized by traditional settlements with 'vernacular housing' as an important component. The village morphology is organic punctuated by public and semi-public open spaces used for collective activities of the people. The village entrance is marked by a temple and a gateway. Some of the villages also had fortification walls, much of which have disappeared.

Vernacular housing has been traditionally built using materials that are most easily available locally, including stone and wood. Typically, the walls are made of stone masonry sometimes more than 600 mm thick, with mud or lime mortar. In the villages where there are large pockets of white clayey soil, walls are predominantly made of adobe bricks from that soil. The most commonly found roof consists of a thick layer of soil serving primarily as roofing. A heavy water-proof and insulating layer is placed on timber under-structure. There is a distinct typology for the housing based on the economic and social status of the household. Houses of people with well-to-do status are characterised by a courtyard surrounded by a colonnaded verandah in front of rooms.



Figure 1



Figure 2

(Source: Author).

A front wall with dressed stone cladding and a massive doorway are other characteristic features of these houses. Other important elements of built heritage are stone temples with typical pyramidal roofs (Figures 1 and 2), cave temples, fortresses and wells and tanks representing a well developed traditional water system. The region also abounds in movable heritage in the form of sculptures and inscriptions, most of which are still part of religious use (Figure 3).



Figure 3



Figure 4

(Source: Author).

Another important aspect of Marathwada heritage is that it is living and dynamic. The building crafts in stone and wood have survived over generations. These included Sutars (carpenters, who make the unique roof pattern called 'Malwad' (Figure 4) as well as agricultural tools), Wadars (who are involved in extracting and breaking the stones from quarries and play a vital role in stone masonry work) and Patharwat (who decorate house entrances and do stone carving). Heritage is very much part and parcel of the lives of people surviving through rituals and traditions.

Earthquake Strikes Marathwada

A devastating earthquake hit Marathwada in the early morning hours of September 30, 1993. Its magnitude was 6.3 on the Richter scale and it left nearly 9,000 villagers dead and around 16,000 injured. In the 52 villages that were most severely affected, some 30,000 houses were destroyed or badly damaged. (Jigyasu 2001) The loss of life and property was particularly high in rural areas since traditional construction, which had already become weak and vulnerable, could not withstand the shock of the earthquake.

VULNERABILITY AND CAPACITY OF CULTURAL HERITAGE AT THE TIME OF EARTHQUAKE

The traditional construction vernacular in the region had several features that would contribute towards good earthquake performance. This included good stone masonry with good corner joints and through-stones, timber under-structure with flexible tongue and groove joinery capable of absorbing earthquake forces as well as wooden columns resting on stone bases that would help in base isolation during ground motion. However, in spite of these features, most of the traditional structures behaved poorly and caused death and injury during the earthquake.

There were several reasons for high vulnerability of these structures, which are linked with overall development context. Increased poverty of agrarian communities meant that these structures were not regularly maintained e.g. kerosene oil that was traditionally applied over wooden beams and columns was discontinued thereby accelerating the deterioration of wood. Also some other traditional practices were discontinued due to sheer ignorance or degeneration of knowledge. For example, mud layer over roofs were no longer replaced periodically and successive mud layers were added thereby increasing the dead weight of the roof. Also stone masonry had degenerated to a great extent and rather than consolidated stone construction with

through stones, random rubble masonry in mud mortar was merely faced with properly cut stones. For several reasons, craftsmen had considerably lost the knowledge that had led to such fine cultural heritage in the region.

Emergency decisions for post earthquake reconstruction

Following the earthquake in the emergency phase, the government took several crucial decisions for reconstruction that would change the destiny of Marathwada and cause irreversible impact on the rich living heritage of the region. These decisions were based on the following assumptions:-

- People are helpless victims. They need to be provided cash and kind. Thus Government decided to take a soft loan from the World Bank worth millions of dollars.
- Permanent shelter is the main need of the victims. Other needs can follow.
- Relocate 52 villages that were heavily damaged because land on which they are located is unsafe from earthquakes.
- Traditional construction and materials, namely wood and stone, are the main culprits. Therefore, there is opportunity to introduce modern earthquake resistant materials and technology using concrete.
- Post earthquake reconstruction is an opportunity to modernize 'backward' rural villages and provide them with 'city like' house designs and villages.

According to Maharashtra Earthquake Emergency Rehabilitation Programme (MEERP) –the first of its kind in India, conceived and executed with the help of a soft loan from the World Bank, the affected villages were divided into three categories based on pre-defined criteria namely (GoM 1993):

- i. Villages to be relocated- type 'A' villages
- ii. Villages to be reconstructed in-situ– type 'B' villages
- iii. Villages where repairs and seismic strengthening and retrofitting programme would be implemented – type 'C' villages.

Most of the plans of relocated villages were prepared by engineers in the local Town Planning office¹. The layouts of these villages were mainly 'city-like' with wide streets forming a grid pattern and row or cluster housing. This is contrary to traditional settlements, which were characterised by narrow streets, a hierarchy of public and private open spaces used for religious as well as other activities, clusters of housing with distinct typologies influenced by traditional occupation patterns etc. (Figures 5 and 6) The houses were again divided into three categories, on the basis of land tenure in the hands of a particular family.²

¹ The villages to be relocated were those where more than 70% of the houses were damaged, where a certain number of deaths were reported and where the ground had black cotton soil up to a depth of 2 metres. Where the damage was more than 70% but strata was good i.e. soil is less than 2 metres depth, it was decided to reconstruct those villages in-situ. The 'C' category villages were decided on the basis of a detailed 'technical' survey by a team of government engineers.

² Accordingly 'A' category houses had a carpet area of 250 sq. ft. These were to be provided to farmers who were landless or had land up to 1 hectare. 'B' category housing of 400 sq. ft. carpet area was provided to those having land-holding between 1 hectare and 7 hectares and all bigger landlords having more than 7 hectares of land-holding got 'C' category houses of 750 sq. ft. The built up area for these houses was about 10% more than the carpet area to allow for future expansion.



Figure 5



Figure 6

(Source: Author).

Among all other components, housing was given the first priority in the rehabilitation process. Accordingly, 52 villages were to be relocated with essential services and infrastructure. New standards were set for housing construction that advocated the use of 'earthquake resistant technology'. The government managed to arrange the participation of a large number of non-governmental agencies in the programme including commercial firms, international donor agencies, religious groups, political parties' etc. These agencies came up with a variety of building technologies to demonstrate seismic resistance. These included pre-cast concrete panels, geodesic domes with Ferro cement, in-situ reinforced concrete, hollow concrete blocks etc. It is worth noting that almost all the agencies advocated the use of concrete.

Most of the relocated villages were adopted by various public and private agencies. The entire reconstruction activity was primarily contractor driven where contractors and labour were hired by donor agencies from outside the region to undertake reconstruction.

Initially there were 10 villages in B category villages that were supposed to be reconstructed in-situ (GoM 1993), but due to social and political pressure, and lawsuits filed by panchayats, the number grew to about 22 villages and ultimately the GoM decided to relocate these villages to new sites (Nikolic-Brezev *et al.* 1999). As a result, by 2001, the number of relocated villages increased from 52 to 74. In fact, none except two villages; Tembhe and Pardhewadi were reconstructed in-situ.

In C Category Villages, the government, with the support of NGOs, undertook strengthening and retrofitting of existing houses. In these villages, a publicity campaign was launched by the Government through constructing 'Model Houses', which advocated for the use of reinforced concrete bands at plinth, lintel and roof level. It is noteworthy to mention here that in these villages, where households were to have 'retrofitted' vernacular buildings, over 99 percent of the work was in the form of new concrete and brick additions (Nikolic-Brzev *et al.* 1999).

IMPACT OF RECONSTRUCTION- INCREASING VULNERABILITY (1993-2011)

In relocated villages, people have undertaken extensions to their houses using variety of materials and technology, which are markedly different than those that were introduced during reconstruction. The walling materials include tin sheets, thatch, ferro-cement sometimes with bamboo posts, stone and brick in cement mortar. Interestingly very few extensions are done using materials and technology that were originally promoted in reconstructed houses due to their unaffordability and unavailability.³

³ Ten 'Building Centres' in Latur and Osmanabad supported by HUDCO (Housing and Urban Development Corporation) and also assisted by the Government. These centres were supposed to promote construction activity and generate employment through training programmes for construction artisans, unskilled labour and unemployed youth. The centres supplied building materials to

Also stone which was predominant building material of traditional houses in the region before the earthquake is used in a very limited extent, mainly for making boundary walls. This is because of perceived fear of stone as unsafe building material⁴ (Figures 7, 8, 9 and 10).



Figure 7



Figure 8



Figure 9



Figure 10

(Source: Author).

The nature of material and construction system varies among various economic groups. While the lower economic groups tend to use tin, ferrocement, thatch and stone, those from higher strata use brick and concrete blocks. In many instances, walls are constructed using hybrid materials such as stone and brick. However in most cases, tin sheets are mainly used for roofing because they are perceived earthquake safe due to their light weight although these get oven hot during day time causing health problems for inhabitants.

Ironically, much of these extensions regardless of economic groups are vulnerable to earthquakes due to poor construction practices such as hybrid constructions built using incompatible materials and poor masonry, poor corner joints between walls, absence of lintel bands and inadequate foundations. The RCC columns wherever used are of improper crosssection and does not have adequate reinforcement. In many instances, tin sheets used for

construction sites and educated people with respect to earthquake resistant technology. This was a very good idea and would have ensured sustainability. Unfortunately, all these building centres were shut down within three to four years as they were completely dependent on external support.

⁴ Traditional houses are built using stone and wood; materials that have been available locally. Typically, the walls are made of stone masonry sometimes more than 600 mm thick, with mud mortar. The most commonly found roof consists of a thick layer of soil serving primarily as roofing. A heavy water-proof and insulating layer is placed on timber under-structure. There is a distinct typology for the housing based on the economic and social status of the household. Houses of people with well-to-do status are characterised by a courtyard surrounded by a colonnaded verandah in front of rooms. A front wall with dressed stone cladding and a massive doorway are other characteristic features of these houses.

roofing are not fixed with the purlins and just held in place with stones thereby making them susceptible to high winds or leakage during heavy rains (Figures 11, 12, 13 and 14).



Figure 11



Figure 12



Figure 13



Figure 14

(Source: Author).

Since the criteria for house allocation was on the basis of land-holding, landless farmers and craftsmen who ended up with very small or no house have undertaken construction on their own using combination of materials such as thatch, tine and stone. However the quality of these self built houses is very poor making these highly vulnerable to hazards such as earthquakes and rainfall.

As mentioned before, retrofitting techniques for existing houses were promoted by the Government and NGOs in C category villages which did not sustain much damage. Some pilot projects were initiated in these villages and it was hoped that these examples would be replicated by others in the village. However, eighteen years after the earthquake, many inhabitants in the village do not even remember the houses where pilot retrofitting projects were undertaken. Even the residents of those retrofitted houses vaguely know the advantages of retrofitting and can only remember 'angles' as distinctive features of these houses that were originally put in place to strengthen connection between walls and roof. In some of these houses, these angles have already been removed for increasing the height of the roof. In others, extensions to these houses do not incorporate any earthquake safe features (Figure 15).



Figure 15 (Source: Author).

As mentioned before, traditional construction process in Marathwada was carried out by craftsmen who have been building in stone and wood for generations. However after the earthquake traditional construction systems were condemned as unsafe and reconstruction policies further encouraged new materials and construction techniques⁵. As a result traditional craftsmen, who were already in less demand before the earthquake further lost their livelihoods and moved to other jobs.

Construction work is now undertaken by other socio-economic groups, who have acquired limited knowledge in brick and RCC constructions through short apprenticeships. However this quickly acquired knowledge results in very poor constructions. In fact, one of the long-term impacts of reconstruction policy has been that traditional building craftsmen have almost disappeared from the region and vernacular constructions in stone and wood are replaced by highly vulnerable new constructions. Thus reconstruction further accelerated the process of marginalisation of traditional craftsmen.

In some instances, where traditional houses are still intact, people do not feel safe living in those and would rather prefer moving to tin sheds. Even so many years after the earthquake, the perception against use of traditional materials is so strong that wood salvaged by the owners from their old houses is used as firewood and stones are only used for boundary walls. These perceptions have also led to replacement of traditional stone temples, which were considerably safe from earthquakes with those constructed in brick and RCC of new architectural vocabulary influenced from nearby region. Most of these new constructions also do not follow any earthquake safety standards (Figure 16).

Traditional villages were located in areas with good water table and water was drawn through wells and tanks. However relocated villages are dependent on piped water supply and during summers face lots of problems in getting enough supply of water.

⁵ As a result of the earthquake, these houses suffered enormous damage primarily due to heavy roofs (mud) and thick stone walls with weak bonding, especially at joints. This caused huge loss of life. On the basis of quick damage assessment immediately after the earthquake, the traditional techniques of vernacular housing were deemed to be the major cause of loss of life. All local construction practices were rejected by the 'official expert agencies'. Local people who saw their loved ones die under the heap of stone rubble also developed an acute fear. The traditional material and techniques were considered to be 'unsafe' for future habitation.



Figure 16 (Source: Author).

Lessons learned: Short-term decisions should not lose sight of long-term implications

The assessment of long-term impacts of post disaster reconstruction in Marathwada has shown how reconstruction policies with all their good intentions have reinforced some pre-disaster vulnerabilities and risks while creating new ones. Clearly the case brings forward how short-term decisions based on immediate perceptions of risks can overshadow considerations of risks that may accrue in the long-term.

The case also brings out how risk perception and communication affects decisions that would have far reaching consequences. Predominant perception against use of stone led engineers to advocate modern materials and technology. As a result people abandoned use of traditional constructions leading to disappearance of local building traditions and skills but created very poor new constructions.

Therefore decision-making during emergency should not be seen as an end in itself. Rather short-term decisions should have a long-term vision, which would mean emphasis on preparedness beforehand. We need to make ourselves relevant to larger sustainable development goals because we are relevant.

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REFERENCES

- Jigyasu, R. (2001). 'From natural to cultural disaster: consequences of the post-earthquake rehabilitation process on the cultural heritage in Marathwada region, India', *Bulletin of the New Zealand Society for Earthquake Engineering*, 34(3), pp. 237-242.
- Jigyasu, R. (2002). *Reducing Disaster Vulnerability through Local Knowledge and Capacity – The Case of Earthquake-prone Rural Communities in India and Nepal*, Dr.ing thesis, Norwegian University of Science and Technology, Trondheim.
- Government of Maharashtra (GoM) (1993). *Proposal for Maharashtra Earthquake Rehabilitation Programme*. Bombay: GoM

Nikolic-Brzev, S., Green, M., Krimgold, F. and Seeber, L. (1999). *Lessons learned over time, Vol II*. Oakland: Earthquake Engineering Research Institute.

Salazar, A. and Jigyasu, R. (2010). 'A Decade of Lessons from Marathwada: Earthquake Vulnerability, Politics and Participatory Planning' In: A. Revi, and S. Bhatt, S. eds. *Recovering from Earthquakes: Response, Reconstruction and Impact Mitigation in India*, New Delhi: Routledge.

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BEYOND THE APPEARANCE OF HERITAGE: Reconstruction of Historic Areas Affected by Earthquakes in Chile

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Abstract

Earthquakes have progressively destroyed Chilean built heritage over the years, not only due to the initial devastation they produce but also due to the applied reconstruction approaches that follow, which has been addressed using non-specific instruments such as social housing subsidies. Moreover, it often aims only to recreate the previous built form, dwellings that look 'as before', but using contemporary materials and building techniques, losing the progressive and sustainable culture that used to characterize their buildings. This raises the question of authenticity and its social and normative corollaries. The objective of this paper is to explore this issue by discussing reconstruction projects that have been built in heritage areas after the 2010 earthquake, considering their formal coherence in relation to the previous architecture, as well as their applied building techniques and the inhabitants' perception of the reconstruction process. The results indicate that the sustainability that used to characterize dwellings is not present in their replacements. This paper follows the idea that heritage should be reconsidered as a sustainable way of designing, going beyond formal approaches.

Keywords: earthquakes; re-construction; heritage; building techniques; sustainability.

INTRODUCTION

Chilean built heritage has always been at risk to natural catastrophes. Poorly maintained buildings, scarce funding, loss of technical knowledge and lack of social valuation are among the causes which, when combined with a destructive event like an earthquake, produce a significant impact in the amount and quality of preserved heritage buildings.

This study looks beyond the widely addressed topic of monumental heritage, to consider housing in heritage settlements. In Chile, dwellings in historic areas are characterised as sustainable answers to climate and environmental conditions, using vernacular building techniques. They are economically efficient in their use of resources, giving place to their inhabitants' way of living and embodying their cultural expressions. They comprise a representative set of anonymous constructions, which are generally related to public spaces through porticos and continuous facades (Fig. 1 & 2). Some authors have described them as a:

Collective product, anonymous, a modality that should not be compared to educated manifestations because its inspiration has other basis. Its merit is in the group and in the considerable achievements obtained despite the use of modest means, (...)
(Guarda, 1988, p. 37).

Social perception of built heritage in Chile

Social perception of Chilean built heritage is not always in favour of its conservation, which increases the fragility of it. One of the reasons for that is the regulation concerning built heritage, as the responsibility and the funding for the preservation of historic buildings rely on the owner. As an attempt to study social perception of heritage areas in Chile, before and after reconstruction, interviews to the inhabitants in three historic areas affected by earthquakes were carried out: *Tarapacá*, *Zúñiga* and *Lolol*, data collected during a fieldtrip in Chile in January 2013.

In the first case, the reconstruction was finished after the 2005 earthquake affected the area. The 2010 earthquake affected the second and third cases. This paper will only focus in the case of *Lolol*, as in *Zúñiga* the reconstruction had not started yet -by the time of the fieldwork-. *Lolol* has the most advanced status in the reconstruction process of all heritage areas affected by the 2010 earthquake in the country, as it was taken as a priority case, which allows having a preliminary evaluation of the reconstruction process.



Figure 1: Continuous façade in *Zúñiga*, Chile, 2011
(Source: Author).



Figure 2: Use of porticos in *Lolol*, Chile, 2011

Even though these areas have historical value, the Council of National Monuments of Chile has only protected some of them in current regulations, declared as '*Typical Zones*'. Yet this declaration does not engender special funding or benefits; on the contrary, it imposes a set of obligations and restrictions on owners to preserve their built heritage, where the Council evaluates every modification, construction or alteration to be made to the buildings. In practice, this means that within the heritage areas, the public perception of this declaration is not always favourable, as many feel that the freedom to modify their own property has been restricted and that construction processes are prolonged, a particularly problematic issue after an earthquake, where the emergency demands quick solutions. For example, in *Lolol*, inhabitants are divided in opinion over its designation as a *Typical Zone*, but 67% of those interviewed do not see any direct benefit from it.

In this context, when a large earthquake occurs, like the Maule earthquake on February 27th 2010 in the central-south area of Chile, measuring 8.8 on the Richter and Mw scale, all previous issues in relation to heritage areas are intensified. Those who disagree with the designation of a *Typical Zone* will see the earthquake as an opportunity to change, which can involve unnecessary demolition even in protected areas, as the scale of the disaster produced less possibility to supervise heritage regulations.

Heritage areas experienced different levels of damage, depending on the quality of their constructions and the distance to the epicentre. For example, in the VI Region, the least affected villages include *Zúñiga*, *Lolol* (Fig.3) and *Paredones*; and the most heavily affected include

Pumanque (Fig. 4) and *Peralillo*, last of which was particularly damaged by indiscriminate demolition in the aftermath.

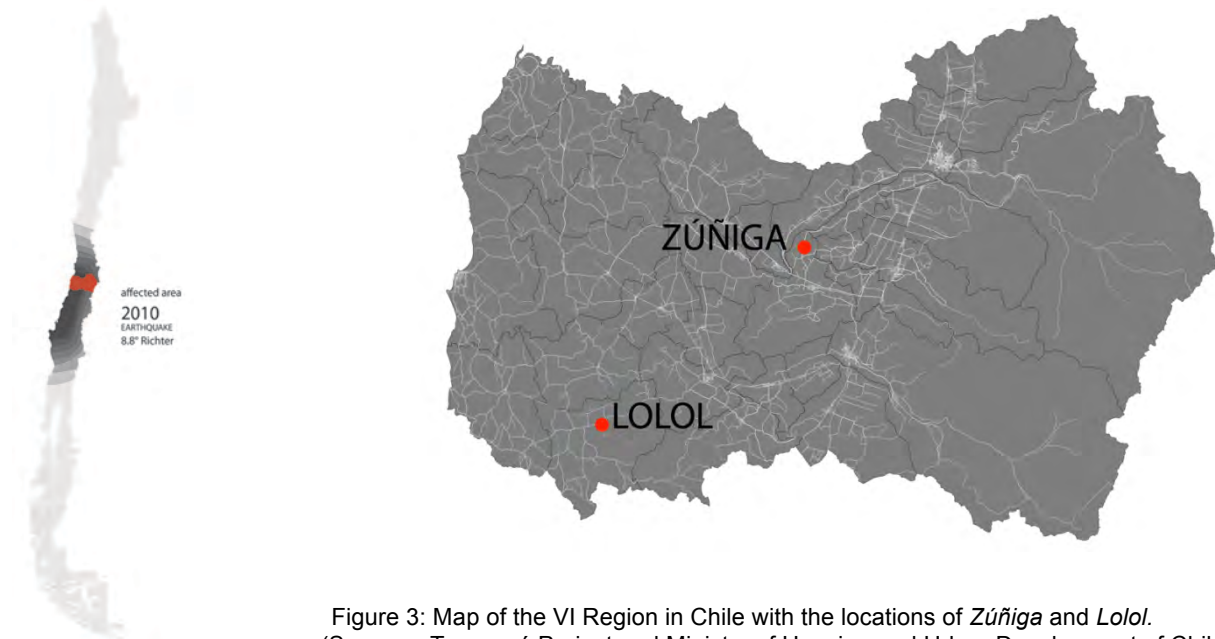


Figure 3: Map of the VI Region in Chile with the locations of *Zúñiga* and *Lolol*.
(Sources: Tarapacá Project and Ministry of Housing and Urban Development of Chile).



Figure 4: Dwelling severely affected by the 2010 Maule earthquake in Chile. *Pumanque*, Chile. April 2010
(Source: Author).

It is important to remark that, as Chile has experienced several earthquakes in its history, even the most powerful one in the world's recorded events in 1960 - occurred in Valdivia with a magnitude of 9.5 in Richter scale -, lessons have been learned and the number of fatalities is low in comparison with similar events occurred in other parts of the world, which allows focusing in the destruction of the built environment, as emergency issues are mostly covered already.

RECONSTRUCTION AFTER THE 2010 EARTHQUAKE

Chilean government did not create a specific institution to assist with reconstruction after the 2010 earthquake. Instead, each existing Ministry was in charge of their area, for example, housing reconstruction was dependant on the Ministry of Housing and Urban Development, in which heritage areas were included. This institutional arrangement meant that they were not treated as a group or heritage set, but according to each individual building. In this research, reconstruction has been studied from the public policies perspective, which impacts in a major scale. However, there are several independent and private initiatives related to reconstruction that might be addressed in future studies.

In that framework, reconstruction of housing in heritage areas has been adapted from non-specific previous policies, such as the one used for social housing. After the 2010 earthquake, a Heritage Reconstruction Programme was created as a more specific approach, although based in the same subsidy tool, always considering the reconstruction to occur in the same sites where the previous dwellings were located. Even though the programme considers funding for the design of each dwelling as an individual project, it is not enough to cover it, so the repetition of the same design is used in practice to cover that, which produces the construction of new dwellings with replicated heritage elements.

Moreover, even when subsidies were adapted to comply with heritage areas, they were primarily created to meet economic requirements, as their aim is to fulfil the habitation deficit of those people that cannot afford a dwelling by themselves in regular situations, thus not designed as a post disaster tool. An application is required, adding extra bureaucracy and making subsidies a very inaccessible and inefficient tool in a post disaster situation, as only a part of the dwellings in heritage areas can be reconstructed or retrofitted through it. Indeed, from the cadastre of damage done after the earthquake in the VI Region of Chile, 5571 buildings were identified in heritage areas, of which 75% were houses. However, only 33% will be repaired or reconstructed via housing subsidies, mainly due to the inflexibility of the instrument. As for the other houses, some are repaired by owners, sometimes just superficially; some are left abandoned, and some are still inhabited; a potential danger in forthcoming quakes.

In summary, there are three main issues concerning reconstruction in heritage areas that continue to persist. First, the indiscriminate demolition that immediately follows disasters, affecting the designs of new projects. Second, the lack of an integrated approach that can cover the reconstruction and repair of the entire heritage area. And third, the design of reconstruction projects as new 'heritage' dwellings, which superficially imitate the appearance of old houses. It is on the final issue of design that this paper will concentrate.

Building techniques used for reconstruction of heritage villages after the 2010 earthquake

The most common building techniques used originally in heritage areas are the *adobe* and *quincha*, which have adapted to fit the different climate conditions over the country. *Adobe* is a type of masonry made of mud and straw bricks, which are sun dried, obtaining usually thick walls of about 50 to 80 cm. In the best cases, it is built using timber reinforcements. *Quincha* is a wood panel structure that is filled with cane as vertical elements and clay, reaching usually 10 to 15 cm. of thickness. In the northern area, most buildings have light roofing because there is almost no rain, and the thermal mass of the clay is perfect for the high daily temperature oscillation. In contrast, at the central-south area of Chile there is constant rain, so dwellings usually have heavy roofing, porticos, and plinths, which are used for adapting to terrain inclination as well (Devilat, 2012). All of these elements protect the adobe walls from the rain, and also collaborate with their structural behaviour, so they perform better during earthquakes (D'Ayala & Benzoni, 2012). However, the most affected buildings were those built in adobe (27%), mainly due poor maintenance, followed closely by timber constructions and those made using reinforced brick masonry (Ministry of Housing and Urban Development of Chile [MINVU], 2011, p.16).

Structural meshes and timber reinforcements are currently used to repair affected houses. After uncovering the plaster in adobe walls and taking out doors and windows, the walls are repaired with clay mortar and reinforced using *geomesh* (plastic structural mesh) (Fig. 5a), which add flexibility to the adobe walls (Torrealva, 2009). With the same principle, walls are being reinforced using metallic structural mesh (Fig. 5b). Both systems should be applied in each side of the wall and then connected with steel or timber pieces, and the mesh should be completely covered by clay plaster in order to reach its full resistive capacity. Other method involves carving the walls to insert timber reinforcements in both vertical and horizontal ways, which should be connected by steel pieces, after which a mesh is applied (Fig.5c). Roofing and ceiling structure is reinforced with timber elements when needed, although it is mostly recycled from before. Tiles are usually installed using traditional weaving techniques, which are safer during seismic events as they would not fall and injure people. In some cases, a concrete beam is also installed in the interior of the dwelling, added to the inner part of the wall in order to reinforce the foundations.



Figure 5: Reinforcements techniques. From left to right: a) *geomesh* used in *Almahue* (Source: author); b) *metallic mesh* in *Lolol* (Source: author); and c) *timber reinforcements* in *Olivar* (Source: F. Pérez, MINVU).

In new projects, contemporary techniques are generally preferred, both by inhabitants and designers, as adobe buildings are not included in the current Chilean regulations and are not considered earthquake resistant. However, it is possible to use adobe as a building technique if the responsible professional refers to international regulations, and only if an independent validated reviser supports the structural design.

Yet, it is important to remark that most of the historic buildings would have experienced less damage if they had been correctly retrofitted and maintained throughout time. For example, there are several monumental *adobe* buildings, which resisted structural damage, such as *San Pedro de Alcántara's* Church, retrofitted just before the 2010 earthquake, or the *Casona Lo Contador*, a 17th Century building in good condition as it has been well maintained over time (Fig. 6 & 7).



Figure 6 & 7: *Casona Lo Contador*, currently used as the School of Architecture of the Pontifical Catholic University of Chile. Photos taken one day after the 2010 earthquake, in which only superficial cracks can be seen.
(Source: Author).

In addition, there is a lack of expertise in designing, repairing and maintaining earthen buildings. The first buildings made of *adobe* and *quincha* were built with timber reinforcements, with good quality roofing structures, careful with the amount and type of material used and with a constant revision during the construction process by the owner (Guarda, 1988). As time has passed, some of these processes have been abandoned, resulting in several adobe houses not as resistant as the first. Also, there has been no dissemination of specific knowledge on how to maintain and repair adobe building, until very recently.

An interesting example is that after the 2005 earthquake, occurred in the north area of the country, a special *Adobe Commission* was created to discuss about this issue. It concluded that the use of earth as a structural material, like *adobe*, was not recommended, and that other mixed technologies, such as *quincha*, should be studied further in its seismic behaviour (Comité Adobe, 2005). After the 2010 earthquake, the scale of adobe-affected buildings makes evident the necessity of rethinking these conclusions, as at least 50% of the buildings were built with that technique, so a new specific regulation for heritage was created. It establishes that adobe could be used only if it is combined with new buildings technologies such as timber or meshes, conforming a new and more efficient structural system (MINVU, 2012). However, a strong view against earth as a building material persists, even among professionals.

For new houses in the reconstruction process, it is possible to group applied building techniques into three categories. The first corresponds to reinforced brick masonry with timber roofing structure, covered with clay tiles, in some cases recycled and in some cases using new industrialised tiles. This is one of the most common building techniques used in general in Chile in new dwellings (Fig. 8a).

The second includes mixed techniques that incorporate earth and clay in the walls or as plaster. Some designers include the use of clay as a raw material as a way to address the value of building techniques in the previous dwellings, yet they do not use it in a structural or traditional way as the *adobe* construction. For example, earthen-made plasters on a timber structure filled with polystyrene as isolation are commonly used in reconstruction projects after the 2010 earthquake. However, they are not efficient from a thermal perspective in the central-southern area of Chile if they are not within thick walls necessary for isolation purposes. Whereas thermal

mass of adobe is perfect for the desert climate of the northern area, it is not useful as such in the central-southern zone, yet as insulation because of its thick walls. Thus, it is not enough for the required isolation of that Mediterranean climate to use only 10 cm. of isolation and clay within the wall structure. Moreover, some of those projects include shaping the walls in such a way that they would be recreating the thickness of the old adobe walls (Fig. 8b).

Finally, the third is based on a timber frame structure with two types of walls. The public façade of the house is filled with straw bales, giving good insulating properties. Their local availability and low cost also make them a sustainable alternative. However, as the other exterior walls, made of timber and clay, are thinner (10 cm), the insulating properties of the straw bales are not as effective (Fig. 8c).

Unfortunately, there is no data available to dimension how many dwellings are being built using each building technique. The Reconstruction Programme operates by selecting a group of professionals that will design their proposals for a determinate area, both for repair and reconstruction. What is currently happening in the VI Region, for example, is that each group have the same generic base proposals for heritage dwellings that are being repeated in the historic areas in which they are working. Thus, it is possible to find the same housing type in *Lolol*, in *Chépica* and in *Paredones*, as it is the same professional team designing the reconstruction dwellings, as a strategy to maintain low design costs, as the funding for the design process are not enough.

In addition, because of the tight budget, some design decisions may affect the perception of reconstructed historic areas. For example, the use of clay tiles is almost compulsory, but as the budget is rarely accommodating enough, industrially-made tiles resembling handcrafted clay ones are usually used, and often only on the side of the roof visible from public spaces, with steel sheets used on the interior face of the roof. These designs circumvent issues of authenticity required in heritage intervention.



Figure 8: Building techniques used in housing reconstruction for heritage areas. From left to right: a) reinforced brick masonry; b) timber structure with clay plaster; and c) timber structure with straw bales in the façade and wood panels with clay in the rest of the walls. (Source: Author).

The Problem of the New 'Heritage' Dwellings

Focusing on new projects, reconstruction models designed for historic areas are based on a superficial understanding of heritage's concept. Those models are considered as 'heritage' as they include formal 'historic' elements using contemporary materials, even when records of previous dwellings are in many cases non-existent, and in others, when the buildings never even included such elements. They do not understand a more complex sense of heritage based in vernacular building techniques and cultural conditions, which are the base of its sustainability.

The proposal of this study is to go beyond only the appearance of heritage, in opposition of what is understood in the regulations. For example, in the general urban regulation document, the term 'reconstruction' is defined as *"to totally or partially build again a building or to reproduce a pre-existent construction, or part of it, which will formally retake the characteristics of the original version"* (MINVU, 2012, p. 27).

This vision is not only for heritage reconstruction, but it is the commonly used approach in historic areas. Indeed, it has been used after other earthquakes in the country. For example, in San Lorenzo de Tarapacá, heritage area affected by the 2005 earthquake measuring 7.9 on the Richter scale, the governmental programme considered three models of 'heritage' dwellings, especially designed for that *Typical Zone*. They recreated the formal features of just three 'typical' types of dwellings existent in the village. Only two types were built, and one with a pronounced gable roof, repeated more times. This type of dwelling has increased with the reconstruction from only 6% of the total dwellings in the village before the earthquake to approximately 40%. These new houses have a special shape in the connection between the wall and the roof, which again intends to recreate the thickness of the old *adobe* walls and, ironically causes leaks to the interior of the dwelling when raining (Fig. 9).



Figure 9: San Lorenzo de Tarapacá before and after reconstruction. Plane roofs were predominant before the reconstruction, which changed when gable-roofing dwellings were repeated many times.
(Source: Author).

These houses in Tarapacá are an example of what can happen if designers strive for an appearance of heritage rather than for a more sustainable construction. The building technique used, steel structure and concrete blocks as filling, with a plaster that includes 50% of clay, it is not appropriate for the dry/arid climate of the village, as thermal mass is needed to store the heat of the day and liberate it in the night when lowest temperatures are usually experienced, which is

a natural capacity of *adobe* constructions. The thermal behaviour of adobe buildings in the central area of Chile is also better than any other contemporary building technique in the sense of its adaptability to the seasons.

What is currently happening in the Central area of Chile after the 2010 earthquake solved many issues from that previous experience: dwellings are bigger, more appropriate building technologies are being used, architectural elements of previous houses are being maintained, such as the continuous facades and the porticos, and old materials are being recycled. In addition, 63% of the projects are designed as repairs to the existent houses, which is something completely new and important for subsidies applied in historic areas in Chile, allowing the preservation of a larger amount of historic houses. After 2005 earthquake, in San Lorenzo de Tarapacá, only new construction subsidies were applied, which means that several important and characteristic dwellings are still in ruins, or, much worse, are being currently being used even when they represent a danger for their inhabitants, as they were never repaired or reinforced.

Nevertheless, a problem of authenticity is underlying the design process for new dwellings: do we want to conserve the built form of heritage areas or the building tradition behind them? Can we as designers maintain a balance between them both? It is important to clarify that the problem is not the use of contemporary building techniques *per se*, as interesting projects can be designed with either new or vernacular techniques. The issue is with the type of design that is being reproduced and how it can change the perception of historic areas for future generations. The chosen building technique in reconstruction is also related with the construction process. Local materials are normally used when the inhabitants are included in that process, but what generally happens is that external contractors are in charge of the construction, hence imported materials are being used. This affects people's participation in the reconstruction process.

The reduction of traditional architecture to its elements has been a common approach in the related literature. There are several publications that aim to be a record of built heritage in order to preserve it for the future. These publications are usually generated after earthquakes, as a reaction to the destruction they produce, such as Guarda's book, published in 1988, three years after the 1985 earthquake that affected the central area of Chile. They are an important and unique record, noting which elements represent the values of vernacular architecture. However, these have been used as catalogues for a non-critical imitation of traditional architectural features: proportions of windows and doors, presence of porticos, pillars, etc. In addition, as particular records of dwellings before earthquakes are not available in most cases (MINVU, 2011), an average 'heritage' house is being designed for the Central area of Chile, where almost the same project, with minimum variations, is being replicated in different historic areas. This is in turn reinforced by the repetitive design strategy used by architects in the most of cases, as mentioned above.

Guidelines from the Council of National Monuments have a similar aim. Most of them were created after the 2010 earthquake, as an attempt to guide reconstruction projects in heritage areas, establishing a series of architectural elements that new constructions should include. The evaluation of projects at the Heritage Reconstruction Programme is also based on this. In the end, it is possible to have a project that conveys all the elements stated on those guidelines, but having no sense of sustainability and identity.

Certain elements, such as porticos are being maintained as architectonic elements in the new houses. One could argue that there is no need to replicate porticos if the new house is rebuilt with contemporary building techniques, as the function of protecting *adobe* from the rain and its structural stabilization is no longer necessary. However, these elements are seen as representative of this kind of heritage and are consequently repeated in reconstruction projects regardless of the structural system they have, which is very popular with inhabitants if they used to have them. Indeed, from the interviews taken in January 2013 almost three years after the earthquake, all interviewed inhabitants are in favour of new houses that include porticos, because they think they improve the appearance of the dwellings and help to preserve the tradition of the place. Besides, the porticos also offer a shaded intermediate situation connected to the public space, used by people during the warm seasons.

But to what extent is the use of these architectonic elements shaping our memory of what these villages used to be? The emerging issue in *Lolol*, and proven in Tarapacá, is the effect of our 'traditional' designs in constructing memory for the future. The 33% of progress in the reconstruction of housing in heritage areas following the 2010 earthquake has proven it is possible to build dwellings that *look like* the original ones, although they are not similar in relation to the quality of its spaces and its thermal behaviour. This relates to intervention criteria in built heritage and how it is never possible to rebuild exactly *the same*, for which it is preferred to use the term re-construction (to build again), as a distinction to reconstruction (to build as before) in this study (Devilat, 2012).

Whether to reconstruct a building or to leave it as ruins, to restore it to its previous condition or to build something new in the same site, and how to do those interventions are issues that have been debated for many years. Nevertheless, the main difference when talking about reconstruction after an earthquake is the scale. Even though earthquakes in seismic areas are common and regular over time, destruction and reconstruction of historic areas are left out of the heritage debate, as reconstruction is considered as something unquestionable in those cases. Some authors even separate post-earthquake reconstruction from their discussion in the assumption that the existence of enough documentation is usually available: *"I have deliberately limited the argument in this way, in the hope of avoiding the confusion that could be introduced by including other types of building reconstruction. I do not consider here buildings that have been reconstructed immediately following a natural disaster or a war. These differ because there usually exists ample documentary evidence of the destroyed buildings"* (Stanley-price, 2009:33).

However, that *usual existence* is not that usual and records of historic buildings are not always available, especially if they are not monuments. Even if those records exist, is a violent change such an earthquake a valid justification to reconstruct historic buildings without a proper debate concerning its heritage value? It is the right time to reconsider the future sustainability of reconstructed houses in heritage areas.

In such context, the role of the record of buildings before (and after) earthquakes and before demolition becomes fundamental. In post-earthquake situations, technical assessment for historic buildings and dwellings is usually done in a second stage, when several things have already changed, not only because of the earthquake but also because of the first emergency actions. This has also been the author's experience with the case studies following the 2005 and 2010 earthquakes. Therefore, the perception of affected historic areas is blurred with the destruction. Sometimes the only possibility to have an idea of the damage level is the existence of previous records that, although partial, can help professionals and researchers to understand the impact of the earthquake (Fig. 10 & 11).



Figure 10: (above) Dwelling in Paredones after the 2010 earthquake. Above: before demolition.
(Source: Muñoz, Alejandra).

Figure 11: (below): after demolition. The image above became the only record available of the dwelling before its demolition, thus the only input available for the design besides owner's experience.
(Source: Author).

It is interesting to explore how these records may impact in the design process of reconstruction projects, considering the formal approach used in most of the cases to design reconstruction projects for heritage areas and buildings. A 3D laser scanning survey, for example, can be a powerful tool for such accurate recording method, as it combines high definition photos and a laser to build a measurable 3D model of the reality in a short period of time -in comparison with the other record techniques-.

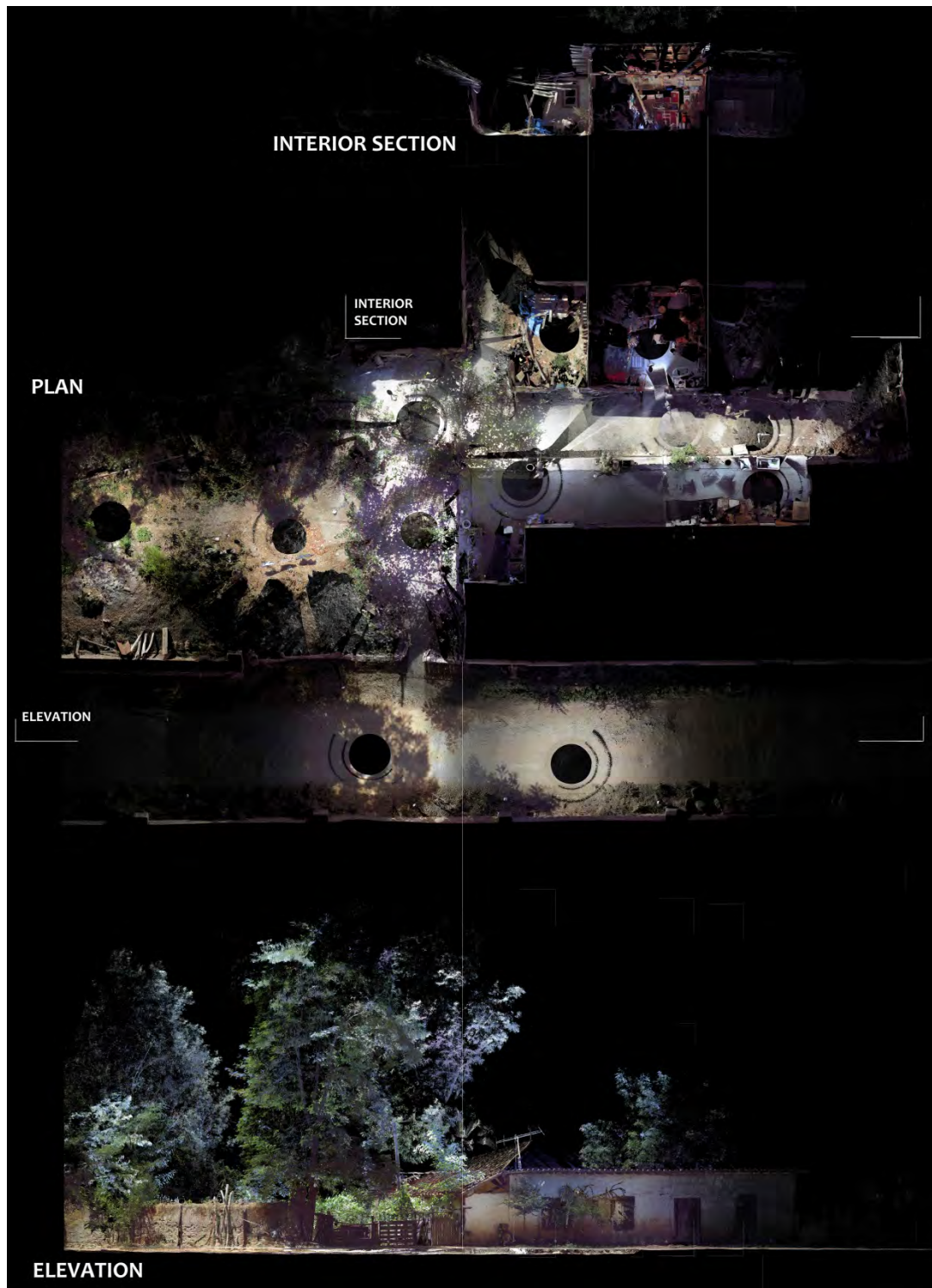


Figure 12: Section, plan and elevation of a dwelling in *Zúñiga* made using 3D digital model obtained through 3D scanning. The black circles show where the scan was positioned on site to survey (Source: Author).

3D scanning can provide a rigorous method of building information to be applied in the reconstruction projects, in order to avoid the interpretation or the creation of *average heritage* projects, as aforementioned. Related to this, it is important to mention that one of the issues that have made reconstruction of heritage areas such a slow process is the need for a survey of existing conditions in order to develop accurate designs of reparation and reconstruction of

dwelling, which usually takes a long time as is being done with traditional representation methods, such as hand and digital drawing, and photographic record. For example, to survey a dwelling with its interior, took only two hours on site (Fig 12).

The application of this tool has being used before as a post-earthquake assessment, but not to critically question the nature of reconstruction, which is being further explored within author's PhD thesis. In addition to the possibility of obtaining such accurate data, the thesis explores also to what extent it could be used as an attempt to address a more sustainable approach to the design process in reconstruction after earthquakes.

Building technology and sustainability

The Cambridge Dictionary defines something as *sustainable* when it “is able to continue over a period of time”, and as something that is “causing little or no damage to the environment and therefore able to continue for a long time” (2013).

An interesting fact is that the value of this vernacular housing in such a way is not recent. Guarda noted José Gandarillas, a famous intellectual in the mid-19th Century, invoked traditional architecture as a comparison during a polemic about fashionable architecture at the time: “(...) *those simple examples inherited from the Spanish period, which resist temblors and earthquakes, adapting to the seasonal changes in a marvellous way, and also adapting to the uses and habits of their inhabitants in an admirable easy way.*” (Gandarillas in Guarda, 1988)

Sustainability is then closely related to the building technology implemented and how it determines spatial characteristics of the building. Some of the reconstruction projects use sustainable materials in the sense that they are cheap, local and have a good thermal behaviour, such as straw bales. However, as aforementioned, their use only in the facades seems to be with the intention to replicate the thickness of adobe walls and not as an answer to the climatic conditions of the place.

Even if it is possible to introduce straw bales as a new building technology, they might not become sustainable in the future, because inhabitants do not want to use it in their houses, as there is a strong misconception about it. In *Lolol*, which is one of the most advanced in the reconstruction process and where all the new projects use straw bales in their facades, 63% of inhabitants interviewed do not like it, as it is associated with animals, mice and insects. Most of people accepted it as no other alternative was offered, reinforced with the restrictions of the *Typical Zone*. There are some others concerned about the fire and earthquake resistance of the straw bales, and how it ages. Based on this, they might not be used by local people in the future after this reconstruction, even when they could be seen as a sustainable technique for the climatic and environmental conditions of the VI region of Chile and even when they will be continuously generated in that agricultural area.

As identified in other post-disaster situations, there is a certain consensus about the importance of participation in reconstruction processes, but in practice, sometimes it presents a manner that does not reflect a real participation (Davidson, Johnson, Lizarralde, Dikmen & Sliwinski, 2007). In example, *Lolol*'s inhabitants participated in some of the decision-making process during the design of the new houses, but they were only spectators during the construction, as identified by themselves when interviewed. How can current reconstruction approaches be sustainable over time if they rely on external actors and not on the inhabitants as in past generations? That does not necessarily mean that they should build their own dwellings, but that they should be involved in the process at least.

Lolol has been declared ‘*Typical Zone*’ because it is: “*a valuable example of spontaneous rural settlement, with a strong influence of traditional architecture from the Central Valley (of Chile), where self-support and self-building are mixed*” (Council of National Monuments of Chile, 2011, p.7). These two important aspects are no longer present in the construction and reconstruction processes. External contractors build reconstruction projects, as Government's subsidy does not permit any other possibility, with the aim of assuring quality construction standards. Self-construction is only allowed for small amounts of money given for minimal reparations in less damaged dwellings. Considering that the space recovered with subsidies is

only between 50m² and 90m², and the previous dwellings used to be much bigger, it is the inhabitant who has the responsibility of continuing with the next stages. Then, the reconstruction process could be an opportunity for education and dissemination in relation to repair, maintenance and building techniques, which has been the approach of some organizations such as Fundación Altiplano.

On other hand, the spatiality of dwellings is something that is being lost in the new projects, as they are not designed for future expansions. The notion of drift or adaptation has not been included as well, as some spaces need to change and be improved according with the ways of life of their inhabitants. Thus, it might be necessary to go beyond the vernacular as valuable per se, because it might be insufficient for contemporary standards. Then, repair and re-construction approaches should also try to solve these issues by including new technologies, which is currently addressed in the new seismic regulation for heritage areas. Marcel Vellinga (2012) argues that the idea that vernacular is superior to contemporary is no longer adequate, and that building traditions that are considered vernacular architecture can also learn from contemporary design. Maybe the selection of building techniques for re-construction projects could be done using the same sustainable principles present in vernacular ones, such as economy, adaptability and use of local materials.

Traditional construction practices and delivery mechanism often embody local knowledge accumulated over time through successive trials and errors. Therefore these cannot be rejected outright when deciding on the appropriate technology for reconstruction. The challenge is how to integrate positive elements of these practices into the proposed solutions. (Jigyasu, 2010, p.49)

CONCLUSIONS

This paper had tried to address some of the issues related to the design of reconstruction dwellings for historic areas in Chile, focusing in how the sustainability of old heritage houses is not being considered as a quality to reproduce in the design process. Advances are being made in the decision of repair existing houses when possible, but the problem continues on the new designs. The description of the building techniques used after the 2010 earthquake is an attempt to find whether they try to achieve that in the design of new dwellings. In that respect, it seems that the building technologies are used as an attempt to recreate formal features of the old houses, such as the thickness of the adobe walls, the shape and amount of openings, among others. Those technologies are not used then to make the most of them and to improve habitability, but to achieve formal conditions of previous technologies.

If reconstruction continues in that way, heritage areas will only be a representation of how they used to *look like*. If that is what the designers search, heritage appearance is easily reproducible with the new accurate recording technologies available, such as 3D laser scanning, thus the value of its shape might even be diminished over time in the future. What is the point on stating that one of these heritage villages was first built in the 1700s, whereas there is almost no construction dating from that period anymore? What about to experience not only the space and shape of heritage buildings but also its light and thermal conditions?

In the end, one could argue that there is an inevitable renovation process each time an earthquake occurs -sometimes imperceptible or one that we do not want to see-, as they have affected heritage areas in Chile many times in their history. Thus, the most important change necessary to be made for the re-construction is to use the basis of a sustainable building tradition and not the appearance of heritage. Sustainable re-construction should include the traces of the changes and events over time, so these historic areas could be seen as a rich palimpsest. They should adapt to the climatic conditions of each place in the same way that vernacular architecture originally did.

It is necessary to recognise earthquakes as regular events that trigger changes in our built environment and therefore, to recognise those changes as part of the heritage in vernacular settlements. On other hand, in terms of memory, the fact that not all the houses are being

repaired or reconstructed with the current reconstruction programme, even when implying a risk for the inhabitants, allows us to understand these places as a process and as testimony of our history.

Finally, this work seeks an understanding of vernacular architecture as a sustainable way of re-thinking and designing, rather than just a formal approach. This is related to the social and cultural role of heritage in places where earthquakes will continue to hit and where it is necessary to approach re-construction as a natural and progressive process.

Notes and acknowledgments

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REFERENCES

- Comité Adobe. (2005). *Informe Técnico Comité Adobe*. Santiago, Chile.
- Council of National Monuments of Chile [CMN]. (2011). *Lineamientos para la Reconstrucción en Lolol*. Santiago, Chile: CMN.
- Sustainable. (n.d.). In *Cambridge Advanced Learner's Dictionary & Thesaurus*. Retrieved from: <http://dictionary.cambridge.org/dictionary/british/sustainable?q=SUSTAINABLE>
- Davidson, C. H., Johnson, C., Lizarralde, G., Dikmen, N., and Sliwinski, A. (2007). Truths and Myths about Community Participation in Post-disaster Housing Projects. *Habitat International* 31(1), 100-115.
- D'Ayala, D. & Benzoni, G. (2012). Historic and Traditional Structures During the 2010 Chile Earthquake: Observations, Codes, and Conservation Strategies. *Earthquake Spectra* 28, S1, S425–S451.
- Devilat, B. (2012) Housing Re-Construction in Vernacular Settlements after Earthquakes: San Lorenzo de Tarapacá as a starting point. In Pulhan, H. *Proceedings from ISVS-6: 6th International Seminar on Vernacular Settlements*. Famagusta, North Cyprus. (pp. 265-277).
- Guarda O.S.B., G. (1988). *Colchagua Arquitectura Tradicional*. Santiago, Chile: Editorial Universitaria.
- Jigyasu, R. (2010). Appropriate Technology for Post-disaster Reconstruction. In G. Lizarralde, C. Johnson and C. Davidson (eds.), *Rebuilding after disasters. From emergency to sustainability*. (pp. 49-69). London: Taylor and Francis.
- Ministry of Housing and Urban Development. (2011). *Plan De Reconstrucción Patrimonial*. Santiago, Chile: MINVU.
- Ministry of Housing and Urban Development. (2012). *Ordenanza General de Urbanismo y Construcciones*. Santiago, Chile: MINVU.
- Ministry of Housing and Urban Development. (2012, June 05). *Nueva normativa de adobe: larga vida a un material tradicional*. Retrieved from http://www.minvu.cl/opensite_det_20120605151256.aspx
- Stanley-Price, N. (2009). The Reconstruction of Ruins: Principles and Practice. In Richmond, A.; Bracker, A (Eds.). *Conservation: Principles, Dilemmas and Uncomfortable Truths*. Oxford: Elsevier.
- Torrealva, D. (2009). *Diseño Sísmico De Muros De Adobe Reforzados Con Geomallas*. Lima: Pontificia Universidad Católica del Perú.

Vellinga, M. (2012). *New vernacular architecture*. Key lecture at 6th International Seminar on Vernacular Settlements, ISVS-6. Famagusta, North Cyprus.

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A THEORETICAL APPROACH TO THE DESIGN OF A SURVEY INSTRUMENT IN POST-DISASTER RECONSTRUCTION: Defining Indicators for a Human-Based Study in Rural Built-Environment

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Abstract

Reconstruction projects built in the post-disaster period have become ever more visible over the past three decades. Research studies completed in this context generally aim to evaluate the finished projects through the viewpoints of either dwellers or implementing actors. Each study deals with a different type of disaster, occurring in a specific context; thus, their target beneficiary group and project focus are varied as well. Due to such differentiations, each researcher aims to put their specific criteria and indicators, or to follow a previous study in same context, to examine the phenomenon and to evaluate it at the end. This study focuses upon the post-earthquake permanent housing projects built by the state in the last two decades in rural eastern Turkey, and the target participant group is the rural dwellers in these settlements. Questionnaire survey is the main data collection tool for this study, and in this paper the theoretical approach to the preparation of the questionnaire is explained in detail. This approach covers selecting and categorizing the indicators, and extending their reasons by examining previous studies done either in Turkey or other countries.

Keywords: Project evaluation; rural context; post-disaster reconstruction; eastern Turkey; questionnaire development.

INTRODUCTION

The basic approach to the post-disaster period principally includes the actions from emergency aid to permanent housing, the reconstruction period, in the worldwide context (UNDRO, 1982; Audefroy, 2010; McCarthy, 2010). Most countries produce their own guidelines for taking action in the aftermath of a disaster. Generally, these guidelines provide details about either temporary shelter, permanent shelter or both. The main goal of post-disaster reconstruction programs that provide permanent shelter is to reduce vulnerability of occupants of the built environment and to increase resiliency of the community affected (FEMA, 2005; Berke and Campanella, 2006; Unlu *et al.*, 2010).

The vulnerability of the rural built-environment is a result of construction practices in rural areas, which produce non-engineered structures built with local materials such as raw timber, rubble stone and earth. The vulnerability of rural communities has a social context, namely the lack of preparedness to and knowledge about disasters. As a response to this vulnerability, governments and organizations see post-disaster periods as an opportunity to invest in the area affected, to introduce a better construction practice, and potentially lead to transformation outcomes within rural settlements. Specifically in rural Turkey, after experiencing an earthquake and its aftershocks, people who become homeless and unemployed encounter serious disruptions to their daily life. Those impacted are desperate for responses and solutions to their physical, psychological and economical needs.

Turkey has a long historical record of experiencing earthquakes, as a result of being situated on highly active tectonic plates (Bayrak *et al.*, 2008). The first official framework

produced in Turkey for post-disaster permanent housing policy was established in 1939, after the earthquake in Erzincan. Since then, the government has developed post-earthquake reconstruction policy over the years based on the country's experiences. After the earthquakes in Van (1976 and 2011), Erzurum-Kars (1983), Erzincan (1992), Erzurum (2004), Bingol (2005), and Elazig (2010), the reconstruction process in rural areas was completed by contractors hired by the state. In each of these projects, the authorities tried to provide houses according to the needs of rural dwellers.

During the development process of these projects, not only catastrophe-based causes but also social-population-based causes influenced decision-making of the authorities. For instance, internal migration started in 1950s, particularly from the eastern regions to the western regions of Turkey. There was a high demand for rapid and massive housing construction, which urged changes primarily in the trend of construction materials such as concrete and steel, by replacing timber, stone and adobe. This trend has steadily increased and today has naturally given a direction to the housing policy of the state (Peker, 2004; Tezer and Yigiter, 2000).

Besides this, along with the pressure of rebuilding the environment affected and providing houses for homeless people quickly after an earthquake, decision-makers have often paid more attention to the speed of project completion than complex social needs. As a consequence, authorities generally prefer to relocate affected communities to a safer area, regardless of internal displacement. In addition, with the aim of minimizing cost and optimizing house layouts, the state also adopted the principle of standardization of housing projects. However, such approaches have been criticized by many researchers in terms of relocation impacts, monotony of settlements, typology of houses and their structural quality (Dikmen, 2005; Ersan, 2006; Korkmaz, 2006; Demirbas, 2008; Orhan, 2008; Kuyucu and Unsal, 2010; Sarpkaya, 2011; Zariç, 2012).

This issue is most critical for rural settlements in eastern Turkey, which have rich historical construction practices embedded as architectural tradition. Unfortunately, today such traditional practice is continued neither by rural dwellers nor state authorities during the reconstruction phase after an earthquake. Although the state's housing policy aims to transform the built environment in terms of increasing living standards and reducing vulnerability to disasters in future, projects often cannot fully respond to the needs of rural living, and cannot please rural people's expectations (Gok, 1995; Gok *et al.*, 2007; Orhan, 2008). For example, Dikmen (2005) examined the occupancy level of the houses built after the earthquake in 2000, which shook the province of Çankırı (in the Central Anatolia Region). The study revealed that the relocation of a damaged rural settlement to a distance of 5 km. from the former settlement resulted in a considerably low level of occupancy. Similarly, Dagistanli (2007) focused on the conditions of post-disaster permanent houses in a village of Bingol (a province in the Eastern Anatolia Region), which were rebuilt after the earthquake in 2004, and revealed that more than half of the dwellers modified their houses. Furthermore, in the social context, the study reports that some of the families in the village preferred to return and live in their damaged houses by repairing them, and to leave the reconstructed houses to their children or other relatives.

While there are improvements to be made in post-disaster emergency aid and relief management in Turkey, the problems in planning of post-disaster permanent housing projects cannot be underestimated (Baradan, 2008). The body of work in this area is a testament to this. There are clear mistakes being made at project level which lead to rural dwellers' low levels of satisfaction. A lack of understanding of the role of beneficiary participation when developing post-disaster permanent housing projects is evident on behalf of the state. At the same time, continued failures are not helped by the lack of longitudinal research studies such as occupancy-evaluation mechanisms after the completion of reconstruction projects. Since the authorities in Turkey do not conduct regular project evaluations in reconstructed settlements, they are not able to revise the failing parts of projects, so as to maximize positive impacts on rural settlements and communities.

This study focuses upon reconstructed rural settlements in the aftermath of earthquakes, particularly in the rural Eastern Anatolia Region of Turkey (the largest region among the seven

geographical regions of Turkey). By questioning rural dwellers regarding their experiences and by observing the built environment reproduced in the last two decades, **the objective is to examine the post-earthquake permanent housing policy of the state with a focus on short-term, mid-term and long-term impacts.** However, to undertake this examination successfully, it is vital to determine the right method for evaluation and to select the right indicators to measure in the field. Accordingly, this paper presents the theoretical and practical approach utilised in the preparation of the questionnaire tool used for the wider research study.

Initially we will explore the type of evaluation that was selected and why. Secondly, the indicators are given in general and selected context, and are grouped as general information, physical, social, economic and overall. Each of the groups details why the selected indicators are important to the current study, and how many of the previous studies pointed these indicators. Finally, the conclusion provides the outcomes of the theoretical approach to the examination of previous studies, which are 30 in total. Apart from the contribution to the current study itself, it is also expected to assist to future scholars interested in similar topic by providing a rigorous background to the indicators.

POST-IMPLEMENTATION EVALUATIONS

A post-implementation evaluation is a kind of assessment, which aims to find out the degree to which a project or program was successful, what the impacts on settlement and dwellers are, and what parts of the implementation could be improved, according to the beneficiaries. Such an evaluation must be accurate and objective in order to be reliable and useful for decision-makers, and to let them derive lessons from previous projects (IFRC, 2012; UNCHS, 2001). Evaluation is a post-implementation task that is neither an audit nor monitoring process, but rather it assesses the efficiency of a project, program or policy from different perspectives (IFRC, 2012). In order to provide an independent and transparent evaluation, the choice of conductor for an evaluation is a key factor. Therefore, an outsider, who is not directly related to the project, is the best option (UNCHS, 2001). IFRC (2012) published similar guidelines for planning post-disaster settlements, suggesting an evaluation phase after the completion of implementation process (Figure 1).



Figure 1: The cycle illustrates a scheme for a better management in designing and implementing the post-disaster interventions (Source: IFRC, 2012).

There are various approaches to the evaluation, depending on their aims and scope. For example, in the guidelines of UNCHS (2001), three types of evaluation are listed: policy evaluation, program evaluation and project evaluation. Policy evaluation focuses on organisations or agencies, and assesses their relevance and activities in general. Sometimes it can be based on comparing one agency with another. Programme evaluation focuses on the performance of a programme in a specific area from a broad perspective. It can cover a number of projects, but it is not extended so far as to relate to policy. Project evaluation, meanwhile, is described as an assessment of the practical impact of a particular project. It may cover the policy framework from a broader extent, but does not evaluate the entire policy.

Similarly, there are three more terms used for different evaluations. They are called post-project reviews (PPRs), post-implementation reviews (PIRs) and post-occupancy evaluations (POEs). PPRs examine the general process of the project by focusing on how the project was designed and how successful it was in terms of time and budget and the interactions between beneficiaries and organisations. PIRs evaluate the parallelism of the objects and results of the project. PIRs are not necessarily applied after the absolute completion of the project but can be used to analyse a project after completion of any phase. In this context, PIRs can be used as a feedback tool for the process evaluation of a project. However, PIRs are also considered as a tool to assess the long-term outcomes of projects if conducted some years after the project ending (Efficiency Unit, 2009). Finally, POEs examine the final performance of the project by covering a number of issues. Generally, POEs are used for assessing the satisfaction level of users/occupants in a specific area or for building an architectural design rationale. There are a large number of studies employed in various disciplines using this evaluation technique to examine the positive and negative sides of housing and planning projects. POEs are human and context based and explore issues that may not normally be strongly considered by built environment professionals. This concept is explained in Figure 2.

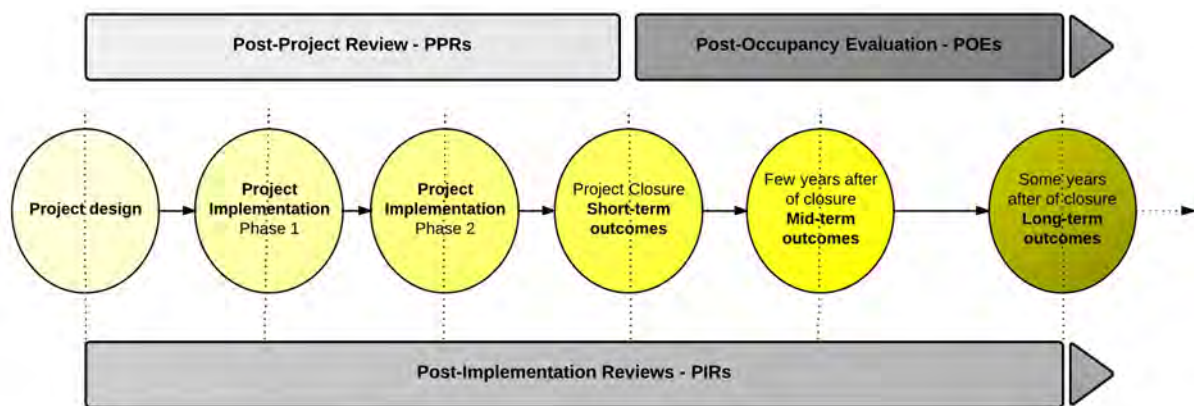


Figure 2: The approaches and the concept of evaluation for projects
(Source: Redrawn from Efficiency Unit, 2009).

SELECTING INDICATORS

General Indicators

Like other phases of post-disaster activity, evaluation also requires a structure for the conductor to follow. The creation of tools to be used during evaluation plays a vital role in achieving reliable results. Setting the correct indicators and their criteria is an essential step in developing a questionnaire or any survey tool. The selection of indicators is based on a theoretical understanding of a phenomenon and its outcomes as well as their relationship (Adger *et al.*, 2004; Amaratunga *et al.*, 2012). The indicators to be measure in a project are commonly identified as Key Performance Indicators (KPIs), Critical Success Indicators (CSFs), and Selected Success Factors (SSFs). These terms can be applied in any type of project, though they originally come from the area of business management.

KPIs are the effects of a certain activity and briefly aims to find what can be done to increase the success of the activity. On the other hand, CSFs are the causes of a success, and aim to find the tasks and basic requirements needed for the success of an activity. In other words, identifying the CSFs means to prioritise the general success factors. CSFs are not KPIs. However, they have an operational relationship. Once you have identified the causes of your success, which refers to CSFs, then you may measure or evaluate the effects of your success, which refers to KPIs. Thus, CSFs should be usable and fit to a possible scenario in order to improve the activity (Koutsukouri *et al.*, 2008). Similarly, identifying SSFs is the step prior to

CSFs. Before you start to determine the CSFs of your project, you must select the general indicators, which have different role in the activity and a different level of influence on the result of the activity. At the same time, the SSFs you identify should be those that can affect or become CSFs of the project. Thus, an extensive literature review and/or previous experiences in the area or topic under study are required to set the SSFs as accurately as possible. This approach is employed by Amaratunga *et al.* (2012) in the context of community-based post-disaster reconstruction projects in pre-construction stages. One more consideration is that of Design Quality Indicators (DQIs), which are used primarily by designers and aim solely to examine the building design and its quality from the perspective of users. When these theoretical approaches are considered as part of this study, it becomes clear how and why these steps should be taken (Figure 3).

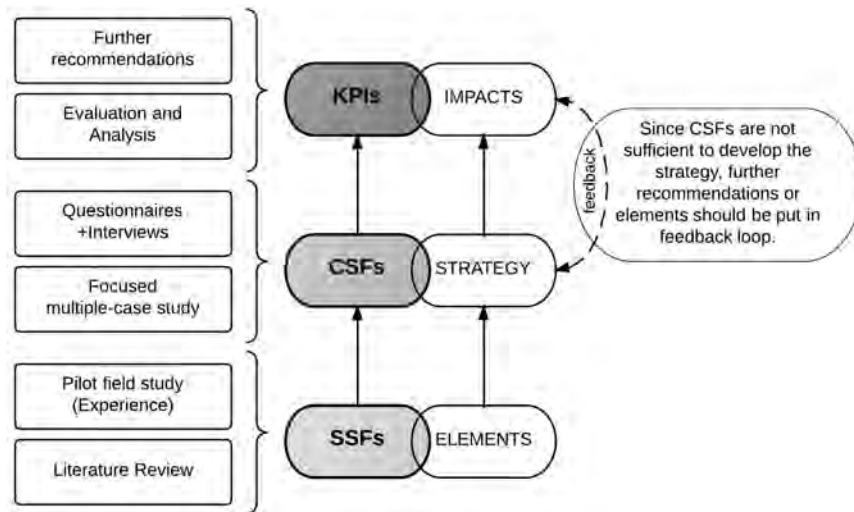


Figure 3: Steps of the approach in the current study to find the indicators influent (Source: Authors).

As part of this process, it is also important to define the areas of assessment in order to help define direct, measurable, specific and adequate measurement tools. These areas of assessment will include the specific indicators. Within this context, Figure 4 shows the fundamental features of the tool developed for this study.

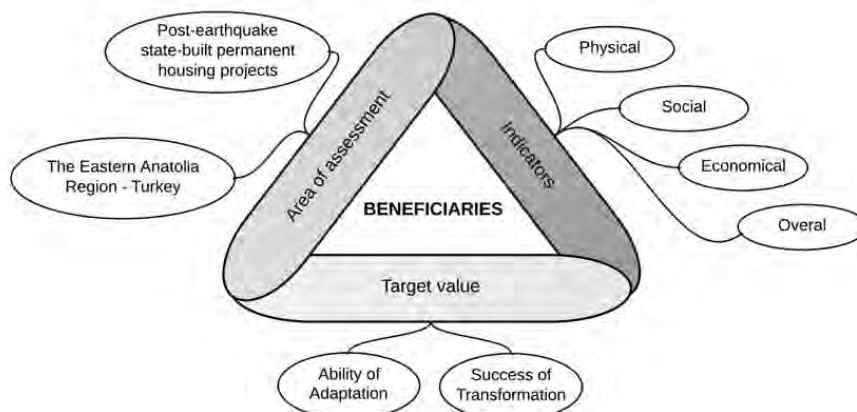


Figure 4: A triangle of measurement with identified features for this study (Source: Authors).

Selected indicators

As shown in Figure 4, the indicator selection is based on measuring and evaluating the 'ability of adaptation' and 'success of transformation' from the perspective of rural dwellers living in the post-earthquake state-built permanent houses in the Eastern Anatolia Region of Turkey. Ability of adaptation or adaptive capacity is often linked to social vulnerability, where adaptive capacity refers to the potentials, and ability of adaptation refers to the results (Adger *et al.*, 2004). Social vulnerability can be described in both individual and community-based contexts. The capacity of a society to cope with post-disaster problems not only depends on individuals' or communities' resilience, but also requires an economic and/or political dimension to be planned for by the authorities.

Adaptation does not happen suddenly after an intervention. It is expected to increase gradually, or in the worst-case scenario, to decrease enough to create another minor/major crisis as an unexpected outcome. Unoccupied houses and migration are examples of negative outcomes of post-disaster housing programmes, and both have been widely observed in Turkey in recent years. In addition to the studies of Dikmen (2006) and Akinci and Dağıstanlı (2007), during pilot field study in the Van province for the current research, many unoccupied houses were observed among those reconstructed by the state after the earthquake in 1976 (Figure 5).



Figure 5: The post-earthquake permanent houses built in 1976 in the province of Van, the owner had left the house in unknown date (Source: Authors).

To prevent negative outcomes and to discover what accelerates adaptation, it is important for both researchers and authorities to revise the measurement indicators. To this end, it is important use previous studies in similar context for maximum benefit, to understand the different outcomes that might be anticipated in the field.

In various fields, social vulnerability is examined based upon individual indicators, such as age, gender, members in household, education, income level, employability, tenure type, health status, nutrition, and insurance record. To place these indicators into a survey, it is important to understand their propositions and relationships to each other. For example, it is common to accept that elderly people over 65 are most vulnerable, while the accepted age group defining children changes from study to study. Due to regional and religion causes, generally women are accepted to be more vulnerable than men as a gender issue. Similarly, if a household covers a large family, it is accepted to be more vulnerable than a smaller family. Within this context, the linking of indicators will create a causal relationship between them. For example, education and employability, or income level, health status and insurance record have strong relationships in the consideration of vulnerability. In the case of an earthquake, if a family has lost their house due to collapse but has a good level of income and insurance protection to compensate their loss, we should consider them as particularly vulnerable.

In the current study, social vulnerability is handled in four parts, alongside the general indicators above. The first section is about awareness regarding disasters, which starts with a question about participation in a programme or seminar raising awareness of hazard risk and disaster preparedness during the post-earthquake reconstruction process. This is invariably central to the discussion about increasing resilience and adaptation of the community affected.

Educating people theoretically in seminars or practically with demonstrations will increase their capacity to cope with disaster, and mitigate the impacts of disasters in future. The second section is about migration problems, and it mainly focuses on householders' decision-making. Migration is seen by many in the context of Turkey as a temporary solution in the aftermath of an earthquake. However, it is essential to examine the associated issue due to the pre-existence of an internal migration problem from rural to urban areas, causing long-term regional disparities. For example, when an earthquake strikes a rural settlement in eastern Turkey, individual members of families tend to migrate to find a regular job and to support the rest of the family. In extreme circumstances, the entire family migrate permanently to re-establish their lives. Hence, to evaluate the impact of owning a post-earthquake permanent house, it is important to understand its role in the decision-making process of dwellers.

The third section is about neighbourhood, and aims to examine social connectedness and its effect on individuals. Interaction between neighbours plays a vital role in the culture of rural living in eastern Turkey. Therefore, maintaining community cohesion in the new location will increase dwellers' adaptation to the environment. The fourth and last section is about changes in daily life habits due to the layout of new house and the location of the settlement. It is presumed that a number of variables relate to the dwellers' perception and this altered mentality may impact their ability to adapt. As they start to compare their old and new environments, they may long for the old, and given a lack of adaptation they may arrive at a conclusion to abandon their rebuilt environment.

Employability and level of income may appear as general indicators, but they form the basis of economic evaluation in adaptive capacity. When people have limited sources of livelihood, such as fishing, agriculture and animal husbandry, they are accepted as vulnerable. For example, during past earthquake experiences in eastern Turkey, when a barn collapses and causes losses in the animal stock of a family, they lose their livelihood and entire income source. In such scenarios, the state offers credits for people to recover their losses and to restart animal husbandry. However, some of those affected will attempt to entirely change their source of income and turn to employment that matches their skillset, education and experience.

Particularly in post-disaster housing projects, long-term loans are crucial in terms of their effects on the monthly expenses of a family. In Turkey, post-earthquake state-built permanent houses are delivered with 20-year-long loans at no interest to dwellers. They require payment of monthly instalments. This is not a simple process for seasonal workers, or those who trade their animal stock at certain times of the year. These debtors have serious difficulties keeping up with monthly instalments. In addition, there are other expenses that cannot be disregarded, such as heating. Normally, in traditional rural life people living in the region do not pay for heating, instead burning wood and turd, which can be obtained locally. However, in rebuilt houses they need electricity or other fuel resources that require regular payment. Within this context, the economic evaluation has three sections entitled loans, livelihood and expenses.

The section of loans aims to uncover the people's perception for the house loans, including preference of other payment options, duration of loans, other financial resources, and worthiness of the house. In the section on livelihood; type of livelihood, loss of animal stock, continuity of pre-earthquake livelihood, and level of income in both pre-and-post earthquakes are the indicators selected to examine people's economic stability. The section of expenses questions the type of heating and the level of essential expenses with close-ended questions, besides the expensiveness of heating, affordability for expenses, and expense comparison between the former and current houses based on personal perception. Since economic issues are a prominent cause of the migration problems observed in the region, it is important to unveil correctly the relationship between the indicators in these sections. Based on their significances, Table 1 lists the group of indicators selected and their frequency of examination in previous studies.

Table 1: The list of indicators selected for general information, social evaluation and economic evaluation based on previous studies (Source: Authors).

General information	
Indicator	Source
Number of household members	Mohapatra (2009), Behloul (1991), Zappettini (2001), Darkwa (2006), Ersan (2006), Korkmaz (2006), Orhan (2008), Demirli (2011), Inal (2008), Arslan (2009), Coskun (2005), Dikmen (2005), Enginoz (2006), Tercan (2008), Dagistanli (2007), Gur (2009).
Number of children	Ersan (2006), Korkmaz (2006), Orhan (2008), Inal (2008).
Age group of family members	Mohapatra (2009), Behloul (1991), Holland (2006), Ersan (2006), Korkmaz (2006), Orhan (2008), Arslan (2009), Coskun (2005), Enginoz (2006), Dagistanli (2007), Darkwa (2006), Dwyer <i>et al.</i> (2004).
Education	Mohapatra (2009), Ersan (2006), Korkmaz (2006), Orhan (2008), Inal (2008), Arslan (2009), Coskun (2005), Enginoz (2006), Demirli (2011), Dagistanli (2007), Gur (2009), Darkwa (2006), Tercan (2008).
Type of occupancy	Behloul (1991), Holland (2006), Ersan (2006), Orhan (2008), Inal (2008), Arslan (2009), Coskun (2005), Tercan (2008), Gur (2009), Dwyer <i>et al.</i> (2004).
Duration of occupancy	Behloul (1991), Holland (2006), Ersan (2006), Orhan (2008), Korkmaz (2006), Inal (2008), Coskun (2005), Dikmen (2005), Enginoz (2006), Demirli (2011), Darkwa (2006), Dagistanli (2007), Gur (2009).
Earthquake experience	Mohapatra (2009), Arslan (2009), Coskun (2005), Demirli (2011), Tercan (2008), Demirbas (2008).
Level of damage in previous house	Mohapatra (2009), Arslan (2009), Dikmen (2006), Tercan (2008), Demirbas (2008), Dwyer <i>et al.</i> (2004).
Loss of family members	Dikmen (2005), Enginoz (2006), Demirbas (2008).
Post-earthquake temporary accomodation and its duration	Mohapatra (2009), Tercan (2008), Demirbas (2008), CURBE (2010).
Social evaluation	
Indicator	Source
Training attendance	Mohapatra (2009), Tercan (2008), Dwyer <i>et al.</i> (2004), Amaratunga <i>et al.</i> (2012).
Fear of earthquakes	Tercan (2008), Demirbas (2008), Dwyer <i>et al.</i> (2004), Leersum and Arora (2011).
Trust in seismic-resistance of the house	Mohapatra (2009), Inal (2008), Dikmen (2005), Gur (2009), Tercan (2008).
Temporary migration	Mohapatra (2009), Tercan (2008).
Decision-making for migration	Dagistanli (2007), Demirli (2011), Tercan (2008), Demirbas (2008), Gok (1996), Gok <i>et al.</i> (1995).
Knowing neighbours	Behloul (1991), Ersan (2006), Demirli (2011).
Relationship with neighbours	Mohapatra (2009), Tercan (2008), Behloul (1991), Ersan (2006), Korkmaz (2006), Inal (2008), Coskun (2005), Dikmen (2005), Dagistanli (2007), Demirli (2011), Gur (2009).
Feeling of normalisation	Mohapatra (2009), Tercan (2008).
Duration of disruption	-
Changes and difficulties in post-earthquake life	Behloul (1991), Demirli (2011), Tercan (2008), Darkwa (2006), Demirbas (2008).
Perception and aspiration of former and current environment	Arslan (2009), Coskun (2005), Dikmen (2005), Tercan (2008), Darkwa (2006).
Economic evaluation	
Indicator	Source
Financial help from the state	Mohapatra (2009), Dwyer <i>et al.</i> (2004), CURBE (2010).
Completion level of house loan	Tercan (2008).
Duration and amount of house loan	-
Preference of other payment options	-
Worthiness of the house received	Behloul (1991), Korkmaz (2006).

Table 1 (Continued): The list of indicators selected for general information, social evaluation and economical evaluation based on previous studies (Source: Authors).

Source of livelihood	Mohapatra (2009), Ersan (2006), Inal (2008), Arslan (2009), Dikmen (2005), Gok (1996), Gok (2001), Dagistanli (2007), Gur (2009), Tercan (2008), Buttenheim (2009), CURBE (2010).
Loss of animal stock and its recovery	Mohapatra (2009), Gok <i>et al.</i> (1995), Gok (1996), Tercan (2008), CURBE (2010).
Being unemployed	Gur (2009), Tercan (2008).
Comparison of income level (pre-and-post disaster)	Mohapatra (2009), Buttenheim (2009), Tercan (2008), CURBE (2010).
Order of essential expenses	Dagistanli (2007).
Type of heating	Mohapatra (2009), Tercan (2008).
Expensiveness of heating	Holland (2006), Korkmaz (2006).
Affording essential expenses	Mohapatra (2009).
Increase in expenses	Gok (2001), Mohapatra (2009).
Spending on alterations	Orhan (2008).

Post-earthquake social and economical situations are invisible elements of adaptation, and generally they are formed as by-products of rebuilt physical environment. A post-disaster implementation is accepted as successful when both the level of occupancy and the satisfaction of dwellers are high (IFRC, 2012). However, dwellers' satisfaction is not only linked to occupancy of settlements, but is also linked to various indicators that affect dwellers' ability to adapt. There are two features of the physical environment in such project implementations; houses on an individual scale, and settlements on a community scale.

Plan layout, size of house, size of interior spaces, number of spaces, number of floors, usability of spaces, interior heating and ventilating, quality of indoor air and humidity, cleaning and maintenance, type of construction, quality of interior and exterior materials, and workmanship are indicators examined in various studies. In the context of rural living in Turkey, some indicators are more critical than others, from a dwellers perspective. For example, Gok *et al.* (2007) reveals that the plan layouts did not please dwellers living in post-earthquake state-built permanent houses in the province of Erzurum, which were built in 2004. The reason behind this was that the barn was located on the ground floor of their residential unit. Most of the dwellers complained that smell and noise came from their barn into the house.

Meanwhile, Gok (1995) reveals that the plan layout of houses and the number of rooms were unsuitable for families' traditional living, while the size of windows caused a perceived lack of privacy. In addition, Dikmen (2005) found that the size of lot provided to dwellers in Çankırı was insufficient in terms of building additional units, such as barn and hayloft. Dagistanli's (2007) study in Bingol province argues that the addition of an entrance and covering balcony or terrace using inadequately thin walls is the result of privacy needs not being met in the first place. Moreover, due to interior heating problems and harsh weather conditions, some dwellers in these settlements build supplementary stone walls around the outer walls. Two examples of post-earthquake housing projects in the region are shown in Figure 6 and 7.



Figure 6: The plan layout and view of the post-earthquake state-built permanent house – without alterations- in Bingol (Source: Dagistanli, 2007).

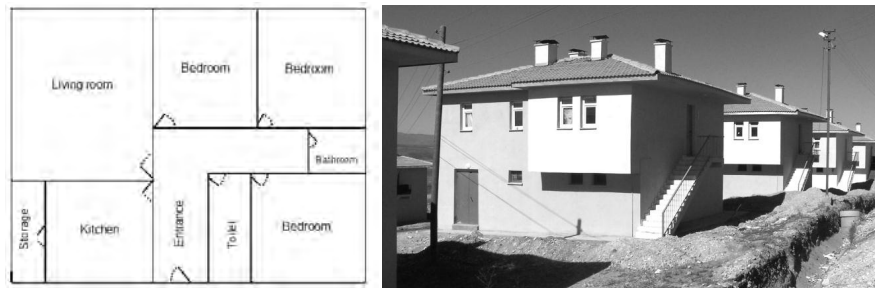


Figure 7: The plan layout and view of the post-earthquake state-built permanent house – without alterations- in Erzurum (Source: Gok *et al.*, 2005).

Building walls, adding or enlarging spaces, changing interior materials and using spaces for different functions are the consequences of adaptation. During the pilot field study of the current project, examples of these modifications were observed in the provinces of Van and Erzurum (Figure 8). In addition to residential unit, additional units, such as barn, hayloft and storage are important for dwellers in rural Turkey. When they receive a barn from the state, they may not be pleased with the size of the barn due to their large animal stock. If they do not receive a barn as an additional unit, they often rebuild it by themselves near to their houses.



Figure 8: The examples of modifications applied by the dwellers in the post-earthquake state-built permanent houses; (a) the province of Van, building and simple covering for entrance; (b) the province of Erzurum, an extension built by the owner as a depot (Source: Authors).

Deciding where to locate or relocate affected communities is accepted as one of the most critical factors in dwellers' adaptation. In the majority of Turkish cases relocation is preferred by the authorities in order to remove dwellers from exposure to hazards. Although the authorities make the decision to relocate, the success of relocation is mainly based on the participation those affected. According to the World Bank (2010), residents must be allowed to voice their preferences and needs during the planning phase. Relocation may appear to be the easiest choice, however, topography, distance to centre, public and local service provision, transportation, infrastructure, site layout and orientation are only some of the factors affecting dwellers in a relocated settlement.

These indicators may cause changes in dwellers' daily life and their livelihood. For example, when the new location is farther away from a central area, public transportation must be provided to allow dwellers to go shopping. Similarly, if families are relocated away from previous schools they face considerable disruption. Incomplete or weak infrastructure may result in disruptions in the dwellers' daily life. Grid layout of the settlement may raise privacy problems among dwellers (Figure 9). Social gathering places and playgrounds can be designed in the new settlements, but it is essential that dwellers still have sufficient land to continue agriculture (Ulubas, 1980). In addition, basic facilities must be provided such as schools, places of worship, health care facilities, post office and a small market. Within this context, location of personal lot in the settlement, location of the current settlement comparing to the former, distance to city centre and other public services, design of the settlement and outdoor facilities, and infrastructure and local public services are the indicators selected for this study.



Figure 9: The grid-layouts of the post-earthquake state-built permanent housing settlements in (a) the village of Pasayurdu, Erzurum; and (b) the village of Hangedigi, Van (Source: Google Map).

As a result of these physical, social and economic indicators, dwellers must come to an overall decision about their post-earthquake rebuilt environment during their adaptation period. These decisions consider their aspirations for the old, expectations from the new, and perceptions of both. Thus, in the development of a survey tool, a separate section entitled 'overall evaluation' is designed to examine this issue. For example, preference of living in a traditionally constructed house and comparing the old and the new was studied by Leersum and Arora (2011) for implementations in Pakistan, after the earthquake in 2004. They found that two-thirds of dwellers had already agreed to change their traditional construction practice. Over 80% of the respondents stated good level of satisfaction for the entire house, and two-thirds also mentioned they would have preferred the structural type of their new houses if they needed to build one in future.

In addition, 60% of respondents stated they were able to control the decision-making process, while 25% said that this was partially true. Similarly, Onder *et al.* (2010) reveals that beneficiary participation is most effective on the level of satisfaction with the quality of interior spaces and psychological needs, rather than technical characteristics of the house. These studies also point towards the standard of living conditions pre-disaster and the impact on dwellers expectations post-disaster. Due to the political context in the region under study, trust in the state after implementation and the relationship between officials and dwellers are regarded as vital indicators, and rose to prominence during the pilot field study. The indicators selected for physical and overall evaluation and their appearance in previous studies are given in Table 2.

Table 2: The list of indicators selected for physical and overall evaluations based on previous studies (Source: Authors).

Indicator	Physical evaluation
	Source
Plan layout	Behloul (1991), Zappettini (2001), Holland (2006), Darkwa (2006), Ersan (2006), Korkmaz (2006), Inal (2008), Coskun (2005), Dikmen (2005), Enginoz (2006), Tercan (2008), Dagistanli (2007), Gur (2009), Buttenheim (2009), Amaratunga <i>et al.</i> (2012), CURBE (2010), Gok <i>et al.</i> (1995), Hayli (2001), Onder <i>et al.</i> (2010), Gok (2011), Gok <i>et al.</i> (2007).
Size of house and rooms	Mohapatra (2009), Behloul (1991), Zappettini (2001), Holland (2006), Darkwa (2006), Ersan (2006), Korkmaz (2006), Inal (2008), Coskun (2005), Dagistanli (2007), Gur (2009), Onder <i>et al.</i> (2010), CURBE (2010), Demirli (2011).
Size of windows	Holland (2006), Gur (2009), Ersan (2006), Korkmaz (2006), Onder <i>et al.</i> (2010), Darkwa (2006), Dagistanli (2007), Gok <i>et al.</i> (1995), Dikmen (2005), Enginoz (2006).
Size of private lot	Darkwa (2006), Tercan (2008).
Quality of interior materials	Zappettini (2001), Holland (2006), Darkwa (2006), Ersan (2006), Korkmaz (2006), Onder <i>et al.</i> (2010), Dikmen (2005), Gok (1996), Gur (2009), Demirli (2011).

Table 2 (Continued): The list of indicators selected for physical and overall evaluations based on previous studies
(Source: Authors).

Direction of entrance and terrace	Holland (2006), Ersan (2006), Enginoz (2006).
Level of privacy	Demirli (2011), Darkwa (2006), Onder <i>et al.</i> (2010), Ersan (2006), Behloul (1991), Korkmaz (2006).
Easy cleaning	Onder <i>et al.</i> (2010), Behloul (1991), Korkmaz (2006), Dikmen (2005).
Heating and ventilating during winter	Darkwa (2006), Holland (2006), Ersan (2006), Korkmaz (2006), Onder <i>et al.</i> (2010), Dikmen (2005), Hayli (2001), Gur (2009), Demirli (2011), Tercan (2008), Dagistanli (2007), Coskun (2005), Gok (2001).
Location of dweller's house	Gok (2001), Korkmaz (2006), Onder <i>et al.</i> (2010), Dikmen (2006).
Location of new settlement compared to former settlement	Mohapatra (2009), Amaratunga <i>et al.</i> (2012), Inal (2008), Coskun (2005), Dagistanli (2007), Gok (1996), Gok (2001), Arslan (2009).
Distance to city centre and other services	Darkwa (2006), Demirli (2011), CURBE (2010), Ersan (2006), Behloul (1991), Korkmaz (2006), Onder <i>et al.</i> (2010), Coskun (2005), Enginoz (2006), Buttenheim (2009), Dagistanli (2007), Gur (2009).
Design of new settlement and outdoor facilities	Darkwa (2006), CURBE (2010), Demirli (2011), Gur (2009), Tercan (2008), Ersan (2006), Korkmaz (2006), Onder <i>et al.</i> (2010), Arslan (2009), Coskun (2005), Enginoz (2006), Hayli (2001), Inal (2008), Gok <i>et al.</i> (2007).
Infrastructure and public services	Mohapatra (2009), Behloul (1991), Coskun (2005), Buttenheim (2009), Gok (1996), Gok <i>et al.</i> (2007), Gok (2001), Hayli (2001), Dagistanli (2007), Gur (2009), Demirli (2011), Arslan (2009), CURBE (2010), Tercan (2008).
Additional units owned	Dikmen (2005), Gok <i>et al.</i> (1995), Gok (2011), Gok <i>et al.</i> (2007), Tercan (2008), Hayli (2001).
Receiving an additional unit from the state	Gok <i>et al.</i> (2007), Tercan (2008), Gok <i>et al.</i> (1995).
Size and location of barn	Dikmen (2005), Gok <i>et al.</i> (2007), Tercan (2008).
Any alterations done	Zappettini (2001), Behloul (1991), Demirbas (2008), Ersan (2006), Korkmaz (2006), Orhan (2008), Inal (2008), Dikmen (2006), Dagistanli (2007), Demirli (2011), Tercan (2008).
Type of alterations	Zappettini (2001), Behloul (1991), Demirbas (2008), Ersan (2006), Korkmaz (2006), Orhan (2008), Dikmen (2006), Dagistanli (2007), Tercan (2008).
Reasons of alterations and anticipated alterations in future	Zappettini (2001), Behloul (1991), Demirbas (2008), Ersan (2006), Korkmaz (2006), Orhan (2008), Inal (2008), Dikmen (2006), Dagistanli (2007), Demirli (2011), Darkwa (2006).
Overall evaluation	
Indicator	Source
Overall satisfaction from the house	Zappettini (2001), Demirbas (2008), Darkwa (2006), Behloul (1991), Tercan (2008), Ersan (2006), Korkmaz (2006), Inal (2008), Dikmen (2005), Dagistanli (2007), Demirli (2011), Gur (2009), Buttenheim (2009), Leersum and Arora (2011).
Comparison between the old and the new houses	Inal (2008), CURBE (2010), Dikmen (2005), Darkwa (2006), Coskun (2005), Tercan (2008), Gok (1996), Enginoz (2006).
Preference of structural system and material	Mohapatra (2009), Inal (2008), Dikmen (2005), Tercan (2008), Amaratunga <i>et al.</i> (2012), Leersum and Arora (2011).
Level of expectations	Darkwa (2006).
Anticipated years to live in the same house	Behloul (1991), Holland (2006), Korkmaz (2006), Inal (2008), Arslan (2009), Coskun (2005).
Relationship with the officials	Amaratunga <i>et al.</i> (2012).
Trust in the state	Amaratunga <i>et al.</i> (2012), Dwyer <i>et al.</i> (2004).
Participation in decision-making	Mohapatra (2009), Inal (2008), Amaratunga <i>et al.</i> (2012), Leersum and Arora (2011), Darkwa (2006), Gok (2011).
Any issues to complain about	Ersan (2006), Dikmen (2005), Dagistanli (2007), Darkwa (2006), Tercan (2008), Demirli (2011).

Table 1 and 2 consider 30 related studies and cover 65 indicators to examine the adaptation of dwellers in post-earthquake state-built permanent housing projects in eastern Turkey. 20 of these studies are directly about disasters and post-disaster implementations, while 10 of them are related to regeneration projects and are in the context of POEs. Similarly, 20 of these studies are completed in various projects in Turkey while the rest are from different countries. 15 of the

studies are related to earthquakes and their impacts, while the rest are about different types of hazard, such as tsunami and flood.

CONCLUSION

The aim in conducting such diverse background research before preparing the required questionnaire for this study was to create a robust evidence base for the validity of the survey tool. The 30 studies that were considered cover a range of different standpoints, as discussed in this paper. It is clear that some indicators have been more heavily studied than others in previous studies. Physical evaluation indicators are the most commonly studied, while economic evaluation has the least precedent. This can be explained by the direct relationship between occupants and their built environment, which is often seen as the easiest to evaluate both for the researcher and the occupant by observing and experiencing it.

As expected, the indicators related to the house and settlement are found to be in common in many studies, while more rural issues, such as size of private lot, level of privacy, and having additional units were difficult to uncover. When collecting the general information of the occupants, number of households, age group of the family, education level and duration of occupancy are the most common indicators. Interestingly, even though many of the studies considered are focused on disasters, indicators such as loss of family members and post-earthquake temporary shelter issues are rarely studied.

For social evaluation, the indicator of relationship with neighbours is most commonly examined. However, duration of disruption, which is one of the indicators selected for the current study, was not found in any previous study. This indicator was added based on pilot field study experiences. Similarly, the two indicators, duration and amount of the house loans and preference of other payment options were not found in previous studies. These indicators are directly linked to the housing policy in practice, but have additional impacts on dwellers' financial status as well as motivation.

All of these 65 indicators are shaped according to these 30 studies and pilot field studies. Some of the indicators were studied separately in these previous studies, or worded differently. The tool resulting from this process is designed to collect data regarding what dwellers think and how they feel at a certain point in time. Within the concept of evaluation, these 65 indicators are the Selected Success Factors (SSFs) for this study, and at the end of the research, some of the SSFs will become the Critical Success Factors (CSFs) of the implementations that are the determinants of positive adaptation among dwellers.

To conclude, the theoretical approach applied into this study for the selection of indicators aimed to specify which indicators are in general context, which indicators are more specific and which are unique to the ongoing research. In addition, certain results can be anticipated within the study. The causal relationship between indicators that the researcher aims to develop and display has emerged from extensive background work. Examination of the questionnaires of previous studies has enabled an appropriate structure to be designed for the survey and for questions to be communicated appropriately and statements made objectively. The tool design was undertaken with the greatest care to avoid researcher and participant bias. Ultimately, we desire that this approach to survey tool design presented in this paper may assist future researchers in related fields by providing a starting point for the measurement of adaptation in post-disaster reconstruction.

REFERENCES

- Adger, W. N., Brooks, N., Betham, G., Agnew, M., & Eriksen, S. (2004). New indicators of vulnerability and adaptive capacity, Tyndall Centre for Climate Change Research, Technical Report 7.
- Arslan, H., & Unlu, A. (2006). The Evaluation of Community Participation in Housing Reconstruction Projects after Duzce Earthquake, 2006 International Conference and Student Competition on post-disaster reconstruction "Meeting stakeholder interests" Florence, Italy.

- Audefroy, J. D. (2010). Post-disaster emergency and reconstruction experiences in Asia and Latin America: an assessment, *Development in Practice*, 20:6:664-677.
- Baradan, B. (2008). "Review of Literature for the Concept of Post-Disaster Housing in Turkey", *G. U. Journal of Science*, 21:2:43-49.
- Bayrak, Y., Ozturk, S., Koravos, C. G., Levetakis, K. A. and Tsapanos, T. M (2008). Seismicity assessment for the different regions in and around Turkey based on instrumental data: Gumbel first asymptotic distribution and Gutenberg-Richter cumulative frequency law, *Natural Hazards and Earth System Sciences*, 8:109-122.
- Behloul, M. (1991). Post-Occupancy Evaluation of Five Storey Walk Up Dwellings: The Case of Four Mass Housing Estates in Algiers, PhD Thesis, University of Sheffield, Department of Architectural Studies, Sheffield, UK. Bordass, W., Leaman, A., and Eley, J. (no date). A Guide to Feedback And Post-occupancy Evaluation, <http://goodhomes.org.uk/>.
- Berke, P. B., & Campanella, T. J. (2006). Planning for Postdisaster Resiliency, *The ANNALS of the American Academy of Political and Social Science*, 604:192-207.
- Buttenheim, A. (2009). Impact evaluation in the post-disaster setting: A conceptual discussion in the context of the 2005 Pakistan earthquake, 3ie Working Paper series, Working Paper 5.
- Coskun, Z. K. (2005). Deprem Sonrası Planlamada Yeni Yerleşim Bölgesi Yaklaşımı: Adapazarı Ornesi/New Settlement Areas in Planning Process After Earthquake: Adapazarı As An Example, MSc Thesis, Graduate Institute of Science and Technology, Department of Urban and Regional Planning, Gazi University, Ankara, Turkey.
- CURBE (2010). Disaster Recovery Indicators: guidelines for monitoring and evaluation, Cambridge University Centre for Risk in the Built Environment.
- Dagistanli, K. (2007). Mimarsız Mimarlık ve Bingöl, Kığı, Alagoz Köyü Üzerine Bir İnceleme, An analysis of Architecture without Architect and Bingöl, Kığı, Alagoz Village, MSc Thesis, Graduate Institute of Natural Science and Technology, Department of Architecture, Yıldız Technical University, İstanbul, Turkey.
- Darkwa, I. (2006). Post-Occupancy Evaluation of State-Subsidised Housing Units in Kayamandi- Stellenbosch, MSc. Thesis in Consumer Science, University of Stellenbosch, Stellenbosch, South Africa.
- Demirbas, C. (2008). Deprem Bölgesi Konutları için İç Mekanların Güvenlik Analizi ve Çözüm Önerileri/ Safety Analysis and Suggestions of Solution in Interior Spaces for Earthquake Region Housing, MSc. Thesis, Karadeniz Technical University, The Institute of Science and Technology, Department of Interior Architecture, Trabzon, Turkey.
- Demirli, M. E. (2011). Socio-spatial Analysis of Urban Renewal In the Case of Relocating Kadifekale Inhabitants to TOKİ Üzümlü, Master of Design Thesis, İzmir University of Economics, The Graduate School of Social Sciences, İzmir, Turkey.
- Dikmen, N. (2005). A Provision Model and Design Guidelines for Permanent Post-disaster Housing in Rural Areas of Turkey Based on an Analysis of Reconstruction Projects in Cankiri, PhD Thesis, Middle East Technical University, The Graduate School of Natural and Applied Sciences, Department of Architecture, Ankara, Turkey.
- Dwyer, A., Zoppou, C., Nielsen, O., Day, S. & Roberts, S. (2004). Quantifying Social Vulnerability: A methodology for identifying those at risk to natural hazards, Australian Government, Geoscience Australia, Commonwealth of Australia.
- Efficiency Unit (2009). Serving the Community Through Successful Project Delivery: A User Guide to Post Implementation Reviews, the Government of the Hong Kong Special Administrative Region.
- Enginoz, E. B. (2006). A Model For Post-disaster Reconstruction: The Case Study in Dinar-Turkey, 2006 International Conference and Student Competition on post-disaster reconstruction "Meeting stakeholder interests", May 17-19, Florence, Italy.
- Ersan, Z. F. (2006). Kahramanmaraş Kenti Toplu Konut Uygulamalarının Kullanım Sonrası Değerlendirilmesi/ The post-occupancy evaluation of mass housing application of Kahramanmaraş City, MSc Thesis, Cukurova University, The Institute of Science and Technology, Department of Architecture, Adana, Turkey.
- FEMA (2005). Chapter 3: Policies for Guiding Planning and Post-disaster Recovery and Reconstruction, available on http://www.fema.gov/pdf/rebuild/ltrc/fema_apr_ch3.pdf.

- Gok, Y. (1995). Gerek Köyü'nde 30 Ekim Sonrası Yapılan Afet Konutlarının Başlıca Planlama Sorunları (*The problems in planning of the post-disaster houses in the village of Gerek*), DOĞU COĞRAFYA DERGİSİ/EASTERN GEOGRAPHICAL REVIEW, Vol:1 No:1, 174-199.
- Gok, Y. (1996). Erzurum-Kars Depreminin Ekonomik ve Sosyal Sonuçları/Economical and Social Results of the Earthquake in Erzurum-Kars (On October 30th 1983), Ataturk University, Institute of Social Sciences, Department of Geography, PhD Thesis, Erzurum, Turkey.
- Gok, Y. (2001). Erzurum-Kars Depremi'nden (1983) Sonra Yeri Değiştirilen Yerleşmeler/The replacement of the settlements after the earthquake, Erzurum-Kars, 1983, DOĞU COĞRAFYA DERGİSİ / EASTERN GEOGRAPHICAL REVIEW, Vol: 7, No:5, pp:145-158.
- Gok, Y., Zaman, S., & Altas, N. T. (2007). Askale Depremlerinden Sonra İnşa Edilen Konutların Sosyo-ekonomik Yonden İncelenmesi (The Socio-Economic Analysis Of Residences That Were Built After Askale Earthquake), DOĞU COĞRAFYA DERGİSİ / EASTERN GEOGRAPHICAL REVIEW, 12:8:111-134.
- Gok, Y. (2011). Erzurum-Kars Depremi (30 Ekim 1983) İle Aşkale Depremleri (25–28 Mart 2004) Sonrası İnşa Edilmiş Olan Afet Konutlarının Coğrafi Açidan Karşılaştırılmaları/Geographic Comparison of Disaster Homes Built after Erzurum-Kars Earthquake (30 October 1983) and Aşkale Earthquakes (25–28 March 2004), DOĞU COĞRAFYA DERGİSİ / EASTERN GEOGRAPHICAL REVIEW, 16:25:67-88.
- Gur, M. (2009). Alt ve Orta Gelir Grubuna Yonelik TOKİ Konutlarında Kullanıcı Memnuniyetinin Araştırılması: Bursa Örneği/An investigation on user satisfaction in TOKİ constructions for low and middle income people: The example of Bursa, MSc. Thesis, Uludag University, The Institute of Science and Technology, Department of Architecture, Bursa, Turkey.
- Hayli, S. (2001). Erzincan ovasında köy meskenleri (Les Domiciles dans les Villages de la Plaine d'Erzincan), (The village settlements in the plateau of Erzincan), Fırat University Journal of Social Science, 11:2:21-42.
- Holland, R. (2006). The Experimental Application of an Occupant Tracking Technology for Domestic Post-Occupancy Evaluation, PhD Thesis, University of Nottingham, Nottingham, UK.
- IFRC (2012). Post-disaster settlement planning guidelines, Geneva, Switzerland.
- Inal, E. (2008). Afet Sonrası Kalıcı Konutlarda Esneklik Kavramının Değerlendirilmesi: Golyaka-Duzce/Evaluation of Flexibility Notion on Post-disaster Permanent Housing: Golyaka-Duzce, PhD Thesis, İstanbul Technical University, The Graduate School of Natural and Applied Sciences, Department of Architecture, İstanbul, Turkey.
- Korkmaz, M. N. (2006). Diyarbakır ve Sanlıurfa'daki Toplu Konutların Kullanım Sonrası Değerlendirilmesi: Karşılaştırmalı bir analiz / A comparative analysis of post-occupancy evaluation of mass housing settlements in Diyarbakır and Şanlıurfa, MSc. Thesis, Dicle University, The Institute of Science and Technology, Department of Architecture, Diyarbakır, Turkey.
- Koutsikouri, D., Austin, S., & Dainty, A. (2008). Critical Success Factors in Collaborative Multi-Disciplinary Projects, Journal of Engineering Design and Technology, 6:3:198-226, Emerald Group Publishing.
- Kuyucu, T., & Unsal, O. (2010). 'Urban Transformation' as State-led Property Transfer: An Analysis of Two Cases of Urban Renewal in İstanbul, Urban Studies, 47:7:1479-1499.
- Leersum, A., & Arora, S. (2011). "Implementing seismic-resistant technologies in post-earthquake Pakistan: A process analysis of owner driven reconstruction", Elsevier Ltd., Habitat International, 35:254-264.
- McCarthy, F. X. (2010). FEMA Disaster Housing: From Sheltering to Permanent Housing, Congressional Research Service, USA.
- Mohapatra, R. (2009). Community Based Planning in Post-Disaster Reconstruction: A Case Study of Tsunami Affected Fishing Communities in Tamil Nadu Coast of India, PhD Thesis, University of Waterloo, Department of Planning, Waterloo, Ontario, Canada.
- Onder, D. E., Koseoglu, E., Bilen, O., & Der, V. (2010). The effect of user participation in satisfaction: Beyciler after-earthquake houses in Duzce, ITU Journal of Architecture, 7:1:18-37.

- Orhan, V. (2008). Toplu Konutlarda Kullanım Aşaması Kalite Değerlendirmesi: Eryaman 7. Etap Toplu Konut Uygulaması/ Quality Evaluation of Mass Housing for the Occupancy Process: 7th Stage Eryaman Mass Housing Application, MSc Thesis, Gazi University, The Institute of Science and Technology, Department of Architecture, Ankara, Turkey.
- Ophiyandri, T., Amaratunga, D., & Pathirage, C. (2012) 'Critical success factors for community-based post-disaster housing reconstruction project (CPHRP) in pre-construction stage in Indonesia', Australasian Journal of Construction Economics and Building, Conference Series, 1:2:80-92.
- Peker, K. (2004). The causes and results of internal migration from rural areas: case of Eastern Anatolia, Agricultural Economy- CZECH, 50:10:471-476.
- Sarpkaya, A. (2011). Bir Kentsel Dönüşüm Ironisi: Osmaniye'de Yapılan ;Yeni Toplu Konut Uygulamaları/ The Irony of an Urban Renewal: The New Public Housing Applications in Osmaniye, MSc Thesis, Cukurova University, The Institute of Science and Technology, Department of Architecture, Adana, Turkey.
- Tercan, B. (2008). Afet Bölgelerinde Yeniden Yerleştirme ve Iskan Politikaları: Doğubeyazıt Afetzedeki Yerleşim Alanları Uygulamaları / Relocation and Resettlement Policies on Disaster Areas: The Case of Doğubeyazıt Province and Four Villages, PhD Thesis, Ankara University, The Graduate School of Social Sciences, Department of Politics and Public Administration, Ankara, Turkey.
- Tezer, A., & Yigiter, R., (2000). "Impacts of 17th August Kocaeli Earthquake on the Development of Rural Settlements", 40th Congress of The European Regional Science Association, Barcelona, Spain, 29 August-1 September 2000.
- Ulubas, A. (1980). Post-earthquake Housing in the Villages of Gediz, Proceeding of the 7th World Conference on Earthquake Engineering, 9:360-362, Istanbul, Turkey.
- UNCHS, The United Nations Centre for Human Settlements (2001). Guidelines for the Evaluation of Post Disaster Programme-A Resource Guide, available on <http://www.unhabitat.org/content.asp?cid=1264&catid=286&typeid=16>.
- UNDRO, Office of the United Nations Disaster Relief Co-Ordinator (1982). Shelter after Disaster: Guidelines for Assistance, New York, USA.
- Unlu, A., Kapucu, N., & Sahin, B. (2010). Disaster and crisis management in Turkey: a need for a unified crisis management system, Disaster Prevention and Management, 19:2: 155-174.
- World Bank (2010). Safer Homes, Stronger Communities: A Handbook for Reconstructing after Natural Disasters, Chapter 5: To Relocate or Not To Relocate.
- Zappettini, K. (2001). Rural Self-Help Housing: A Post-Occupancy Evaluation of Homeowners' Satisfaction with Residential Space Plan and Housing Quality, Virginia Polytechnic Institute and State University, PhD Thesis in Near Environments, Blacksburg, Virginia, USA.
- Zariç, S. (2012). "City Planning in Turkey and the Dimension of Enlargement in TOKI's Planning Power", Kirghiz-Turkish Institute of Social Sciences, E-Journal of Social Sciences, 28:1-19.

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HOUSING AND RECONSTRUCTION IN CHILE (2010-2012): Institutional and social transformation in post-disaster contexts

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Abstract

Stemming from the assumption that disasters present unique conditions to rethink the associations and relationships among different actors, while acknowledging post disaster reconstruction as a political process that may generate momentum for institutional transformation; this article discusses the institutional responses to housing in such a transformative moment. Grounding the empirical terrain into the 2010 Chilean earthquake, the article is concerned with how the institutional response to housing needs has been influenced by the neoliberal context and civil society in the aftermath of the event. Its objective is to review the changes in housing policy over this period, and to what extent these changes are proposing a new social order, or consolidating the existing one; to what extent civil society claims can challenge contexts of exclusion; and to what extent the actors' roles change or remain static. To do so, it develops a series of criteria to apply to the reconstruction process and housing policy transformation that took place after the earthquake. The main findings show that the institutional responses have promoted the consolidation of a model rather than a transformative process. By contrast, social organisations have embraced elements of transformation towards collective capability strengthening that are not necessarily recognised by formal institutions.

Keywords: housing policy; reconstruction; Chile; institutional transformation; right to the city; neoliberalism.

INTRODUCTION

"I propose to consider the construction of reciprocal actions and, particularly, the reciprocal determination of subjects at the core of political practice" (Lechner, 2006:162 [author's translation]).

The process of production of a social order based on a reciprocal determination of different actors is difficult to achieve. There are moments, however, that give rise to exceptional conditions that may trigger such processes. Disasters affect both human and non-human agents, presenting unique conditions to rethink the associations that are linking them. A disaster can imply the strengthening or reordering of those relationships and the roles that they play. Reconstruction is a political process that may generate momentum for institutional transformation, challenging the position and capabilities of State, private sector and civil society alike. Due to its central role in reconstruction, institutional responses to housing needs can play a critical role in such transformations (Boano and Hunter, 2012).

In 2010 a devastating earthquake affected Chile's most populous area. Its timing coincided with the beginning of the first right-wing government in 20 years, and with the emergence of emboldened social movements. This article is concerned with how the institutional response to housing needs has been influenced by the neoliberal context and civil society claims since the earthquake in 2010. Its aim is to review the changes in housing policy over this period, and determine to what extent these changes are proposing a new social order, or consolidating

the existing one; to what extent civil society claims can challenge contexts of exclusion; and to what extent the actors' roles change or remain static.

It is organised in two parts. The first, frames the discussion around the meaning of transformation in a context in which, as described by Latour (2005), actors cannot be grasped, misunderstanding their relations and asymmetries. Post-disaster contexts, as political processes facing the reshuffling caused by the catastrophe, offer an exceptional opportunity to think about a new order of associations. This work argues that such reordering can be shaped both by the neoliberal context, consolidating exclusion structures, as it can by the *right to the city* claims that, insofar they are collective, can be transformative. The first part concludes generating a list of variables worthy of discussion regarding such transformations. The second section describes the case for analysis: housing policy transformation after the 2010 earthquake in Chile. Following the historical and socio-political context, we will analyse the institutional transformations of responses to housing needs and social process between 2010-2012. This analysis will take place through normative documents, official and non-official speeches, as well as other available data.⁶

This paper uses secondary data as a source for inquiry into the changes in housing policy over the reconstruction period. Methodologically, it looks to apply conceptual categories to understand the transformative potential of the process so far. It seeks to specifically assess to what extend changes in housing policy over the 2010-2012 period are proposing a new social order, or consolidating the existing one. The implications expected from such analysis are to open a discussion about the distance between transformations led by civil society and the institutional responses led by the government. This dialogue points towards identifying the main opportunities for housing policy, in the task of reconfiguring the social order from a reciprocal determination perspective.

PART 1: TRANSFORMATION IN POST-DISASTER PROCESSES: RIGHT TO THE CITY CLAIMS IN A NEOLIBERAL CONTEXT

Institutionalisation, transformation and disasters: some definitions

In every dimension, collective and individual actions transform relations and shapes. We will define a framework to analyse transformation processes in a post-disaster context in circumstances in which, as defined by Latour (2005), any object or event is embedded in a set of associations among actors. As Young (1990) notes, a transformation process towards justice requires both distributional and institutional components. We will focus on institutional components, for their politically recognised transformation processes, likewise for their ability to influence distributional order. In this section, we will define some of the key concepts that will inform such a framework.

What does institutionalisation mean? According to Abercrombie, it is “the process whereby social practices become sufficiently regular and continuous to be described as institutions’, that is, ‘social practices that are regularly and continuously repeated, are sanctioned and maintained by social norms, and have a major significance in the social structure’” (in Levy, 1997:254). Institutionalisation implies the political and cultural recognition of transformation processes.

A transformation process implies a setting of new social orders through the redefinition of the roles of different actors -State, private sector and citizens-, and the nature of their relationships. The difficulty of such a redefinition of roles is that “to use the word ‘actor’ means that it is never clear who and what is acting when we act since an actor on stage is never alone in acting” (Latour, 2005:46). Any actor is within networks that place its agency among others. In such networking, elements can have a different nature, or, as defined by Latour, *not all actors look like humans*, and changes in any dimension of the environment can trigger processes of transformation.

⁶ Most of the data was obtained by direct request to governmental departments, under the Law 20,285 for Access to Public Information, Chile.

In other words, the actions of individual actors cannot be grasped without understanding the associations in which they are embedded. These associations involve asymmetries related to information, resources and power, which are impossible to ignore. Exchange, collaboration and even participation are already forms of conflict (Miessen 2010), occurring in spaces that are not neutral but are themselves shaped by power relations (Cornwall, 2003). In these spaces of collaboration and conflict, such asymmetries appear in the capability of actors who use their agency to influence the world around them.

Can a process of transformation and institutionalisation challenge such asymmetries, on a process of reordering relationships towards reciprocal determination? Changes in the environment may imply a reshuffling of associations: “a new planetary system is discovered, a new law is voted, a new catastrophe occurs. In each instance, we have to reshuffle our conceptions of what was associated together because the previous definition has been made somewhat irrelevant” (Latour, 2005:6). There are events that shift relations among human and non-human actors, triggering the possibility to reshape the social order, representing an opportunity for reducing asymmetries through a political process.

A catastrophe produces a reshuffling that requires different actors to reorder associations. The nature of such reordering will be eminently political, considering Rancière’s definition in which “politics implies a disruption of the order of the police (...) [that] refers to an established social order of governance with everybody in their ‘proper’ place in the seemingly natural order of things” (Dikeç, 2005:174). The process of reconstruction, insofar as it implies a reordering of actors’ roles, is a political process (Zetter and Boano, 2010; Boano, 2009; Lyon, Schinderman and Boano, 2010).

This process of reshaping connections can trigger the institutionalisation of new orders. As in science, in which a paradigm shift “is seldom or never just an increment to what is already known” (Kuhn, 1962:7), those unique reactions may present the opportunity to reframe institutions: to trigger radical transformation challenging structures.

Often, the magnitude of a “natural disaster” is reached partly due to “unnatural” causes: either by lack of foresight, previous destructive actions, or inadequate responses (Rodríguez, 1990). Natural disasters can become social catastrophes due to the associations shaping their effects: they don’t affect everybody in the same way, and may reproduce inequality and power asymmetries. It implies that the opportunity to reframe institutions may be dominated by certain actors reproducing spaces of “tyranny” (Cooke & Kothari, 2001).

Can a disaster trigger radical institutional transformation that challenges structures, despite the pressures of a context of exclusion sustained by a neoliberal structure? It may be important here to introduce Sen’s concept of “development as freedom”; Sen introduced the idea of people perceived as agents of change rather than mere recipients of it, and the concept of freedom as the *opportunity to achieve* rather than the *autonomy of decision* (Frediani, 2009; Frediani and Boano, 2012). If freedom is the opportunity to achieve, then the increased capabilities are central in the achievement of freedom. Accordingly, it is possible to view a disaster as a progressive opportunity providing the possibility of reordering use associations to improve capabilities.

The main obstacle takes place given the problematic definition of freedom and capability, considering that neoliberalism is based on the idea of championing individual freedom. Understood as individual values, they may reinforce and “support the development and expansion of the neo-liberal approach” (Frediani, 2009:11), rather than challenging existing paradigms. The question of freedom and capabilities, therefore, should be accompanied by the question about collectiveness. As was discussed, actors have to be understood within networks that place their agencies among others. In the political processes of the post-disaster context, actions should be shaped from communal agencies to be truly transformative.

This idea of collectiveness can be framed within the discourses of *Right to the City* (RTC hereinafter). In the next two sections, we will review how reconstruction can transform the current context of neoliberalism and exclusions; first, defining the neoliberal context, and then such collective RTC claims.

Transformation in a neoliberal context

Neoliberalism can be defined as a “theory of political economic practice that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterised by strong private property rights, free market and free trade” (Harvey, 2005:2).

Most of the social catastrophes triggered by natural disasters can be explained by the political-economic context in which they occur. In neoliberal contexts, the close relationship between financial dynamics and urbanisation acts as a strong force. As Harvey explains, the *politics of capitalism* are mainly shaped by the “perpetual need to find profitable terrains for capital-surplus production and absorption” (2008:24). The intimate connection between capitalism and city production comes out “since urbanization depends on the mobilization of a surplus product” (*op.cit.*).

Urbanisation is influenced by its dependency on surplus absorption, but actors are affected differently according to their asymmetric social positions. The consequences of these dynamics lead to exclusionary processes on the economic, political and cultural arena (Madanipour, 2000).

How does the relationship of surplus absorption/urbanisation affect a post-disaster scenario? In neoliberal contexts, a few actors often control both the means of production and the decision power, and therefore have a strong capacity to use their agency to shape the process. In practice, it implies that in the course of reordering associations after a disaster, exclusionary processes can be exacerbated.

Even though some neoliberal economists put poverty reduction as a core challenge, since “satisfying the needs of the poor (...) will directly affect economic growth” (Edwards, 1995:252), these attempts to face poverty from an individual standpoint have not successfully challenged power structures nor decreased inequalities⁷. The consolidation and reproduction of exclusionary dynamics should be at the centre of questions about what powers can be challenged in a post-disaster context. Looking at capability and freedom from a collective standpoint is key to challenge not neoliberalism itself, but its consequences on exclusion. How can those collective capabilities be built and moved to the political arena in order to transform institutions?

Collective Right to the city claims

The question about collective RTC claims being made by social movements emerges to understand how reconstruction acts as a catalyst within a context of neoliberalism, and their influence in radical institutional transformation.

What does RTC mean? Harvey defines it as “a right to change ourselves by changing the city” (2008:23), based on the Lefebvrian conception of *creation* of rights through political action. In a contemporary context, RTC has become a slogan that “seek[s] to influence public policy and legislation in a way that combines urban development with social equity and justice” (Mayer, 2009:368).

What is the role of RTC claims in the context of neoliberalism? Because it “focuses on the question of who commands the necessary connection between urbanisation and surplus production and use” (Harvey, 2008:40), it should be understood as an ideal whose first mechanism is to increase democratic control over the production of such surplus. Along with increasing democratic control over surplus, a transformation coming from civil society can imply reshaping capabilities, and therefore challenging power asymmetries.

If empowerment is “where people, organizations and communities have control over their affairs” (Rapoport in Sanoff, 2008:62), then a process of transformation in a post-disaster context led by people’s claims, is also a process of empowerment, one that increases their freedom to act and have agency over their associations. How can this be developed collectively? Empowerment

⁷ Chile belongs to the OECD, where the after-tax income Gini Index average is 0.31. Chile has an after-tax income Gini Index of 0.49.

can also be understood as the strengthening of citizenship, defined as a practice rather than a legal status (Hickey & Mohan, 2005); and as the reinforcement of collective intelligence, by which “the outcome is more insightful and powerful than the sum of individual perspectives” (Sanoff, 2008:60).

Civil society organisations have the potential to trigger deep transformation, but at the same time face difficulties in the process of institutional recognition, given the aforementioned concentration of power. It requires the generation of a civil society with the capabilities to organize themselves and to design (Dong, 2008; Boano and Garcia, 2011; Boano, 2013; Boano, García La Marca and Hunter, 2013)

Framework for analysis: transformation of institutional responses to housing needs

An approach has been presented of how institutional transformation may be shaped in a context of multiple actors with different power relationships. There has been a focus on two elements that may have agency: neoliberalism and exclusion, and collective RTC claims. Focused on these two aspects, we will concentrate on transformation in terms of institutional responses to housing needs.

Why housing? “Housing reconstruction is pivotal for the overall social and economic recovery of war- or disaster-affected countries and communities” (Barakat, 2003:37). After a disaster there is an extraordinary demand for housing, which, as a multidimensional city-builder (Fiori *et al*, 2001), has implications in economic and social associations.

Responses to housing needs are also particularly important for the two spheres mentioned: in neoliberal contexts, its production is a main driver of economy, and in terms of civil society, it is one of the main assets that mobilises people’s organisation. The political significance of housing is undeniable.

The case study will be the on-going reconstruction process in Chile after the 8.8° Richter (M_w) earthquake in 2010, which will be used to review how the reconstruction has acted as catalyst for change. It will seek to determine how the institutional transformation concerning responses to housing needs has been influenced by the context of a neoliberal agenda, whether the social movements emerged with RTC claims, or both. Additionally it will help to understand if there has been any transformation in terms of increased collective capacities.

A matrix based on the main variables that define the consolidation or transformation of a social order will be used as a framework for analysis. Based on the definition of neoliberalism and collective RTC claims discussed, the variables and criteria are (figure 1):

1. Transformation process led by top-down decisions or participatory processes, in order to understand the level of decentralisation of decision-making, facing asymmetries and opening space to improve capabilities.
2. Promotion of housing production led by individuals or collectiveness; on the understanding that it is through collectiveness that exclusion structures can be challenged.
3. Incentives for a concentrated or democratically controlled absorption of urban surplus generated through housing production.
4. Promotion of urban patterns of segregation or inclusion.
5. Consolidation (through strengthening current hegemonic structures), or transformation (through deep reforms in actors’ associations) of political and economic dynamics.

PROCESSES		
1) Processes of transformation led by:	Top-down decisions	Participatory processes
2) Promotion of housing production led by:	Individuals	Collectives
3) Incentive of absorption of urban surplus:	Concentrated	Democratically controlled
4) Promotion of urban patterns:	Segregation and exclusion	Inclusion
5) Political and economical dynamics are:	Consolidated [improvement]	Transformed [reform]
IMPLICATIONS	neoliberal consolidation	collective transformation ensuring RTC

Figure 1: Variables and criteria for a transformation process (Source: Authors).

The focus will be in the transformations of housing production, but also in its implications for actors' roles. There will also be focus on how, after disaster, collective RTC claims can emerge, transforming citizens power and reciprocal determination capacities.

PART 2: HOUSING POLICY IN CHILE: POST-DISASTER TRANSFORMATIONS (2010-2012)

To examine the institutional transformation concerning housing needs responses in Chile after 2010, it is necessary to introduce the context. We will first present a historical review, both in terms of reconstructions and housing policy; and then, the specific socio-political context in the 2010-2012 period.

Chile, a country of reconstructions

In the last 100 years more than 30 earthquakes with a magnitude over 7.0M_w have hit the Chilean territory. It could be defined as a periodic *pulsation* that has shaped the development of society and cities, influenced by diverse ideological agendas at different moments of history (Cocifia, 2010). These pulsations have also implied institutional changes after disasters.

In 1939, the 7.8M_w earthquake near Chillán coincided with the government that implemented a first modern State with a developmental agenda⁸. The main institutional transformation that followed the catastrophe was the creation of CORFO (Corporation to Promote Production). Its creation was triggered by a conviction regarding the key role that economic reactivation plays on reconstruction. It was intimately related with the productive development of the following decades, and even today plays a key role in terms of promotion of innovation and enterprises.

Another example is what happened after the 9.5M_w earthquake and tsunami in 1960 in Valdivia, which is hitherto the most powerful earthquake ever recorded. There are many institutional changes that followed it: the promotion of the first seismic construction laws; the

⁸ The governments of the Radical Party were in the period 1939-1952.

creation of financial incentives to the construction of low middle-class housing (DFL2), that still operates; and the creation of ENTEL, the National Telecommunications Company that replaced the original network damaged by the earthquake.

In a different political context, a 7.8M_w earthquake hit Santiago and Valparaíso in 1985. After 12 years of military dictatorship led by Pinochet, the economic reforms implemented by the *Chicago Boys* following Milton Friedman's ideas, had built the base of the neoliberal model. In this context, some institutional changes happened: the implementation of an improved seismic construction regulation (NCh-433); and following the government macroeconomic agenda, the promotion of private action in construction through tax exemptions that exist even today.

During the 20th century, State and private sector roles in city production have been reshaped after disasters. As we will see, after 2010 it appears to be an appropriate juncture to ask about the role of civil society.

A century of housing policy

The history of institutional responses to housing needs in Chile extends back more than 100 years, with the "workers housing law" of 1906. During the first half of the century the urban population increased so fast that any official effort was insufficient⁹. It was in the 1950s, when housing deficit became a real State problem: urban growth led to the organisation of informal settlement dwellers, called *pobladores*, occupying land, negotiating collectively and increasing the social pressure for appropriate solutions. By 1957, in Santiago alone there were more than 40 informal settlements where more than 35,000 people lived (Garcés, 2002).

New subsidy strategies and a bigger social pressure characterised the 1960s (Hidalgo, 1999). There were different approaches to low cost housing production, from massive modern estates, to *marking land operations*. The ever-growing demand for housing of the poor and a highly polarised political context characterised the ages at the end of a modernist era.

After 1973's coup and subsequent 17 years dictatorship, the implementation of neoliberalism and subsidiary State completely shifted every sectorial policy. Housing policy reforms left in private hands, the design, construction and capitalisation of profits of social housing production, while residents became owners of the houses through State subsidies. This scheme, running from the 1980s, allowed the building of thousands of units, reducing dramatically the housing deficit (figure 2).

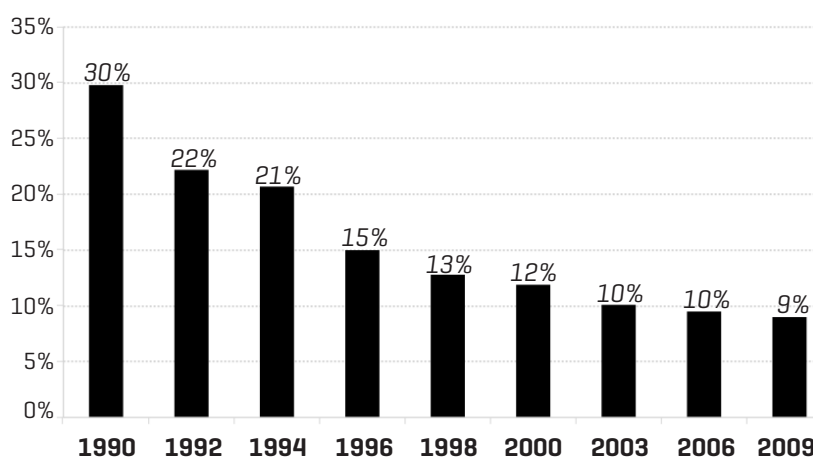


Figure 2: Households with housing needs (%) 1990-2009
(Source: Authors, based on data from Datavos (2009)).

The scenario after three decades of such a model has different faces. The positive numbers contrast with massive displacement, the production of segregated cities, the decline of social

⁹ In the 1930s decade urban population in Chile was more than 50%. Currently, almost 90% of population is urban.

cohesion, and the failure in the attempts to decrease inequality. The product was the construction of extensive areas of housing on cheap land to increase private profits, socially and functionally homogenous, in which the houses are understood as commodities (Rebolledo, 2011), and citizens as customers whose purchasing power is subsidised by the State. It has implied the emergence of the problem of those with roof (Rodríguez & Sugranyes, 2004), who have access to formal houses but live in stigmatised territories, with social and economic consequences, as the diminished value of State and family housing investment.

During the past two democratic decades, housing institutions have changed partially. As in other sectors, changes after the dictatorship have been processes of “improvement” but not deep “reform”, as defined by Atria (2012): there have been corrections to the system, but not a process of re-ask what should be the role of the State in providing responses. In terms of housing, such improvements of the system included a progressive increase of the size and quality of housing solutions delivered, as well as changes in financial mechanisms, but not to fundamentally question roles and definitions. In 2002, the “Dynamic social housing without debt” programme was implemented, whereupon the poorest groups receive a house without a loan, facing one of the main socio-political conflicts at that moment with the “housing debtors”. The same year, the “competitive funds for solidary housing projects” programme was introduced, promoting the organisation of people to develop alternative projects to what the traditional sector offered.

After 2007 reform of National Housing Policy, institutional attempts emerged to face some of the shortcomings described above. With the creation of the “Housing Solidary Fund” (FSV), any application of poor people for new housing had to be done collectively, with groups of families organised in collaboration with a “Social-Estate Management Body” (EGIS). Additionally, the subsidies system introduced new variables, such as the creation of special subsidies for Socially Integrated Projects (PIS); for densification projects; and for well-located projects. Further, the “Family assets’ protection programme” (PPPF) started promoting the improvement of houses and public spaces. Supreme Decree-40 (DS40) was passed in 2007 as a subsidy for the construction of middle-class housing. A main effort in order to face problems of vulnerability and ghettoisation of neighbourhoods was made creating the programme “I love my neighbourhood” (PQMB), with focus in participatory processes and social and physical improvements.

These efforts, however, have been insufficient to tackle the problems of urban inequality. The location subsidies, for instance, were in practice absorbed by the increasing land prices; the social-integration subsidy has been used only in a few exceptions; and the PQMB and its 200 pilot neighbourhoods have had different levels of success.

There have been improvements to a system that needs to ask itself what the role should be for the State, private sector and citizens in the construction of the built environment. The earthquake and 2010 social context has appeared to be a great opportunity to re-ask such a question. Part of that context is what we will review in the next section.

Table 1: Acronyms used in this paper (Source: Authors).

CORFO	Corporación de Fomento a la Producción <i>Corporation to Promote Production</i>
DFL2	Decreto con Fuerza de Ley 2 <i>Decree with legal force 2</i>
DS1	Decreto Supremo-1 <i>Supreme Decree-1 for middle classes</i>
DS40	Decreto Supremo-40 <i>Supreme Decree-40 for middle classes</i>
DS49	Decreto Supremo-49 <i>Supreme Decree-49 for poor groups</i>
EGIS	Entidad de Gestión Inmobiliaria Social <i>Social-Estate Management Body</i>
FNR	Fondo Nacional de la Reconstrucción <i>National reconstruction fund</i>
FSV	Fondo Solidario de Vivienda <i>Housing Solidary Fund</i>
LRC	Ley Reservada del Cobre <i>Restricted law on copper</i>
MINVU	Ministerio de Vivienda y Urbanismo <i>Ministry of Housing and Urbanism</i>
MNRJ	Movimiento Nacional por la Reconstrucción Justa <i>National Movement for the just reconstruction</i>
PIS	Proyectos de Integración Social <i>Socially Integrated Projects</i>
PPPF	Programa de Protección del Patrimonio Familiar <i>Family assets' protection programme</i>
PQMB	Programa Quiero mi Barrio <i>Programme: "I love my neighbourhood"</i>
PRES	Planes Reconstrucción Estratégico-Sustentable <i>Strategic-sustainable reconstruction plans</i>
PRU	Planes Regeneración Urbana <i>Regeneration Urban Plans</i>
RTC	Righ to the City

The political magnitude of 2010 shocks: 2010-2012 context

After the earthquake on the 27th of February, people considered that Chile was facing two big shocks: one tectonic, the other political. One month before the earthquake, the first right-wing president since the end of dictatorship was elected. Twelve days after the earthquake, the millionaire businessman Sebastián Piñera assumed power. The diverse natures of the associations among actors were completely shifted in a few months, and the task of reordering such links appeared to be a challenge full of uncertainties.

Piñera's election was considered the iconic end of 20 years of "democratic transition" of social-democratic governments. After a few months, it had to face the emergence of social discontent. From April 2011, a well-articulated student movement took action through huge street

protests, asking for good quality and public education. The education system, like housing, was partially privatised during the 1980s, increasing the enrolment rate to universities under an expensive and under-regulated system. This system reproduces a segregated structure in which the quality of education is directly related to how much someone can pay, and from which profits stay in private hands. The student movement grew with increased citizens support (over 80% at the end of 2011), while public support for the government dropped (under 30% at the end of 2011).

The question inevitably arising is why the social discontent appeared on the streets in 2011 and not before, when inequalities and education injustices were the same. The arrival of Piñera to the presidency symbolised the inauguration of a businessman government. Historically, there has been a positive evaluation of Chilean institutions. In 2011, confidence in institutions fell, leaving Chileans without a reference framework; but the social movements initiated the building of such a framework from its citizenry. It is within this socio-political context that reconstruction has occurred.

In terms of housing policy, Piñera's programme represented basically a continuity option. Notwithstanding, there were some changes proposed by Piñera during the period prior to the presidential election. The main divergence was in the management of subsidies; while the last years' reforms had focused in the diversification of subsidies according to different urban and social situations, Piñera's programme proposed a "simplification" of the system, alluding to the over-complicating procedures, and return to individual application for housing (Amaral, 2010).

But twelve days before Piñera took office, the 8.8M_w earthquake and tsunami affected around 900 small towns, 45 cities, 4 local capitals, and 1 metropolitan area (Bresciani, 2010), with hundreds of fatalities; just in terms of housing, the investment needed in the three most affected regions represented 557% of the 2009 Ministry of Housing budget for the same regions (Cociña, 2010). The government promised free solutions to every person affected in the short-term, with announcements from the President about an *historic process* of a complete reconstruction in 2.5 to 4 years, while experts spoke about at least 10 years (Poduje in Valenzuela, 2012).

This mismanagement of people's expectations had consequences in the social perception of the process. The climate of social unrest led by the students' movement, also influenced the reaction. Even if thousands of people have used subsidies to rebuild their houses or move to new ones, some groups of people with more complex situations were excluded from the standard responses: people who rented in central areas where the land value is too high; people whose source of income disappeared or changed radically; people who used to live in areas that after the tsunami are considered risky; etc.

This triggered the organisation of people in some emblematic places such as Dichato (a touristic and fishing village devastated by the tsunami), Barrio Yungay (a central heritage-neighbourhood in Santiago), or the neighbourhoods' organisations in central Talca, a medium-sized city where over 60% of the central area was damaged, and where most of the people were renting.

These small organisations started with locally conducted activities. In January 2011, the "National Movement for the just reconstruction" (MNRJ) was constituted, bringing together NGOs and CBOs from different regions (figure 3). The claims of MNRJ are real participation and transparency in the process of reconstruction, and the right to stay in neighbourhoods on well-situated land (MNRJ, 2012).

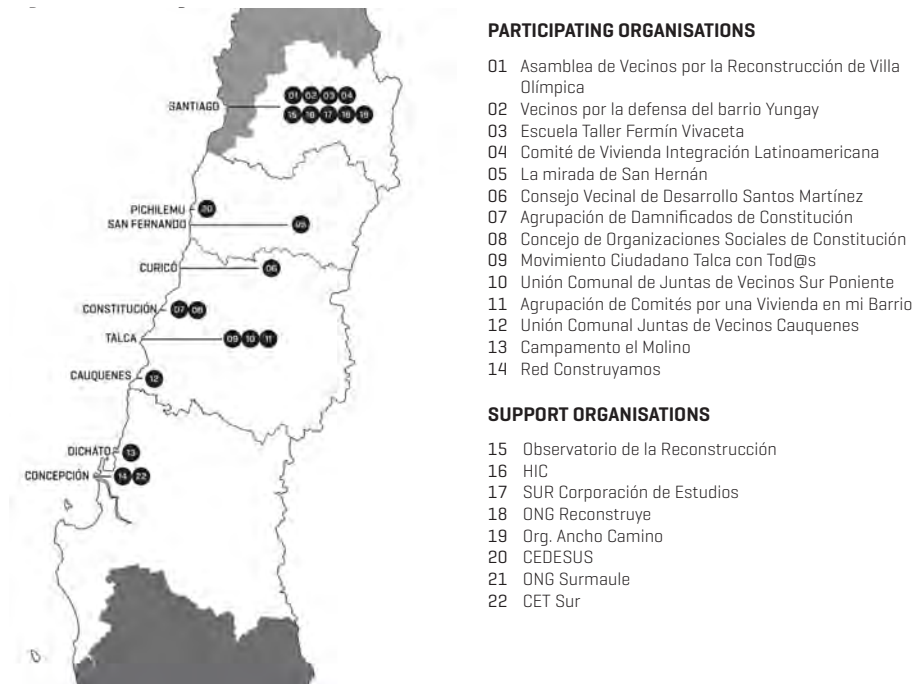


Figure 3: MNRJ Organisations
(Source: Sentidos Comunes (2011)).

Institutional transformations to respond to housing needs analysis

To deal with the challenges that the reconstruction involved, the recently instated government developed different responses:

1. **Resources:** it was necessary for Parliament to approve significant additional funding. The government proposed two mechanisms: a Reconstruction Financing Act, that included reallocation of several taxes, including US\$ 300 million from the "Restricted law on copper" (LRC), that is usually used by the army¹⁰; and a "National reconstruction fund" (FNC), that was supposed to collect US\$300 million in two years through donations (Echenique & Ramírez, 2011).
2. **Governability:** authorities of reconstruction were defined: a national coordinator of housing reconstruction, and a national coordinator of urban reconstruction. Additionally, an inter-ministry committee was created to coordinate different initiatives.
3. **Planning:** "Strategic-sustainable reconstruction plans" (PRES) were proposed for the 13 main urban areas affected; the scheme was that a private company signed an agreement with the municipality, paying to a consultant office (selected by the private company), to develop in 90 days a plan for the city. Then, a new model of Urban Regeneration Plans (PRU) was implemented for medium- and small-size cities, this time publicly bidding to consultant offices.
4. **Housing:** once the emergency had been overcome, the government decided to face reconstruction with basically the same institutional tools that existed before, hence the State subsidises, the demand and the private sector produces the solutions.

The success of such mechanisms has been highly disputed. The allocation of resources has not been as efficient as was expected; after the first year of reconstruction, the funds of the LRC

¹⁰ Another US\$300 million was going to be designated to reconstruction of military dependencies, so the final amount from the "Restricted Law on Copper" was US\$600 million.

were invested in the capital market and not spent in reconstruction (Echenique & Remírez, 2011). The FNC was supposed to receive US\$150 million per year, and after two years it had collected little more than US\$26 million, 8.7% of what was expected¹¹.

In terms of governability, both “authorities of reconstruction” were defined as “advisors”, without political responsibility. So much so, that even though the authority in housing had played an important coordination role, the authority of urban reconstruction abandoned the position, leaving it vacant since August 2011. The inter-ministry committee worked for a limited period, with no institutional long-term projection. By February 2012, for example, the Housing Ministry declared not having in its possession the “Reconstruction and Emergency Plan”, developed by that committee¹².

The strategic-sustainable reconstruction plans (PRES) were developed just partially, and, because they were based on agreements between private companies without public definitions for investment priorities, most are just on paper, despite their quality (Bresciani, 2010). The instrument created for small and medium-size towns (PRU), however, has grown beyond the towns affected by the earthquake, covering almost the whole national territory. It can be explained by the public nature and administration of the PRU, unlike the PRES, that has allowed it to remain as an institutionalised tool.

In terms of housing, there was an extraordinary demand faced with an ordinary answer. There was an assumption about the capacity and will of the market to answer. The extraordinary demand was massive, urgent and diverse, but the private sector’s response was conservative; the complex and diverse demand has been beyond its response capacity.

The question is, if the institutional changes in response to housing needs after the 2010 earthquake have been transformative in terms of collective RTC claims, or whether they have simply reproduced exclusionary structures. We will review three processes: housing reconstruction; the changes in housing policy; and social transformations.

Housing reconstruction programme

Housing reconstruction was implemented with the same instruments existing before the earthquake, to maximise efficiency. The main instruments used were the FSV, DS40 and PPPF, with small variations such as the elimination of the saving requirement. By June 2012 (MINVU, 2012), the 222,418 subsidies for housing that the government was supposed to provide were already allocated to families¹³, 102,324 of which were finished, 70,677 were under construction and 49,414 were just allocated (figure 4).

¹¹ Information provided by the Treasury Department (*Ministerio de Hacienda*) as an answer to the request made by the author through the web <https://www.accesointeligente.org>, in July 2012.

¹² Information given as an answer to the request made by Nicolás Valenzuela for the “Plan de Emergencia y Reconstrucción” through the web www.minvu.cl, under the Law 20,285 of Access to Public Information, in February 2012.

¹³ This means that the subsidies have been designed for a person, but not necessary have been used or assigned to a property.

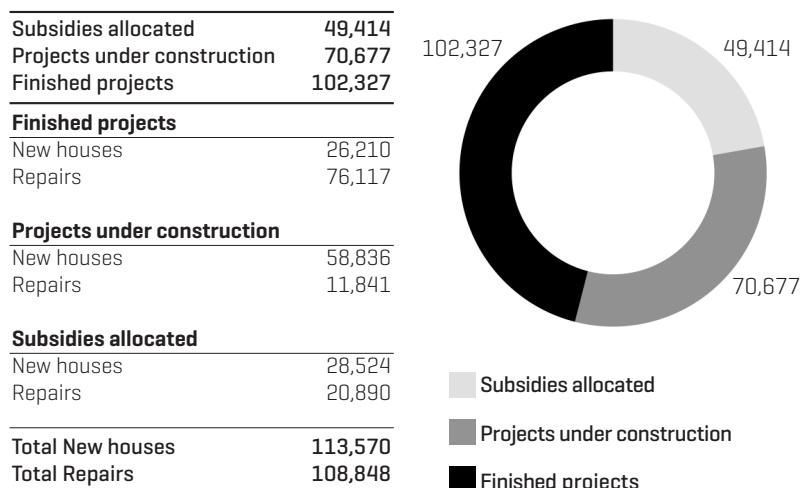


Figure 4: Subsidies allocated, projects under construction and projects finished by 30th June 2012
(Source: Authors, based on data from MINVU (2012)).

In order to analyse the consequences of such a programme, we should return to the initial five conceptual criteria to measure the level of transformation this policy has triggered (presented in figure 1). Using policy documents and information about the process of the past 2 years, each criteria will be assessed positioning the policy analysed as a means of structural consolidation or transformation, according to the conceptual framework presented.

First, has the transformation process been led **by top-down decisions or participatory processes**? The mechanism was a public call to construction companies to develop *standardised projects*, where participation was limited to the process of *choosing* among the solutions presented. In the words of the national coordinator for housing reconstruction, “the families choose the housing solution that they want. The fantastic thing is the competition among companies, because the construction firms are looking to differentiate themselves to be chosen. (...) we could ask the families to choose the *winning* company (...) and the process was beautiful” (Ivelic, 2010). The kind of participation here assumes the citizens as customers, whose liberty is in the possibility to choose among market options.

This is linked with the second criterion, the question about **individualism or collectiveness**. Because of the conceptualisation of beneficiaries as customers, most of the developments were done for individual families. Apart from few exceptions in which communities became organized of their own volition, the reconstruction has promoted an individual approach to housing, eliminating the requirement of a Social-Estate Management Body (EGIS) coordinating groups. For cases in which the demand was too dispersed on the territory and there was not profitability for the construction companies, the authorities organized groups of families that voted among a set of proposals (Ivelic, 2010), but even if the decision here was collective, it did not encourage organisation.

The third point is about the incentives for a **concentrated or democratically controlled absorption of urban surplus**. This is closely connected with the other two: the decision was to promote the competitiveness among existing construction companies to generate standardised solutions, generally avoiding process of self-construction or management. The promotion of external agents managing reconstruction surplus was evident not just in the construction of the houses, but also in the other activities such as the purchase of construction materials: one month after the earthquake the government, without public tender, designed the three main hardware retailers as the suppliers of reconstruction materials (Biobío Chile, 2010).

The fourth point is about the promotion of **urban patterns of segregation and exclusion or inclusion**. The government made big efforts to promote the construction of “*standardised*

projects on residents' plots" for families who owned land, and *"tsunami-resistant"* houses for the coast. However, a large number of families were renting, subletting or sharing in areas where the land value is too high for the profit aims of construction companies. These families have faced the threat of evictions from their original neighbourhood to more peripheral ones. Did it affect the location of reconstruction projects? To answer this we will review the information for houses built in different districts. We will concentrate in the regions in which the number of projects for new houses is significantly more than for those of repairs: O'Higgins, Maule and Biobío¹⁴. The main urban areas of each region are Rancagua, Talca and Concepción, respectively. To evaluate how the reconstruction has affected territorial distribution, the number of subsidies allocated in the three cities is compared with the average of each region, differentiating between subsidies in central and peripheral districts. The indicator used is the number of subsidies allocated per 100 inhabitants, taking as a base the population of each district. The objective is to review if housing reconstruction for affected families has focused on the regeneration of centres or expansion of the periphery (figures 5-6-7).

The data shows that in the three regions the rate of subsidies allocated in the central districts of the urban area are below the regional average. In the region of O'Higgins, the average rate is 3.07 subsidies allocated per 100 persons; in Rancagua central district this rate is 2.72, while in peripheral districts as Graneros it is 3.90. One could argue that, without the information about the housing damaged by district, this information doesn't necessarily imply displacements. In the case of Talca, however, it is clearer. While the regional rate is 4.96 subsidies allocated per 100 inhabitants, the rate in central Talca is 3.04, and in peripheral districts such as Penco, Maule and San Rafael it is over 7, 10 and 11 respectively. This contrasts with the information about the damages in the city of Talca, which were mainly concentrated in the central area, where 63.2% of houses were damaged (figure 8).

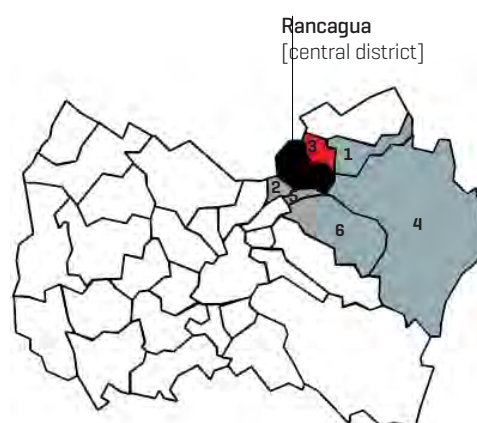
The Concepción-Talcahuano-San Pedro conurbation presents a similar scenario: the regional average was 4.56 subsidies per 100 families, while the rate in the central area is 2.77. Even if we cannot conclude that it necessarily implies a process of displacements, it presents the consolidation of patterns of exclusion and peripheral development for poor groups. Additionally, by July 2012, there were no projects using the social integration subsidy (PIS) on reconstruction¹⁵. Even though there were *Guidelines of densification* for central areas in Talca developed by the PRES, which promote integration and densification, they have not been extensively used.

¹⁴ In the Regions of Valparaíso, Metropolitana and Araucanía, there were more repairs than new houses, so the data is useless to measure possible displacements.

¹⁵ Information provided as an answer to the request made by the author to the Ministry of Housing (MINVU) through the web www.minvu.cl, under the Law 20,285 for Access to Public Information, in July 2012.

O'HIGGINS

District	Subsidies allocated	Population	Rate
Rancagua [central district]	5,832	214,344	2.72
1. Codegua	306	10,796	2.83
2. Doñihue	222	16,916	1.31
3. Graneros	1,108	28,428	3.90
4. Machalí	526	28,628	1.84
5. Olivar	163	12,335	1.32
6. Requínoa	333	22,161	1.50
Total periphery	2,658	119,264	2.23
New houses	19,493		
Repairs	7,619		
TOTAL REGION	27,112	883,368	3.07



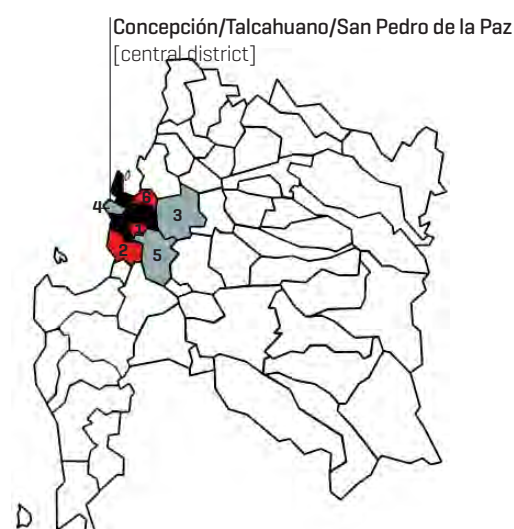
MAULE

District	Subsidies allocated	Population	Rate
Talca [central district]	8,514	279,978	3.04
1. Maule	2,750	27,000	10.19
2. Pelarco	262	7,266	3.61
3. Penco	612	8,315	7.36
4. San Clemente	1,400	42,000	3.33
5. San Rafael	869	7,674	11.32
Total periphery	5,893	92,255	6.39
New houses	32,472		
Repairs	17,490		
TOTAL REGION	49,962	1,007,831	4.96



BIOBÍO

District	Subsidies allocated	Population	Rate
Concepción, Talcahuano & Sn Pedro [central district]	20,428	738,523	2.77
1. Chiguayante	4,527	81,302	5.57
2. Coronel	6,285	95,527	6.58
3. Florida	114	10,017	1.14
4. Hualpen	3,654	88,046	4.15
5. Hualqui	763	20,660	3.69
6. Penco	2,643	53,000	4.99
Total periphery	17,986	348,552	5.16
New houses	48,881		
Repairs	44,138		
TOTAL REGION	93,019	2,038,443	4.56



Figures 5-6-7: Subsidies allocated in Rancagua, Talca and Concepción central and peripheral district. *Rate: subsidies allocated per 100 inhabitants. Districts with rates above the regional average are in red.*

(Source: Authors, based on data from MINVU (2012) for reconstruction data, and INECL for population data).

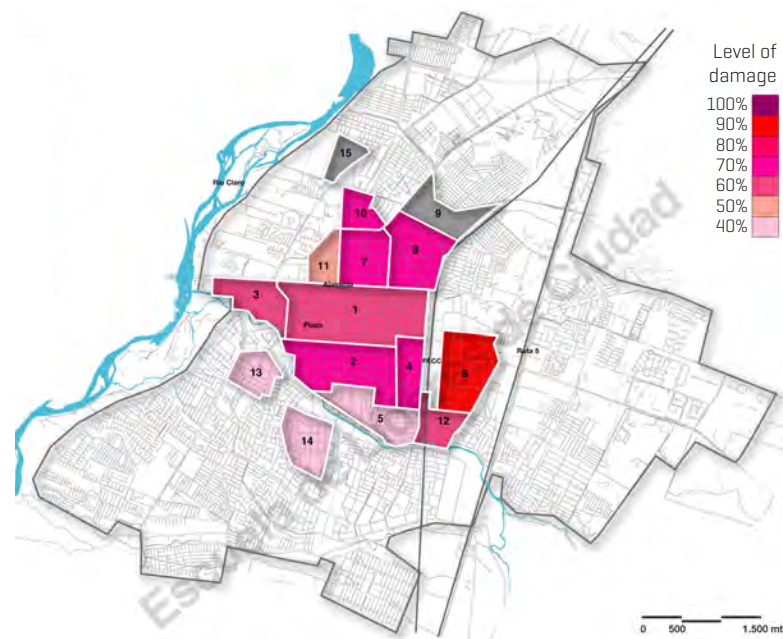


Figure 8: Housing damaged by neighbourhood in Talca district
(Source: Escuela de líderes de ciudad (2010)).

The final criterion of the matrix should be clear at this point: whether housing reconstruction dynamics are consolidating or transforming actors' associations and their agencies. Participation has been understood as *customers' decision*, promoting individual action over collective, concentrating surplus in external actors and, even if there have been attempts to build most of the solutions in the previously owned land, for many people it has reproduced urban patterns of exclusion (figure 9). As the coordinator of housing reconstruction says, "the Housing Ministry works with demand subsidies, and ultimately what we do is to run the market (...), and the market operates under the legitimate desires of profit of companies" (Ivelic, 2010). The housing reconstruction process has not challenged such a principle.

PROCESSES		
1) Processes of transformation led by:		Participatory processes
2) Promotion of housing production led by:		Collectives
3) Incentive of absorption of urban surplus:		Democratically controlled
4) Promotion of urban patterns:		Inclusion
5) Political and economical dynamics are:		Transformed (reform)
IMPLICATIONS		
	neoliberal consolidation	collective transformation ensuring RTC

Figure 9: Variables and criteria for a transformation process: Housing reconstruction programme
(Source: Authors).

Housing policy changes

The political situation since 2010 has been especially apt for policy changes, given the disaster and the change of a political cycle. Since 2010, there have been two main policy changes in housing, beyond the reconstruction: the FSV-title 1 (for poor groups) changed in April 2012 to a new regulation called Supreme Decree-49 (DS49); and the FSV-title 2 and DS40 (for emerging and middle-class groups) changed in June 2011 to Supreme Decree-1 (DS1) (table 2).

Table 2: New housing regulations (Source: Authors, based on data from www.ninvu.cl, accessed on 27th July 2012).

Name of regulation	Former regulation replaced	Target
DS1 - title 1	FSV - title 2	Emerging groups with savings and optional credit. - To build houses in owned plot or in densification schemes. Houses price up to UF1000 or UF1200*, with a subsidy up to UF450, UF500 or UF600*. Minimum savings of UF30. - To buy new or used houses. Houses price up to UF1000 or UF1200*, with a subsidy up to UF500, UF600 or UF600*. Minimum savings of UF30.
DS1 - title 2	DS40	Middle-class groups with savings and optional credit. - To build houses in owned plot or in densification schemes. Houses price up to UF1400, UF1600 or UF2000*, with a subsidy up to UF300 or UF350*. Minimum savings of UF50. - To buy new or used houses. Houses price up to UF1400, UF1600, UF1800 or UF2000*, with a subsidy up to UF100, UF300, UF350 or UF400*. Minimum savings of UF50.
DS49	FSV - title 1	Poor groups with savings and not credit. - To buy new or used houses and to build houses in owned plot or in densification schemes. Base subsidy up to UF380 to UF700* [detailed amounts in DS49] including allocation subsidy for urban areas or feasibility subsidy for rural areas. Special subsidies can complement these amounts. Minimum savings of UF10.

Notes: All amounts are in UF. UF means "unit of foment", and is a Chilean re-adjustable unit of account. For this document UF 1=\$22,587, and £1=\$762, so 1UF=£29.62 [at 27/07/2012].

* Difference of prices and subsidies according to the region of location

Even though there are no radical transformations, both the DS49 and DS1 do introduce some changes. The most substantial are:

- The unification of a subsidy for middle-class and emerging groups (DS1), because of the deficient applications to some sections of the previous subsidies. The DS1 proposes continuity in order to be more targeted.
- The incorporation of individual applications for poor groups (DS49), and the elimination of the requirement of a Social-Estate Management Body (EGIS) to be eligible to apply.

Again, now we should return to the initial criteria to analyse the level of transformation these policy changes have triggered.

In terms of **who led the process of the policy change**, it was, as in almost any legal initiative in Chile, led completely by the government. In terms of the promotion of participatory processes, both the former FSV as the new DS49, incorporated the requirement of an "enabling social plan" for collective applications made by management bodies (former EGIS, now "sponsoring bodies"). In such a requirement, however, the word "participation" is not mentioned in the new normative text, while it was repeated several times in the former one. Nonetheless, the

main implication in the participation process of the new regulation is the incorporation of individual applications to purchasing new houses, which are not affected by the requirement of an “enabling social plan”.

In terms of the second criterion, the promotion of housing production by **individuals or collectiveness**, the new policy promotes the first one. The former normative required the presence of EGIS for the construction of new houses, which implied the development of projects collectively. With the introduction of individual or collective applications, with or without “sponsoring bodies”, the condition of families as customers is deepened.

The third criterion looks at the **incentives for a concentrated or democratically controlled absorption of urban surplus**. The promotion of individual applications discourages the organisation of people and, therefore, the creation of business models in which families themselves can manage their resources and use them to improve solutions, and not to generate others’ profits. Despite such disincentive, the new regulation includes the possibility for organised people to act themselves as a “sponsoring body”. The question is, in a framework of individual action promotion, with no instruments generating design capabilities in organised citizens, how many groups will assume such role?¹⁶

The fourth point is about the kind of **urban patterns** promoted. Contrary to what was announced in the first drafts in 2010, most of the incentives to offer integration to the urban fabric are still on-going: subsidies to socially integrated (PIS), well allocated or densification projects. Even if these instruments are not necessarily well used, or are absorbed by market prices, their existence is still a contribution. While the neighbourhood improvement programme (PQMB) continues, other instruments, such as the special subsidy to community facilities, were eliminated. However, the approach of private housing production implies the imperative of cost reduction, and land costs are at the centre of such a principle. The patterns of urban expulsion, therefore, are not necessarily faced and challenged simply by conserving these subsidies.

Again, the question of whether new housing policies **are consolidating or transforming actors’ associations** is easy to answer at this point. Participation and collective action have been discouraged. The transformations towards a more democratic control of surplus have been timid, as have the possibility for organised groups to act as a “sponsoring entity”. Segregation patterns are therefore faced with the same tools that have not been completely successful (figure 10).

¹⁶ Question by the author to the Ministry of Housing (MINVU) through the web www.minvu.cl, under the Law 20,285 for Access to Public Information, in July 2012, the answer was: “The registration of Sponsoring Bodies does not distinguish among the different types of legal organisations that they comprise, so it is not possible to have the number or neighbours’ organisations that have acted as Sponsoring Bodies”.

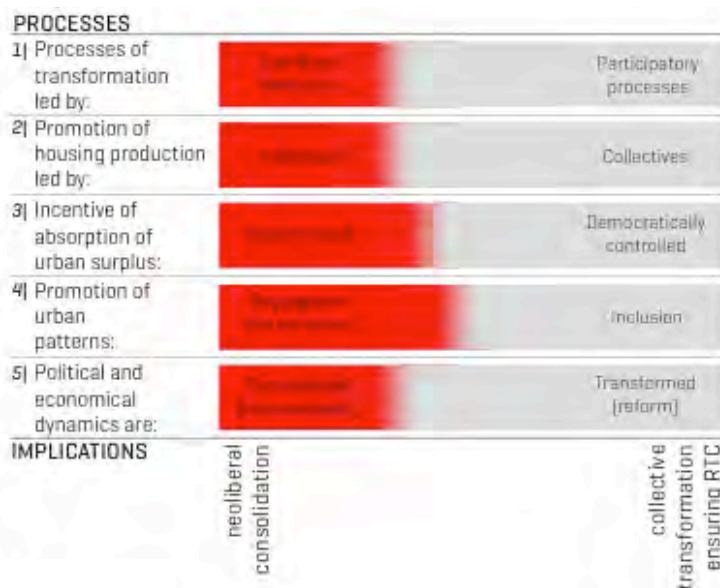


Figure 10: Variables and criteria for a transformation process: Housing policy changes (Source: Authors).

Collective right to the city claims: where are they being manifested?

The natural disaster and its social consequences, in addition to the climate of social unrest, could imply a movement towards transformation of institutional responses to housing needs. As we have seen, it has not happened, or at least government institutions and their policies have not recognised it.

The collective RTC claims emerged, nonetheless, through organised movements. The National Movement MNRJ presented its demands through slogans such as “the earthquake was for the poor, the reconstruction for the rich”; “right to the city”; or “the right to stay in our neighbourhoods” (MNRJ, 2012). Thereby, as Mayer proposes, “the Right to the City slogan has become a live wire material practice today” (2009:367). The MNRJ had the opportunity to present their ideas to the parliament, with support from academia and NGOs, but the institutional transformations have not recognised such claims.

So, where have the collective RTC claims been manifested? The MNRJ slogans are closely connected with our matrix variables, asking for more participation, more collective organisation, to avoid a “reconstruction for [only] the rich”, to stay in their neighbourhoods, and for substantial changes. The misrecognition of such claims in the institutional policy changes does not imply that such transformations are not happening within civil society, which, as an institution, recognises the need of change towards social justice. Because of the awareness of their role within reconstruction, affected people are shifting their own perception of their position in relation to other actors.

In practice, it has implied two phenomena in the approach to housing: on one hand, despite such rhetoric, most of the housing reconstruction process was led by individual families acting as customers, with few exceptions: the urgency, *standardised projects* programme and conservative responses of private sector may be the main explanations. But on the other hand, the response to ordinary housing production has presented a different scenario: by July 2012 all the applications made since the implementation of the new normative for poor groups (DS49), have been made collectively¹⁷. Even if the policy change promotes an individual approach to housing, people have continued applying collectively in 100% of the cases. Even if it promotes

¹⁷ Answer to the request made by the author to the Ministry of Housing (MINVU) through the web <http://www.minvu.cl>, under the Law 20,285 for Access to Public Information, in July 2012. The DS49 was implemented in April 2012.

the consolidation of a model of individual freedoms, pushing toward individual actions, collectiveness is present as in the historical movements of *pobladores*.

This is clearly illustrated in one community leader's words, which represents one of the few groups building an alternative solution during the reconstruction¹⁸. During a public speech, she presented the distance between official responses and their process of organisation:

"The government doesn't have a real will and commitment to solve our problems with dignity, and the reconstruction was handed over to the market". But she also recognises the richness that the process has implied in their own organisations: "As we have suffered and fought, we have also learned a lot during these two years. (...) These two years have shown us that nothing can be achieved without struggle. Nothing is achieved without a collective effort. Nothing is achieved without active male and female citizens. We hope our experience may encourage others to claim for the rights that we have to live in a better city, with more justice, equality and without social discrimination" (SurMaule, 2012).

CONCLUSION

Disasters force us to reorder associations because, as Latour argues, previous definitions become *somewhat irrelevant* after such reshuffling. This work has argued that in neoliberal societies reconstruction can act to consolidate that context; collective RTC claims could challenge such a scenario and influence institutional transformation reordering associations; reconstruction is a political process that, as Rancière says, *implies a disruption of the order of the police*.

Chilean history shows how constant earthquakes have triggered important institutional changes, transforming the roles that the State and private sector have in building the city. The time period 2010-2012, because of the global and local context of social mobilisation, looked like an appropriate time to re-ask 'what is the role of civil society?'

In terms of housing, two main institutional responses have been reviewed: the housing reconstruction and changes in housing policy. Both of them promote the consolidation of a model rather than a transformative process: even some changes such as the promotion of individual housing production, could foster exclusion.

But the disaster and social mobilisation have also implied the construction of resilience. Elements of transformation towards collective capability strengthening are part of social movement discourses, and low-income citizens continue approaching housing collectively, with no individual applications since the promulgation of the new regulation.

This scenario presents opportunities and challenges to policy, recognising societal transformation, re-asking the roles of actors in housing production: is the role of the State just to be a provider of subsidies? Is the private sector the only appropriate actor to produce housing, if it has demonstrated its incapacity to innovate facing extraordinary scenarios and consolidating patterns of segregation? Are citizens just individual customers buying a commodity called a house? Answering this last question with a "NO", civil society has started re-considering its own position. By doing so it is also re-considering the role of the remaining actors embedded in housing production and opening spaces for reciprocal determination.

There exists opportunity, consequently, to institutionalise changes that promote a new social order, recognising such claims have emerged from citizens through solid organisations. This work has shown that there is a trend in citizens to act collectively, even if institutions promote the contrary. The task of civil society is, therefore, to turn this trend into a force of radical transformation, through the organisation and creation of collective intelligence, in reciprocity and self-determination. As the community leader said in her speech, their claims are far from over; and housing policy must recognise this.

¹⁸ To know more about this project visit: <http://www.reconstruye.org/projects/modelo-de-vivienda-integrada-para-recuperacion-de-barrios-centrales/>

REFERENCES

- Amaral, Verónica (2010). *Las 7 diferencias entre Frei y Piñera*. Presentation in forum "Vivienda y Ciudad, 7 Diferencias". Santiago, 02-12-2010. [Available on <http://www.plataformaurbana.cl/archive/2010/01/12/las-7-diferencias-entre-frei-y-pinera/>], (Accessed 11/07/2012).
- Atria, Fernando (2012). *La mala educación: Ideas que inspiran el movimiento estudiantil en Chile*. Santiago: Catalonia/CIPER.
- Barakat, Sultan (2003). Housing reconstruction after conflict and disaster, *HPG Network Paper* 43, Overseas Development Institute, Humanitarian Practice Network, Humanitarian Policy Group, London, ODI.
- Boano, C. (2009) Housing anxiety, paradoxical spaces and multiple geographies of post tsunami housing intervention in Sri Lanka. *Disasters*, Vol. 34(3) pp: 762-785.
- Boano, C. (2013). Architecture must be defended: informality and the agency of space [Digital scholarly resource]. Retrieved from <http://www.opendemocracy.net/opensecurity/camillo-boano/architecture-must-be-defended-informality-and-agency-of-space>.
- Boano, C., & Garcia, M. (2011). Lost in translation? The challenges of an equitable post-disaster reconstruction process: Lessons from Chile. *Environmental Hazards*, 10 (3-4), 293-309.
- Boano, C., Garcia La Marca, M, & Hunter, W. (2013). "Contested Urbanism". In Boano, C, Hunter, W, Newton, C (Eds.), *Contested Urbanism in Dharavi. Writings and Projects for the resilient city* (pp. 15-37). London: Development Planing Unit.
- Boano, C., Hunter, W., (2012) "Architecture at Risk (?): The Ambivalent Nature of Post-disaster Practice". *Architectoni.ca* Vol. 1, pp: 1-13
- Bresciani, Luis Eduardo (2010). Chile 27F 2010: La catástrofe de la falta de planificación. *EURE*, vol.36, N°108, pp.151-153.
- Cocifia, Camila (2010). "Ideología y reconstrucción. Levantar ciudades y ciudadanías" in Mardones, Patricio (Editor) *Catálogo XVII Bienal de Arquitectura, Chile: Reconstrucción*. Santiago: Colegio de Arquitectos, pp.52-65.
- Cooke, Bill and Kothari, Uma (2001). "The case of Participation as Tyranny" in Cooke, Bill and Kothari, Uma (eds.) *Participation – the new Tyranny?* London: Zed Books.
- Cornwall, Andrea (2003). Whose voices? Whose choices? Reflections on gender and participatory development. *World development*, 31(8) pp.1325-1342.
- Dikeç, Mustafa (2005). Space, politics, and the political. *Environment and Planning D: Society and Space*, vol.23, pp.171-188.
- Dong, Andy (2008). "The Policy of Design: A Capabilities Approach", *Design Issues* Vol.24(4), pp.76-87.
- Echenique, Juan and Ramírez, Pedro (2011). *El primer año de la reconstrucción no se financió*. Ciper Chile. [Available on <http://ciperchile.cl/2011/05/12/el-primer-ano-de-la-reconstruccion-no-se-financio/>] (Accessed 26/06/2012).
- Edwards, Sebastián (1995). *Crisis and Reform in Latin America: From Despair to Hope*. New York: Oxford University Press.
- Fiori, J., Riley, E., & Ramirez, R. (2001). Physical upgrading and social integration in of Rio de Janeiro: the case of Favela Bairro. *disP-The Planning Review*, 37(147), 48–60.
- Frediani, Alexandre (2009). The world bank. Turner and Sen - Freedom in the urban arena. *DPU Working Paper*, N.136.
- Frediani, A. A., & Boano, C. (2012). Processes for Just Products: The Capability Space of Participatory Design. In I. Oosterlaken, J. V. D. Hoven (Eds.), *The Capability Approach, Technology and Design*. Springer Verlag.

- Garcés, Mario (2002). *Tomando su sitio: Movimiento de pobladores de Santiago, 1957-1970*. Santiago: Lom.
- Harvey, David (2005). *A brief history of neoliberalism*. Oxford: Oxford University Press.
- Harvey, David (2008). The Right to the city. *New left review*, N.35, pp.23-40.
- Hickey, Sam and Mohan, Giles (2005). Relocating Participation Within a Radical Politics of Development. *Development and Change*, Vol. 36(2), pp.237-262.
- Hidalgo, Rodrigo (1999). "La vivienda social en Chile: la acción del estado en un siglo de planes y programas". *Scripta Nova* N° 45(1). Electronic version [<http://www.ub.edu/geocrit/sn-45-1.htm>] (Accessed 16/03/2012).
- Ivelic, Pablo (2010). *Exposición plan gubernamental de reconstrucción urbana, territorial y vivienda*. Seminar in Colegio de arquitectos, Santiago, Chile, 14/07/2010.
- Kuhn, Thomas (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Latour, Bruno (2005). *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford: Oxford University Press.
- Lechner, Norbert (2006). *Norbert Lechner, Obras escogidas. Tomo 1*. Santiago: Lom.
- Levy, Caren (1997). "Institutionalization of Gender through Participatory Practice", in *The Myth of Community*.
- Lyon M, Schinderman T, Boano C., D'Urzo, S. (2010) "Conclusions", in M. Lyon T. Schinderman, with C. Boano (eds) *Building Back Better. Delivering People-centered housing reconstruction at scale*, Practical Action Publishing: Rugby, pp. 345-359.
- Madanipour, Ali (2000). "Social exclusion and space", in LeGates & Stout (eds.) *The City Reader*, Routledge, London; pp.181-188.
- Mayer, Margit (2009). The 'Right to the City' in the context of shifting mottos of urban social movements. *City*, Vol.13(2-3), pp.362-374.
- Miessen, Markus (2010). "Collaboration and the Conflictual" in *The Nightmare of Participation*, pp.91-104. Berlin: Sternberg Press.
- MINVU (2012). *Avance en Vivienda* [Available on http://www.minvu.cl/opensite_20111122104351.aspx] (Accessed 25/07/2012).
- Rebolledo, Nicolás (2011). *La gran deuda del sector vivienda*. Ciper Chile. [Available on <http://ciperchile.cl/2011/03/07/la-gran-deuda-del-sector-vivienda/>] (Accessed 06/11/2011).
- Rodríguez, Alfredo (1990). Desastres urbanos, fenómenos no-naturales. *Medio ambiente y urbanización*, N.30, pp.11-20.
- Rodríguez, Alfredo and Sugranyes, Ana (2004). El problema de vivienda de los "con techo". *EURE*, 30 (91), pp.53-65.
- Sanoff, Henry (2008). Multiple Views of Participatory Design. *International Journal of Architectural Research*. Vol. 2(1), pp.57-69.
- Sentidos Comunes (2011). *Un año sin reconstrucción*. Santiago: Sentidos Comunes. [Available online on <http://www.sentidoscomunes.cl/diario/2011/03/dossier-1-un-ano-sin-reconstruccion/>] (Accessed 14/08/2012).
- Valenzuela, Nicolás (2012). *¿Cómo va la reconstrucción? Evaluación del modelo de construcción post 27F 2010*. Presentation in CEP Seminar, Santiago, 11th April 2012. [Available on <http://www.reconstruye.org/2012/04/presentacion-de-reconstruye-en-el-cep-como-va-la-reconstruccion/>] (Accessed 25/07/2012)
- Young, Iris (1990). *Justice and the politics of difference*. New Jersey: Princeton University Press.

Zetter R., Boano, C. (2010) "Making space and place after natural disasters and forced displacement", in Lizarralde, G., Johnson, C., Davidson, C., (eds.) *Rebuilding after Disasters: From Emergency to Sustainability*. Taylor and Francis: London, pp: 206-231

Press and websites

Biobío (2010). *Sin licitación pública Gobierno elige a 3 empresas como únicas proveedoras para la reconstrucción*. Published 31st March 2010. [Available on <http://www.biobiochile.cl/2010/03/31/sin-licitacion-publica-gobierno-elige-a-3-empresas-como-unicas-proveedoras-para-la-reconstruccion.shtml>] (Accessed 26/07/2012).

Datavoz (2009). *Vivienda y urbanismo*. [Available on <http://ebookbrowse.com/datos-duros-vivienda-urbanismo-ppt-d110367575>] (Accessed 08/08/2012).

Escuela de líderes de ciudad (2010). *Mapas de daños post-terremoto*. Escuelas de líderes de Ciudad. [Available on http://elci2011.sitiosur.cl/mapa_dano_postterremoto/mapas.htm] (Accessed 26/07/2012).

MNRJ (2012). *Quiénes somos*. [Available on <http://reconstruccionjusta.blogspot.co.uk/p/quienes-somos.html>] (Accessed 25/07/2012).

SurMaule (2012). *El Comité de Sin Tierra San Pelayo coloca la primera piedra del conjunto habitacional integrado "Los Maitenes" con crítica al Gobierno*. Published 28th March 2012. [Available on <http://surmaule.wordpress.com/2012/03/28/el-comite-de-sin-tierra-san-pelayo-coloca-la-primera-piedra-del-conjunto-habitacional-integrado-los-maitenes-con-critica-al-gobierno/>] (Accessed 27/07/2012).

Policy documents

MINVU (2004). *Chile. Un Siglo de Políticas en Vivienda y Barrio*. Santiago: Pehuén Editores.

MINVU (2006). *Reglamento 174 de Fondo Solidario de Vivienda* [Available on <http://bcn.cl/563g>] (Accessed 27/07/2012).

MINVU (2007). *Decreto Supremo 40* [Available on <http://bcn.cl/4s22>] (Accessed 27/07/2012).

MINVU (2009). *Balance programático 2006–2010. Ministerio de vivienda y urbanismo. Principales logros*. Working document.

MINVU (2010). *Licitaciones Planes Maestros PRU*. [Available on http://www.minvu.cl/opensite_20101129144708.aspx] (Accessed 25/07/2012).

MINVU (2011). *Decreto Supremo 1* [Available on <http://bcn.cl/4the>] (Accessed 27/07/2012).

MINVU (2012b). *Decreto 49* [Available on <http://bcn.cl/sn8p>] (Accessed 27/07/2012).

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AN EVALUATION OF THE USEFULNESS OF ACTOR NETWORK THEORY IN UNDERSTANDING THE COMPLEXITIES OF VULNERABILITY AND RESILIENCE IN POST-DISASTER RECONSTRUCTION

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Abstract

The literature is replete with accounts of the struggle to effectively target and deploy post-disaster aid so as to achieve maximum benefit to recipients, both direct and indirect, over the short- and longer-term. Generally these stories balance success with lessons learned from failure, in order to inform practice in future recovery and reconstruction events. They are often derived from the heroic accounts of key actors in case studies, on the understandable basis that these carefully selected individuals will have been pivotal in designing and directing the implementation of aid programmes. The influence of non-humans such as organisations, systems, processes, or elements of the constructed environment are considered only insofar as they impact upon the experiences of the raconteurs. However actor network theory, a technique originally developed to examine phenomena at the socio-technological interface, ascribes human characteristics such as motives and behaviours equally to human and non-human actants, ultimately to better explain the worldly consequences of their interaction. This paper reports on the ex post application of ANT to data collected in an earlier actor-centric study, to both evaluate its usefulness in disaster research and to identify potential gaps in the disaster research agenda.

Keywords: disaster; resilience; vulnerability; actor network theory.

INTRODUCTION

Disaster management is the structured attention to mitigating the effects of catastrophic events (James, 2008), both natural and human-related (Furedi, 2007), by governmental or non-governmental organisations (NGOs), with the intention of helping restore a degree of safety and normality to those who have been disadvantaged by these events. Whilst initial efforts necessarily tend to focus on the provision of material aid – food, medicine and shelter – there is an increasing emphasis on providing longer term assistance in terms of social support services.

The provision of aid has been characterised variously as "top-down" or "hard" aid, as opposed to "bottom-up" or "soft" aid. The former tend to consist of hazard mapping, engineering, architectural design and structural management programs. These contrast with the latter, which are designed to address community issues by focusing on planning and preparation for potential disasters, allied to the education of the population in relation to disaster risks (O'Hare & Rivas, 2005).

Disaster mitigation and preparedness initiatives in areas prone to natural disasters are the natural operational environment for NGOs. It is frequently the case that these regions are located in developing countries, and are populated by the poor and socially disadvantaged. In a sense it is their disenfranchisement and vulnerability that renders them obvious recipients of NGO aid (Twigg & Steiner, 2002). However it is frequently apparent that their efforts are not altogether successful, resulting in negative impacts upon the populations they set out to assist (Cavill & Sohail, 2007).

The focus of aid and recovery initiatives is often disrupted by the actions of the government authorities in the affected state. Frequently this occurs as a consequence of hastily conceived responses to earlier disaster events, usually in the form of policies to drive to preparedness and mitigation. This may be as a consequence of humanitarian instincts, or out of a desire to be seen to be proactive: any event the hasty rebuilding of communities, livelihoods, and mitigation of future risks often results in an increase in long-term vulnerability (Ingram, Franco, Rio & Khazai, 2006).

It is apparent that in any disaster context there are complex relationships between individuals, groups, and populations, each with their own concerns and motivations. What are perhaps less apparent are the various non-human actants at work in the same contexts; examples would include the crops in the field, sacks of food aid, government policies, and business models of NGOs. Callon (1986) first suggested that in order to understand problems situated at the socio-technological interface it is first necessary to understand the motivations of both human and nonhuman actants engaged in this context, describe a specific problem that occurs there, engage relevant actants in the search for a solution, and obtain evidence from each (using an appropriate spokesperson where necessary). This approach later crystallised into an approach known as Actor Network Theory (ANT) (Latour & Woolgar, 1991).

Since its development ANT has extended its utility as a tool for studying organisation (Czarniawska & Hernes, 2005), geography (Bingham, 1996), innovation (Miettinen, 1999), power (Munro, 2009), gardening (Hitchings, 2003), and education (Fenwick & Edwards, 2010). This paper posits that it may be beneficial to our understanding of the causes of sub optimal outcomes arising from disaster relief to use ANT to unravel the complex interplay between the individuals and communities affected by disasters, and their governmental and non-governmental aid providers. Using data collected for a previous study of the impact of disaster response actors on vulnerability reduction and building community resilience (McVeigh, 2012) as the point of departure, it constructs hypothetical actor networks to illuminate vulnerability reduction/community resilience failures. The paper is ultimately intended to explore the appropriateness and utility of ANT in this context, and is subject to the constraints imposed by the reuse of data collected for a different, though complimentary, purpose.

ACTOR NETWORK THEORY

Actor network theory (ANT) provides a sociologically based investigative tool with which to understand how scientific disputes are resolved, new ideas become accepted, and how new tools and protocols are adopted and integrated by a group. Decisions of this kind tend to be transient and are frequently rendered redundant by the passage of time, and the development of new innovations; consequently ANT is not usually concerned with the search for indisputable truth or fact (Latour & Woolgar, 1991; Callon, 1986).

Actor networks are comprised of technical and non-technical elements. The observed performance of a sailing boat is a consequence not only of its technological design features, but also the skills of its skipper and crew. This combination is also responsible for the boats behaviour. ANT acknowledges the heterogenous nature of actor networks by linking the human and nonhuman, sociological and technological, thereby revealing issues at the socio-technical interface (Hanseth & Montero, 1998). It achieves this by enrolling diverse elements into a broadly cohesive network that can then be described and analysed: interestingly these elements may not themselves be aware of their connection to each other (Van House, 2001).

The systematic approach embodied by ANT exposes the nature, extent, and influence of the network's component parts usually neglected by conventional "heroic" stories of new discoveries. Goguen points out that:

"Newton did not really act alone in creating the theory of gravitation: he needed observational data from the Astronomer Royal, John Flamsteed, he needed publication support from the Royal Society and its members (most especially Edmund Halley), he needed the geometry of Euclid, the astronomy of Kepler, the mechanics of Galileo, the

rooms, lab, food, etc. at Trinity College, an assistant to work in the lab, the mystical idea of action at a distance, and more, much more. The same can be said of any scientific or technological project.” (Goguen 1999)

ANT CONCEPTS

Actor networks are comprised of elements that bend space around themselves, make other elements dependent upon them, and translate the will of others to accept its own language. Practically speaking these elements or "actors" can include humans, groups of humans, organisations, texts, images, and technical artefacts: the term "actant" is often used, in order to avoid differentiating between human and non-human actors. Importantly, all actants are deemed to have their own interests, leading them to desire the alignment of the interests of other actants in the network to their own. If they are successful in this endeavour they will have created an actor network around them, which can be defined as "a heterogenous network of aligned interests" (Callon, 1986).

Network creation involves three major stages that together described as the process of translation. The first stage of translation, *problematization*, is initiated by an actant who has identified a discreet problem, defined its boundaries, and identified other actants who could conceivably assist in solving it. If this focal actant canvases the involvement of the others it will have established itself as the obligatory passage point (OPP), which can be thought of as the gatekeeper to the network. It therefore becomes essential to the existence of the network, protecting it by establishing the membership rules. The second stage of translation is *interessment*, where the focal actant (which is now the OPP) seeks to gain acceptance of its view of the problem through the universal acceptance of its definitions and objectives. If the interessment process is successful it will result in "buy in" – the acceptance by other actants of the OPP's framing of the problem and the process of its solution. This third stage is known as *enrolment* because the other actants choose to join in the focal actant's cause. (Latour & Woolgar, 1991)

Actor networks need not remain stable. The OPP may exert sufficient social and political power as to keep the efforts of the other actants focused on the problem in which they were initially enrolled. However there is no guarantee that this will be the case: all actants in the actor network have the potential to initiate further translations: if a subsequent translation is successful the initiator will establish itself as the new OPP (Sidorova & Sarker 2000).

The stability of the network requires technological and sociological accord, arising from a continual dialogue between the actants, and generating a social process that endeavours to align their interests: success in this regard generates stability. Given that all the actants have their own diverse motivations and objectives, the extent to which stability can in fact occur is dependent upon the extent to which each one can translate (reinterpret, represent, or appropriate) the interests of others to their own (Aanestad & Hanseth 2000). The translation process is highly political, requiring the interests of the OPP to be "marketed" in order to enlist broader support and can be "embodied in texts, machines, orderly skills (which) become their support, their more or less faithful executive." (Callon *et al* 1986). Thus it can be seen that the formal processes and procedures defined by governments and NGOs for use in the event of disaster emergencies may have to compete with each other, and also compete with contextual exigencies at the disaster scene, resulting in ad hoc actor networks that couldn't possibly have been envisaged at the outset.

CONSTRUCTING THE ACTOR NETWORKS

McVeigh (2012) conducted in-depth interviews with key actors in relation to disaster case studies, which were intended to reveal their impact on the disaster events, with specific focus on reducing community vulnerability and building community resilience. Although these were initiated as a consequence of the interviewees' current theatre of operation, the interviews often made reference to multiple contexts, and incidents or events within them. Several of the interviews

referred to the same disaster event, though from different perspectives. Table 1 lists the details of the participants.

Table 1: Interviewees (Source: Authors).

Interviewee	Organisation	Role	Location
1	Professional Consultant	Humanitarian and development – disaster risk reduction	Jakarta, Indonesia
2	Merlin UK – Professional Consultant in Haiti at Merlin UK	PM in disaster risk reduction	Port-au-Prince, Haiti
3	NGO – Habitat for Humanity	Co-ordinator of international relief	Amsterdam, Netherlands
4	NGO – Red Cross	National Disaster Reduction Advisor	Kyrgyzstan
5	European Commission	Humanitarian aid and civil protection	Bangkok, Thailand
6	NGO – Oxfam	Humanitarian relief and recovery	Currently in the UK but experience includes relief in Haiti, Pakistan, Zimbabwe and Sri Lanka
7	Disaster risk management consultant – Global Climate Adoption Partnership.	Vulnerability reduction	Currently in the UK but experiences includes vulnerability reduction in SE Asia.

The original methodology for the interviews was exploratory in nature, employing an entirely open and unstructured form of interviewing, designed to both probe issues raised by the literature and establish a research agenda for the future. Prior to the interview the respondent was briefed on the area of research, allowing them time in advance to prepare. Generally all the interviews began with the respondent discussing the area of vulnerability; naturally this then progressed to their experiences and the actions they took to reduce vulnerability and/or build resilience. This style of interviewing ensured no boundaries were set, allowing for the scope of experiences to expand and exploratory discussion to occur. Interviewees were given the opportunity to discuss all areas of their work, or other actors' work which they felt had significant impact -- positive or negative -- on the fields under investigation.

In order to construct the actor networks, which is the subject of this paper, it was necessary to deconstruct the earlier thematic analysis conducted by McVeigh (2012) in order to unpack the full range of actants and their individual concerns/motivations. Whilst identification of human and non-human actants was achieved without recourse to subjectivity (all actants were

explicitly mentioned in the original thematic analysis) it should be noted that the actor networks thus constructed were only partial (other actants could be inferred from the context). Moreover, whilst particular care was exercised when ascribing motivations to non-human actants this activity was necessarily limited by the lack of specific questions directed to this end in the original interviews.

The interviews themselves covered the experiences of the interviewees across several theatres of operation, but for the purposes of this paper only those experiences directly or indirectly relating to disasters in the Caribbean region were included in the analysis. This decision was taken after reviewing all of the interviews on the basis that a) there was sufficient data to create multiple compelling actor networks, and b) the experiences of Haiti and Cuba in many respects encompassed both the best and worst of vulnerability reduction and resilience building practice.

ACTOR NETWORK CONTEXT 1: HAITI

Haiti is a developing country, located in the Caribbean sharing a border with the Dominican Republic. The country has a population of 10.1 million and a relatively low life expectancy. The country has a history of dictatorships and politically induced violence. In 2004 an elected leadership took control of the country however political violence still ensues and the country's human rights conditions are described by the UN as catastrophic.

The political situation in Haiti leaves the country ill-equipped to deal with the management of disasters with a lack of leadership and no mechanisms in place for co-ordination of an emergency response. Meanwhile, economic vulnerability is also high; the economic underdevelopment restricts the export base of the country's economy. Widespread poverty prevails, with high levels of social inequality: unemployment rates are chronic. Whilst Haiti superficially mirrors elements of more developed countries much of its infrastructure is poor and aging, dating from colonial times; the absence of a meaningful local development policy combined with a collapse in the national economy has increased vulnerability to natural hazard.

Haiti is positioned on a fault line on the Gonave micro plate, leaving it vulnerable to seismic activity. It also lies in the hurricane belt and thus is prone to natural hazards. Throughout history, Haiti has suffered tsunamis, numerous earthquakes, hurricanes, tropical storms, flooding and mudslides. The 2010 Haitian Earthquake was described by the UN and other Aid organisations as the worst urban disaster in modern history. The epicentre of the earthquake struck 15 miles from the densely populated Haitian Capital of Port-au-Prince on January 12th at 4:53pm. It measured 7.0 on the Richter scale, with an estimated 59 aftershocks to follow for almost 2 weeks after, some of which measured 4.5 on the Richter scale.

The earthquake had an immediate devastating impact with thousands initially feared dead. In the days to follow that figure rose rapidly and official estimates of the total death toll stand at 230,000. It was estimated that over 1 million people were left homeless. The quake was subsequently declared to be the worst recorded in the region in over 200 years. The City of Port-au-Prince was in ruins and fires raged down town amidst the rubble, telephone lines were down and there was an electricity blackout. A number of important political buildings were reduced to rubble; the UN headquarters was badly damaged and 37 UN staff confirmed dead, the National Palace suffered considerable damage and a hospital was also destroyed.

The quake was a devastating blow to the country and the knock on effects of the events of January 12th 2010 are still a reality for the Haitian people today. In the aftermath of the quake it was evident that much of its impact had been as a consequence of poor government policies and procedures.

- Haiti was (and continues to be) characterised by a lack of government regulation and control, leading to unregulated urban and rural development.
- Economic policies were driven by the need to create export revenues: cash crops predominated.

- Consequent land clearance resulted in widespread deforestation which in turn increased vulnerabilities to landslides and a general loss of the topsoil necessary to support economically viable agriculture.
- The deforestation also resulted in a lack of timber for construction, increasing local reliance upon concrete as the predominant building material.

Many of the problems continuing to be experienced in Haiti are the consequence of poor economic performance, which have been created and perpetuated by a top-down approach by government to disaster management and recovery. Little attention has been paid to the root causes of vulnerability, and experienced practitioners urge the adoption of bottom-up collaboration between aid agencies and local communities in order to increase levels of education, break the poverty cycle, and develop/implement meaningful disaster preparedness strategies.

ACTOR NETWORK CONTEXT 2: CUBA

Like Haiti Cuba is a developing country situated in the Caribbean in the heart of Hurricane belt, and is also highly exposed to seismic hazards, flooding and land/mudslides. Despite its exposure to natural hazard and frequency of disaster Cuba is regarded as one of the world's most prepared countries in terms of its approach to, and strategies for disaster management.

Unlike Haiti however, Cuba is recognised as a world leader in the field of disaster resilience because of its successful prevention and mitigation strategies. It contrasts with many developing countries where the lack of planned strategies is often the reason for high death tolls and significant destruction. By way of illustration, between 1996 and 2002 the Caribbean was struck by 6 major hurricanes. Within that time frame, 16 Cubans died as a result of the hurricanes. The Caribbean as a whole lost several thousand lives during this same time period. In 2004 when Hurricane Jeanne hit the Caribbean the death toll was significant in neighbouring Haiti with almost 4000 reported dead. Jeanne struck Cuba with even more deadly force, however not one single life was lost.

Developed countries can indeed learn lessons from Cuba: the USA's catastrophic response to Hurricane Katrina in 2005 is often cited in this regard. Problems arose as thousands of residents were unprepared for such a disaster, and refused to leave their homes when they were advised to do so by authorities. There was no co-ordinated response plan in place and many died due to a lack of medical facilities.

Cuba has a mature and established disaster preparedness and management strategy. At the beginning of each hurricane season the Government revises its preparedness strategy based on experiences from the previous year. The success of the Cuban approach has been greatly attributed to the education and engagement of the public in protection, emergency response and the recovery process. Building resilience adaptation at the community level is critical and mobilises the entire community in the promotion of mutual health and safety. Everyone is aware of their roles and responsibilities. Particular focus is paid to identifying and assisting those who are most vulnerable.

Citizens participate in a two day hurricane drill, which involves measures such as cutting down potentially dangerous tree limbs and assessing possible scenarios that could prove dangerous if a hurricane was to strike. The key focus of the preparedness strategy is on public participation. Every citizen is well briefed and understands his/her own hurricane refuge location and procedures. As refugees are allocated they are stocked with food and medical supplies. When a hurricane approaches strategies are executed by the National Civil Defence Force, from national government level down to the public, who are kept well informed by radio and television broadcasts with updates on the approaching storm.

Cuba operates a bottom-up approach in terms of preparedness and prevention focusing on the people and the social fabric as opposed to only the technical elements of a preparedness strategy. Their strategy targets the root causes of vulnerability: by executing these strategies the

Government builds resilience across the entire nation, helping to reduce long-term vulnerabilities and mitigating the devastating effects that a disaster could inflict.

In general the actions of the Cuban government in relation to disaster preparedness, vulnerability reduction, and resilience building embrace the following principles:

- Whole-of-community engagement with disaster preparedness initiatives.
- Mutual responsibility amongst the population for health and safety outcomes, including identifying and assisting the vulnerable ahead of disaster events.
- Long-term planning and resourcing of disaster refugees and health facilities.
- Constant communication between disaster actors and the general population before, during, and after disaster events.
- Reduction of social inequalities to mitigate post-disaster vulnerabilities and accentuate resilience outcomes during rebuilding.
- Development of low energy, ecologically sustainable building materials and techniques, allied to education and training of the population in order that disaster-affected residents can initiate rebuilding activities without recourse to expensive imported materials and highly skilled labour.

While some would argue that the Cuban situation has been exacerbated by US economic sanctions against the State, others have argued that it is this very challenge that has triggered Cuba's enviable resilience in the face of disasters.

IDENTIFYING AND CONSTRUCTING THE ACTOR NETWORKS

The characteristics of an actor network include the existence of a clearly defined problem, the solution of which is a matter of common concern to the actants of which it is comprised. It can be seen from the preceding two contexts that a) disasters do not respect social or geographic boundaries, and b) pre-existing conditions – social, constructed, and governmental – play an important role in determining how post-disaster recovery plays out. Given the exploratory nature of this research, with its focus on assessing suitability of an investigative technique, it was decided that two scenarios were suitable for investigation: a) the influence of post-disaster food aid on the local economy in Haiti, and; b) the influence of resilience planning in Cuba. In both cases the first step was to identify the boundaries of the problem and the actants contained therein. Figures 1 and 2 illustrate the results of this process, identifying firstly the powers and organisations active within the disaster theatre, the actants groups located within the theatre, and their influence upon the specific problem context. The arrows thereafter indicate a detected influence upon the problem solution or problem context.

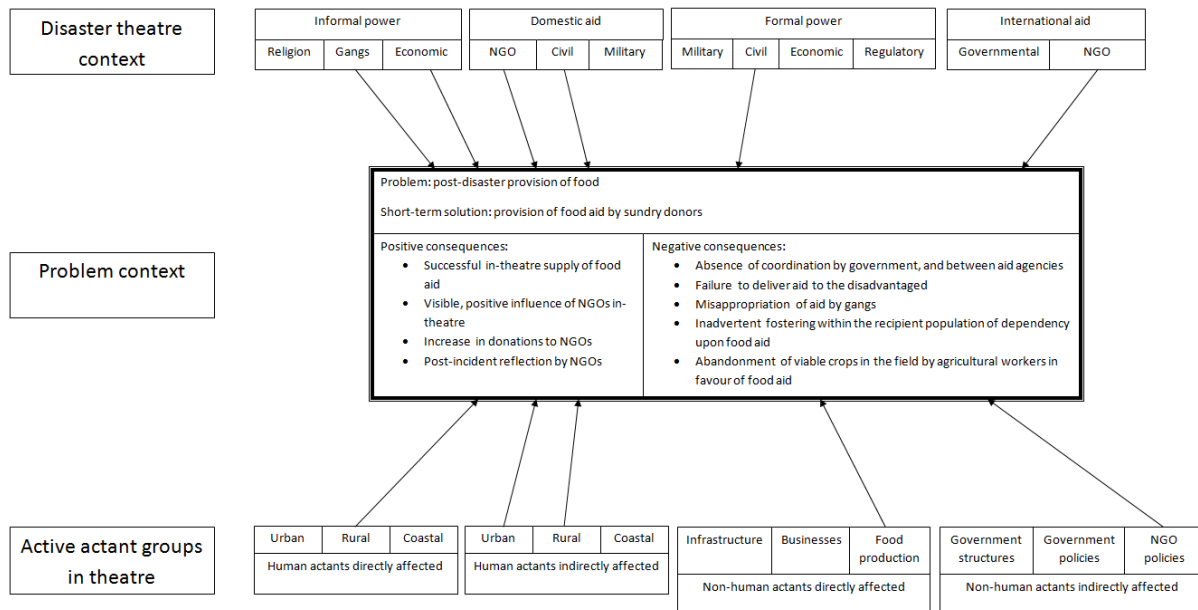


Figure 1: Haiti disaster: problem context and actants (Source: Authors).

In the case of Haiti it was apparent that both rural and urban populations had been affected, both directly and indirectly, by the weather event. Direct losses for those immediately affected included property, shelter, crops, and livelihoods. Indirect impacts on those not directly affected included massively increased competition for now-scarce resources. Vulnerabilities in the population based upon high levels of poverty and deprivation were exacerbated by repeated severe weather events.

This structural vulnerability could be traced back to Haiti's political instability where democracy was a relatively new and predominantly unstable condition, poorly understood by the population. From the politicians' perspective the main focus was on political survival in an environment where corruption was endemic, and street gangs were the most powerful social structure. Government and civil powers were generally ill prepared for severe weather events, and acted in an uncoordinated, reactive mode in the absence of any formal disaster management policy.

The absence of an overarching governmental plan for disaster management ensured a lack of coordination between local and international NGOs, thereby limiting their effectiveness to the short-term. In essence their activities could do nothing to reduce the long-term vulnerability of the population, and certainly did nothing to increase Haiti's resilience. The lack of coordination between international NGOs ensured that specialised aid – such as emergency housing, engineering services – was applied piecemeal with little or no consideration as to their long-term impact or integration. As a consequence the opportunity to build resilience – to exert a multiplier effect – was missed.

What was perhaps not evident at the time was the impact of food aid on the economic behaviour of the population. International NGOs recognise that although a well-timed cash intervention to the government was preferable and led to better outcomes, issues of local corruption rendered this option impossible, making the direct supply of food aid the next best option. However the availability of NGO food relief reduced the need for the population – and particularly the agricultural sector – to restore their farming capacity. Indeed the removal of the hunger imperative resulted in viable crops that had survived the severe weather event remaining unharvested and rotting in the fields. Given the cyclic nature of grain production (with a proportion held back for sowing in the following year) this has a devastating effect on the agricultural sector as a whole, fundamentally reducing Haiti's resilience to future severe weather events.

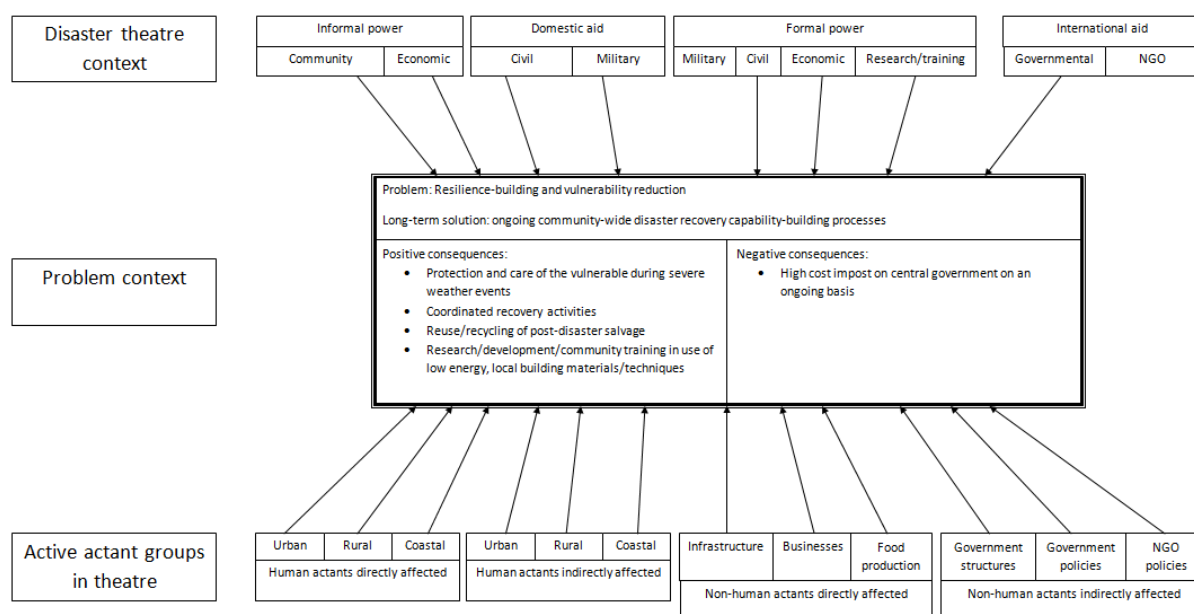


Figure 2: Cuban disaster: problem context and actants (Source: Authors).

In Cuba, which was subject to similar numbers of severe weather events, and where disruption to the rural and urban populations was widespread, it was evident that the long-term impacts of disasters were less severe than in Haiti, and post-disaster scenarios were altogether more constructive. This could be attributed to long-term programmes of vulnerability reduction and resilience building initiated by the government, but enacted by the community.

Cuba can be thought of as a despotic Communist dictatorship or as the last bastion of true socialism, depending upon the viewer's perspective. Objectively, it can be said that political and social structures on the island are stable and mature, and although personal wealth is not a hallmark of Cuban society there are many aspects of Cuban life (e.g. health care, education and aged care) that are centrally supported and widely admired. More importantly, in the context of the current study, societal care for the well-being of the individual extended to a long-standing commitment to disaster management and reconstruction.

The impact on Cuba of severe weather events is markedly less than that experienced by her neighbours. Ongoing training and rehearsal in vulnerability reduction techniques, including community-based simulations and exercises, result in the population behaving in a well ordered way once a severe weather event has been predicted. This includes empowerment of the population at local level to take care of its own members, particularly the vulnerable, and provides them with suitably sturdy and resourced shelters within which to ride out the storm.

Much of Cuba's resilience in post-disaster recovery stems from a political will and commitment to resilience-building. Research and development into building with low technology, locally available materials (including the reuse of salvaged materials), together with the education of the population in their use are fundamental policy cornerstones.

DISCUSSION

The previous section introduced two actor networks describing clearly defined problem scenarios related to severe weather events, vulnerability reduction on the one hand and resilience building on the other, in two neighbouring Caribbean states. These were constructed from multiple interviews, conducted for another purpose, some considerable time after the events to which they referred. All subsequent discussion must be considered with these constraints in mind.

It could be argued that the problem scenarios occurred at the socio-technical interface, where the technical component was economic behaviour in the first instance and government policy in the second. In both of these cases the social dimension represented a powerful influence on the level of both the vulnerability experienced and the resilience subsequently demonstrated by the communities affected. In the first case the lack of social cohesion ensured that the choice of aid mechanism to be deployed had to be expedient and necessarily result in sub optimal outcomes. In the second a degree of social cohesion had been engineered by the government and bolstered by complimentary civil defence activities, resulting in year-on-year improvements in societal resilience.

Though both the context and the active actant groups differed in detail the overall challenges faced by both communities were broadly similar. Yet comparing the density of arrows in the active actant groups between the two disaster scenarios is instructive: in Cuba engagement with the problem enlists the entire social structure, whereas in Haiti disenfranchised sections of the community appear to have missed out on disaster relief altogether, and yet criminal street gangs were reported to be controlling the distribution of much of the food aid.

The food aid itself, and perhaps the manner of its distribution, are inanimate objects that would not normally be ascribed their own "motivations", yet actor network theory demands that this be the case (Munro, 2009). It is therefore instructive to reflect on the nature of such motivations: food aid is one of a suite of products marketed by local and international NGOs; its motivation is firstly to be consumed, and secondly to be seen being consumed (as effective marketing to current and potential donors). It may also act as a demonstration of "power", possibly even as a source of dependency or addiction. Such words and phrases are laden with value judgements and could cause offence. Yet it remains the case that NGOs are businesses, rely on being seen to be effective humanitarians, marketing themselves as such in order to generate income streams. Perhaps inadvertently, NGOs may be regarded by aid recipients as representing power, being powerful (certainly more powerful than them), and at some point the ongoing provision of food aid may diminish recipients' capacity to feed themselves.

In the Cuban case study it is apparent that the process of resilience-building was conducted by individuals and groups throughout entire communities. Yet these activities were not aimless or ad hoc, rather they were conducted with coordinated purpose, and that purpose was enshrined firstly in policies that were centrally developed, and subsequently through the agency of civil defence organisations. ANT suggests that these documents and structures have their own motivations, which are given life (or perhaps made visible) by those human actants who are influenced by them. Clearly, in this case, they (policies and organisations) have satisfied the ANT stages of problematisation and interessmant, and the subsequent enrolment of civil society as a whole (Miettinen, 1999). The population invests in resilience-building activities and is willing to accept associated non-human actants as OPPs (Callon, 1986).

It is difficult to imagine a situation in Cuba where the enormity of the disaster, and therefore the long-term reliance upon food aid provided by NGOs, would render the food aid to be sufficiently persuasive as to make it the new OPP in that disaster theatre (though it is not difficult to imagine the need for food aid in the short-term). Cultural researchers (Utsey *et al*, 2007) e.g. might suggest that the strong community spirit and ingrained training that occurs in Cuba would create a community culture that could, over the short-to medium-term, "lean back on the ropes" provided by food aid whilst being sufficiently resilience to "bounce back" and move forward into reconstruction and the recovery of the food production systems.

For Haitians the high level of social fragmentation combined with a lack of coherent, centralised power resulted in a situation where food aid itself achieved a level of power and currency not envisaged by its providers. The aid was able to establish itself as an OPP, irrespective of the human actants who were distributing it. Under these circumstances neither the presence of viable crops in the field nor the need to reconstruct devastated agricultural infrastructure in order to ensure long-term food supplies were sufficiently enticing to achieve interessmant.

CONCLUSIONS

The point of departure for this paper was to investigate the suitability of ANT for deployment in a disaster-related context in order to illuminate and tame the inherent complexities encountered during disaster relief and beyond, in relation to building resilience and minimising vulnerability. In conducting this exploratory research the following constraints became apparent:

- ANT requires that the problem boundaries be carefully and clearly defined. Disaster-blighted environments tend to be both complex and dynamic, both of which conditions have the tendency to blur boundaries.
- ANT also requires the fullest engagement with all stakeholder groups: paradoxically it is often the most affected parts of the population who are also the most disenfranchised, and therefore frequently the least contactable/investigated.
- It is apparent that the scope for causing serious offence to some stakeholder groups (e.g. government aid authorities, NGOs, religious fundamentalists, etc) could be significant under certain circumstances, especially when analysing their aid strategies. The extent to which they could therefore be expected to cooperate in such research might therefore be questionable.

In order for ANT to be applied meaningfully to solve a problem (or at the very least, explaining the complex interrelationships between the influences on a problem context) it is necessary to interrogate the actants first-hand, where possible, or to give non-human actants agency through a reliable intermediary. Neither of these conditions could be satisfied in this study – this was known from the outset – but the usefulness of the technique could nevertheless be confirmed (or discounted); indeed such an approach might prove very useful, when for instance conducting scenario planning exercises for potential or imminent aid programmes.

In the event, although motivations that were attributed to nonhuman actants during the course of this research could not be verified by an ongoing interaction with various third parties it was apparent that many of these motivations were implicit in the consequences of the actants' existence in-theatre. More importantly consideration of these, admittedly esoteric, motivations before deployment of nonhuman actants (such as food aid) might have given aid-related human actants the opportunity to reconsider the manner of their deployment.

REFERENCES

- Aanestad, M., and Hanseth, O. (2000). "Implementing Open Network Technologies in Complex Work Practices: A Case from Telemedicine," in *Organizational and Social Perspectives on Information Technology*, R. Baskerville, J. Stage, and J. I.DeGross (eds.), Kluwer Academic Publishers, Boston, pp. 355-369.
- Bingham, N. (1996). Object-ions: from technological determinism towards geographies of relations. *Environment and Planning D*, 14, 635-658.
- Callon, M. (1986). The sociology of an actor-network: the case of the electric vehicle. Callon, M., Law, J. & Rip, A. eds. *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*. London: Macmillan Press, 1986 p. 19-34.
- Callon, M., Law, J. & Rip, A. eds. (1986). *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*. London: Macmillan Press.
- Cavill, S. and Sohail, M. (2007). Increasing Strategic Accountability: A Framework for International NGOs, *Development in Practice*, 17(2), pp. 231-248.
- Czarniawska, B. & Hernes, T. eds (2005). *Actor-Network Theory and Organizing*. Copenhagen Business School Press. ISBN 8763001446

- Fenwick, T., & Edwards, R. (2010). *Actor-network theory in education*. Routledge.
- Furedi, F. (2007). The Changing Meaning of Disaster, *Area; Journal of the Royal Geographical Society*, 39(4), pp. 482-489.
- Goguen, J.A. (1999), Art and the Brain. *Journal of Consciousness Studies*, 6(6/7), June/July.
- Hanseth, O and Monteiro, E. (1998) Changing irreversible networks. In *Proceedings from ECIS '98*, Aix-en-Provence, 4.-6. June, 1998.
- Hitchings, R. (2003). People, plants and performance: on actor network theory and the material pleasures of the private garden. *Social & Cultural Geography*, 4(1), 99-114.
- Ingram, J.C., Franco, G., Rio, C.R. and Khazai, B. (2006), Post-disaster Recovery Dilemmas: Challenges in Balancing Short-Term and Long-Term Needs for Vulnerability Reduction, *Environmental Science & Policy*, 9(7/8), pp. 607-613.
- James, E. (2008), *Managing Humanitarian Relief: An Operational Guide for NGOs*, Intermediate Technology Publications Ltd, Warwickshire.
- Latour, B. and Woolgar, S. (1991). *Laboratory life: the construction of scientific facts*, Princeton, NJ, Princeton University Press.
- McVeigh, A. (2012) *The impact of disaster response actors on vulnerability reduction and building community resilience*. Unpublished dissertation MSc in Construction and Project Management. Queens University, Belfast, Northern Ireland.
- Miettinen, R. (1999). The riddle of things: Activity theory and actor-network theory as approaches to studying innovations. *Mind, Culture, and Activity*, 6(3), 170-195
- Munro, R. (2009). Actor-network theory. *The Sage handbook of power*, 125-139.
- O'Hare, G. and Rivas, S. (2005), The Landslide Hazard and Human Vulnerability in La Paz City, Bolivia, *The Geographical Journal*, 171(3), pp. 239-258.
- Sidorova, A., & Sarker, S. (2000) Unearthing Some Causes of BPR Failure: An Actor-Network Theory Perspective. *Proceedings of the Americas Conference on Information Systems*, Long Beach, CA.
- Twigg, J. and Steiner, D. (2002), Mainstreaming Disaster Mitigation: Challenges to Organisational Learning in NGOs, *Development in Practice*, 12(4), pp. 473-479.
- Utsey, S.O., Bolden, M.A., Lanier, Y. & Williams III, O. (2007). Examining the role of culture-specific opening as a predictor of resilience outcomes in African Americans from high-risk urban communities. *The Journal of Black Psychology*. 33(1). pp75-93.
- Van House, N. (2001). *Whom Do You Trust? Digital Libraries as Boundaries and Boundary Objects*. Presentation at the Annual Meeting of the Society for Social Studies of Science (4S), Cambridge, MA.

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REDUCING RISK AND PROMOTING SUSTAINABILITY IN THE FOOTHILLS OF THE HIMALAYAS

A Pedagogy for Teaching and Practicing Sustainable Development

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Abstract

This paper considers the role of a workshop as an educational approach and as a catalyst for positive change in the context of vulnerability and risk in the foothills of the Himalayas in the region of Uttarakhand, northern India. The paper will discuss the evolving pedagogy of Architecture Sans Frontières-UK (ASF-UK), an organisation that uses workshops as a primary tool to explore international development issues and help develop the relevant competencies for built environment professionals working in this sector. The workshop, and its catalytic potential, will be discussed and evaluated in relation to a case study: an international workshop coordinated by ASF-UK and partner, SEEDS India, which took place in Almora, Uttarakhand in 2010. The workshop marked the inception of a three year project which aims to facilitate improved building practices in symbiosis with disaster mitigation and wider development agendas through education, capacity building and prototype development.

Keywords: Risk; vulnerability; participation; education; sustainability; building capacity; catalyst; resources; workshop; technology.

INTRODUCTION

The context in which ASF-UK is working

The approach of Architecture Sans Frontières-UK is continually evolving as the organisation witnesses, and attempts to respond to, a context of rapid urbanisation, scarce resources, poverty, vulnerability and natural disasters which define the 21st Century. Over twenty years ago UN-Habitat (1987) warned that ‘cities in the developing world will account for 95% of urban expansion over the next two decades and by 2030, 4 billion people will live in cities – 1.4 billion in slums’ (in Hamdi, 2010). ASF-UK is examining the impact of this context on the human development of billions of people across the world, and the critical role the built environment professional can play in facilitating positive change.

In ASF-UK’s work there has been a continual dialogue concerning what can and should an architect do, and how well are architects equipped to work in challenging contexts with vulnerable people? While ‘only about ten percent of the population has the resources to commission the kind of buildings that the ‘academically trained’ architect has learnt to design’ (Tovovich, 2008), it is essential for architects to question the impact their work has on the other ninety percent of the world’s population. ASF-UK’s programme offers architects the opportunity to embrace a social and environmental agenda; broadening the area of concern in a bid to make the profession more relevant, and the skills architects possess available to a much wider audience.

By increasing the number of practitioners equipped with the necessary skills to work effectively with their local partners, ASF-UK hopes to improve living conditions for vulnerable groups and disadvantaged communities. ASF-UK also seeks to influence the aid and humanitarian sector by highlighting the importance of using appropriately trained international and local practitioners in order to enhance agencies’ capacity to deliver relevant shelter solutions.

The organisation is not just an avenue for architects, but all building and environmental professionals and community place-makers. ASF-UK endeavour to work with a range of people, with a range of skills to offer, and find new methodologies and platforms for sharing knowledge.

ASF-UK believes that there are challenging contexts locally as well as further afield, and that the skills of building professionals can be invaluable if used appropriately. A working methodology grounded in community engagement, which is at the heart of ASF-UK's mode of practice, is relevant to a multitude of contexts and capable of adding untold value in all project scenarios. While the ASF-UK programme is diverse, delivered through workshops, lectures and events in the UK and internationally, there is a consistency in the approach. All projects promote the development of partnerships with local organisations that are involved in sustainable development and all projects develop transferable competencies for participants, which are relevant to practitioners in any context.

A gap in education

Questioning and understanding the role of the architect in *development* currently sits on the margins of architectural education. Unless students have made a conscious decision to attend one of the few universities that offer a course specifically aimed at giving students the '*opportunity to develop knowledge, skills and attitudes in the rapidly changing field of development and emergencies*' (CENDEP, Oxford Brookes University, 2010) they would struggle to cope in such a challenging and different context. The other options are a handful of university courses with a design/build focus, academic courses purely focused on development, and extra-curricular short practical courses for architects or a wider range of professionals.

While Nabeel Hamdi and others have been pioneers in establishing courses alongside the curriculum at universities such as Oxford Brookes, there is still little on offer for the majority of architecture students. ASF-UK is attempting to bridge that gap by teaching the inclusive, participatory and empowering methods of working effectively within communities, to alleviate poverty and increase community capacity. Workshops in the UK and internationally, combine theory with practical experience, to teach international development issues, and the unique roles and responsibilities built environment professionals have when working in this sector.

Relevant competencies

In reality, it is impossible to know everything, so it is essential for students to develop critical thinking, methods of learning and judgement, to prepare themselves for a career of continued learning and investigation. Jeremy Till, (2005) an architect, academic and critic, suggests that the development of *judgement* is far more pressing than the accumulation of knowledge, and emphasises the value of '*multiple modes of thinking rather than specific methods of doing*'. Hamdi (2010b) uses the word competency in a similar way and indicates that '*competency is actually about being flexible, being entrepreneurial, recognising your ignorance, and taking opportunity when you spot it*'. Being able to reflect on your actions is a crucial part of it, as is accepting that '*getting it wrong is part of getting it right*'.

Through accumulated experience ASF-UK has identified a number of core competencies (in addition to those that architects are assumed to possess as a result of their training) which need to be developed and nurtured through field-based learning. In a move towards relevance, the architect does not need to abandon the skills they have, but redirect them from the traditional model of provider, to that of an enabler, or servant and interpreter. In this position they can draw on a wide range of sources and consider their impact on current and future societies (Khan, 1987). The role requires of architects a transparency, and a willingness, to engage. This can transform the commodity of architecture from a private skill to '*a social resource*' opening up the rights for people '*to make high demands of it.*' (Oliver, 2005)

Key competencies

A willingness to question the preconceived role of the architect, and redefine it, is a key competency and involves probing the process undertaken and your position within it. With a

freedom-centred understanding of development, architects can assume a position of agency, which Lisa Findley describes as *'the power to act on behalf of someone else or on one's own behalf'* (in Loh, 2005). Agency is more than just taking a position to help people, but a way of working that is participatory, instead of patronising or controlling.

Responding to context is the ability to balance creativity with cultural considerations, and locally available and appropriate resources in diverse environments. It involves developing an understanding of how a community operates: from a basic appreciation of community composition to uncovering networks, exchange, production and hierarchy. Context broadly includes resources, shelter, and settlement and by considering all three, an architect can begin to develop a locally relevant and sustainable architecture.

Broadening the area of concern can introduce architects to contexts they would not have previously conceived of working in, and opportunities to engage with 90% of the worlds' population, who would not otherwise have access to design services. The ability to develop ethical judgement is even more critical when working in a context with fewer building and planning restrictions. It is essential that these contexts do not become a testing ground for architects' aspirations, and that learning from experience is not solely the *'freedom to make the same mistakes'* (Edwards, 1996). It is vital to consider the long-term implications of a potential project, and not to take advantage of the freedom to experiment in a context with less enforced building regulations.

PEDAGOGY OF A WORKSHOP

A *workshop* can be understood in this context as a particular method of learning, combining aspects of the architectural design studio with characteristics of field-based/live projects, to create an opportunity for *'experimental learning linking action with reflection'* (Hamdi, 1996) which ASF-UK term *learning in action*. The *workshop* is a small moment in a much bigger picture: in one sense it attempts to embody a way of working and a whole process. On another level it merely serves to introduce and expose participants to the complex web of issues associated with development. It illustrates the relationship between theory and practice, and how one can generate new theory from research and practice.

While workshops do not follow a rigid curriculum they are structured around a series of parameters which act as a framework to facilitate planning and evaluation. On one level the framework serves to regulate an otherwise organic process, while on another it clarifies the intention of the workshop, and helps to measure how successful it is in developing the competency of participants and in contributing towards a long-term agenda.



Figure 1: Learning in action (Source: Sarah Ernst).

Vulnerability and Risk: the role of green technology 2010

This pedagogy will be discussed and evaluated using, ASF-UK's workshop in 2010 as a case study. This was the second collaboration between ASF-UK and SEEDS India (SEEDS) which explored a range of small innovations in green technology; from bamboo prototypes for earthquake resistant building to compressed stabilised earth blocks, in the context of vulnerability and risk in the Indian Himalayas. SEEDS is a non-profit voluntary organisation supporting vulnerable communities to become more resilient to disasters. SEEDS adopt a 'multi hazards', 'locally-based' approach seeking to empower communities through generating awareness, training and action. Founded in 1994, by a group of students and pedagogues of the School of Planning and Architecture, New Delhi, SEEDS comprises young professionals drawn from various development-related fields.

Partnerships, participants and facilitation

ASF-UK believes strongly that local communities and local built environment professionals should be determining their own development, and any external players should be building capacity and helping to facilitate the change needed. Through partnerships with national NGOs in developing and 'non-developing' countries, ASF-UK has organised international workshops where students have learnt on the ground. The partnership between ASF-UK and SEEDS India, which began in 2006, is built on mutual learning and exchange. SEEDS India is keen to support and strengthen the work of smaller NGOs, and provide opportunities for workshop participants (or students) to bring their experience and skills, to give a different perspective to the challenges their partners

face. The participants learn first-hand from the local NGOs and community, rather than the other way around.

In this workshop, the local NGO was Lok Chetna Manch (LCM), a grassroots organisation which runs courses on skills training and sustainable livelihoods. LCM is a member of Mountain Forum Himalayas (MFH), a network of established voluntary organisations across the Himalayan states of Himachal Pradesh and Uttarakhand which works to promote good governance, environmental sustainability and disaster risk reduction. MFH is in turn supported by CASA (Church's Auxiliary for Social Action) a leading Indian voluntary organisation, specialising in emergency response, and disaster risk reduction for over sixty years. The combination of organisations working in partnership enhanced the shared learning experience and potential for scaling up initiatives.

Seventeen participants from the UK and overseas and five Indian participants took part in the workshop; all were students or professionals at different stages of their architectural training. The workshop was directed by three facilitators (which included 2 members of staff from ASF-UK and the ex-director of SEEDS India, Anshu Sharma) supported by 3 volunteers. Although a workshop tends to be short, the number of man hours available during this time is significant. Numbers on ASF workshops range from 15-25 on average, which results in 1250-2000 man hours over a two week period. Strategically, placing a workshop within an ongoing or emerging project can be a simple way of temporarily bolstering capacity.

Equally, there is an interesting relationship and dynamic between *insiders* and *outsiders*. During workshops, ASF-UK carefully considers the responsibility and ethics of being an outsider and both the positive and negative implications. The challenge as an outsider is to be collaborative and interactive, rather than simply extractive. An outsider can be a resource to assist smaller groups to engage with the authorities and demand the attention they deserve in the local context. There is a lot of potential for skilled outsiders who are willing to offer organisations access to their skills.

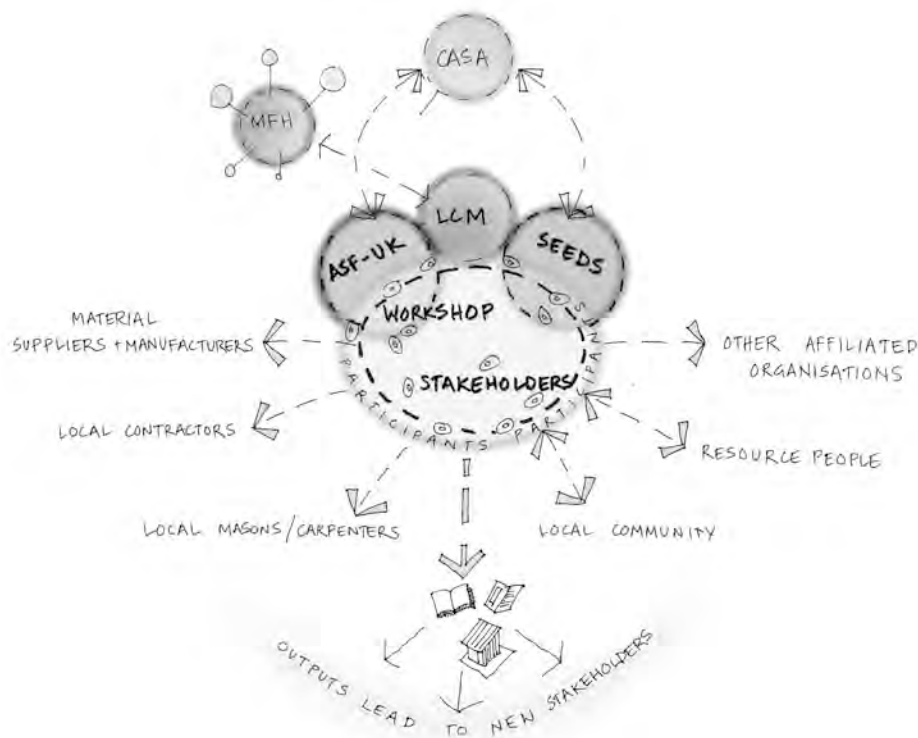


Figure 2: Stakeholders of workshop and long-term programme (Source: Andrew Edwards).

Context, content and approach to learning

The workshop took place in Ranikhet, a hill station in the northern state of Uttarakhand, in the Indian Himalayas. The Himalayan region is one of the most disaster prone and ecologically vulnerable ecosystems in the world. It lies mostly in Seismic Zones IV and V, indicating very high earthquake vulnerability. It is prone to cloudbursts, flash floods, avalanches, landslides and forest fires, with natural disasters affecting thousands of lives, houses and infrastructure each year. Many of the hydro-meteorological disasters have been demonstrating an increasing trend in the past decades, and are reportedly set to get worse due to the impacts of climate change (Mountain Forum Himalayas, 2010).

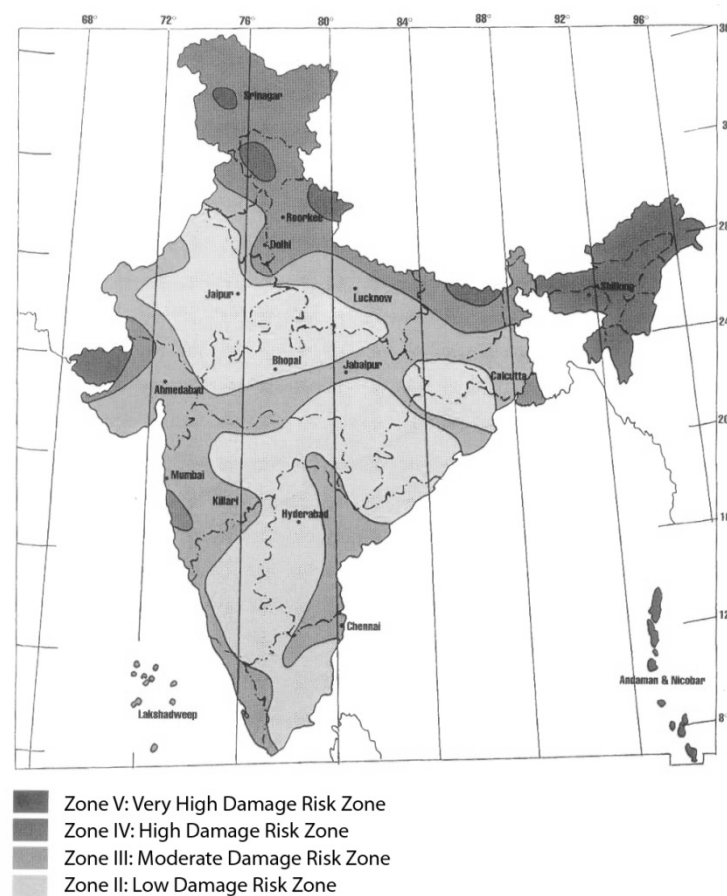


Figure 3: Map of India showing relative earthquake risks
(Source: Building Materials and Technology Promotion Council, Government of India, 2006).

The workshop took place over a two week period and was structured to allow the first week for research and analysis to understand the context and issues of vulnerability (by looking at the traditional and contemporary vernacular architecture, available skills and materials employed) and the second week for developing propositions for a safer and more sustainable architecture in the area (considering the role of green technology and options to reduce risk and vulnerability).

The group had an opportunity to present their findings from week one to Aarohi, another NGO in the region, at the end of the week and present their propositions and design development to local government officials at the end of week two. These were essential moments for feedback and reflection in an otherwise packed programme which galvanised thoughts and raised new questions. The second week was far more intense, as groups were thinking about shelter and

settlement strategies to reduce risk and promote sustainability as well as considering locally available materials and how they can be used in isolation and in combination. The culmination of this activity was a small covered shelter which utilised knowledge from the testing and research into bamboo and earth construction, and shelter design.

The approach draws on the model of the *design studio*, which as Parnell (2001) explains, requires students to step out of the familiar didactic process of learning in order to develop judgement, and take responsibility for their own learning. Paulo Friere, (1972), a Brazilian educationalist, challenges the didactic model of education, where the consciousness of a student is seen as an 'empty vessel' to be filled by the tutor and advocates that the oppressed must participate in developing a pedagogy for their liberation (Parnell, 2001). *Problem based learning* encourages students 'to make propositions which are often speculative and exploratory in nature' (Roberts, 2004) and values the 'practice of coming to know through struggle' (McNiff, 2002). It allows students the freedom to develop their own ideas from the stimulus they have been given, and by doing so come to terms with a range of possible outcomes. The skill of learning from a problem, and not starting with a series of determined outcomes to choose from, can shift development from being 'top-down' to 'bottom-up'.

Research vs. practical build

In the process of unravelling the workshop, it is possible to draw comparisons with the workshop ASF-UK ran two years ago. In 2008, participants engaged in a complex two week programme of investigation, design, procurement, negotiation and construction of a small intermediate shelter behind a primary school. The shelter served not only as a prototype for the local community, but also as an additional classroom for the school. The group also looked at designing solutions for retrofitting the existing school for earthquake resistance and to begin designs for a model school.

The context in which the scenario was based introduced the majority of issues development practitioners have to confront when working post disaster. The participants were faced with physical and mental exhaustion, diarrhoea and food fatigue, the heat, dangerous working conditions, frustration with communication difficulties, time and cost constraints, difficulties in finding suitable materials, cultural differences, a complex site, and group dynamics which all contributed towards a very real learning environment in which they had to work.

The challenging process meant that the sense of achievement at the end was all the more real, but the time constraints limited the opportunities for them to reflect on what they were doing at the time. In contrast, the workshop in 2010, was designed to provide more time and space for reflection, and had less ambitious outputs within the time available. While the learning curve was steeper in 2008, ASF-UK hope the learning from this workshop will be more gradual and sustained.

Community engagement

When learning takes place in the community, working alongside local partners, the process can be empowering, participatory and more meaningful. Field based learning allows for complex problems to be approached from a number of angles in order to see the short-term and long-term implications, and the range of stakeholders involved. The perception of this complexity changes once one is able to break down the challenges into a process consisting of people and responsibilities.

Participatory Rural Appraisal (PRA) is an empowering way to work in a community, where surveys are abandoned in favour of collaborative discussion and mapping of ideas. Maps can be drawn with the communities' involvement, to locate people, families and resources, and consider density, topography, geography and resources. The process, described by Robert Chambers (1992) as '*handing over the stick*', is the first step to building trust and rapport when working in a community. In doing so, the information that is generated is shared, and not extracted, and you may find the answers to questions you would have never thought to ask.

Long-term agenda

No matter how effective a workshop is in developing competency amongst participants, unless it builds on partnerships with local organisations, and is strategically placed to form part of a long-term agenda, it will be detrimental to development. Building successful partnerships and devising a sustainable long-term agenda are the hardest parameters to meet. Workshops which take place at a key stage or start of a project to generate ideas, energy and direction have the potential to catalyse change. This relies on a strong relationship with local partners, and their capacity to take things forward.

If shelter is understood as a process and not just a product, as first articulated by Ian Davis (UNDRO, 1982) the process of shelter design and construction has the potential to have a positive impact on lives and livelihoods, when devised in a fair and just way. As Tovivich (2009) explains 'a catalyst uses architectural design process/interventions as a step for local capacity building in order to strengthen community bonds with regard to raising awareness of the beneficiaries to start critically thinking about their situation and future by doing.' This process is illustrated in Figure 4.

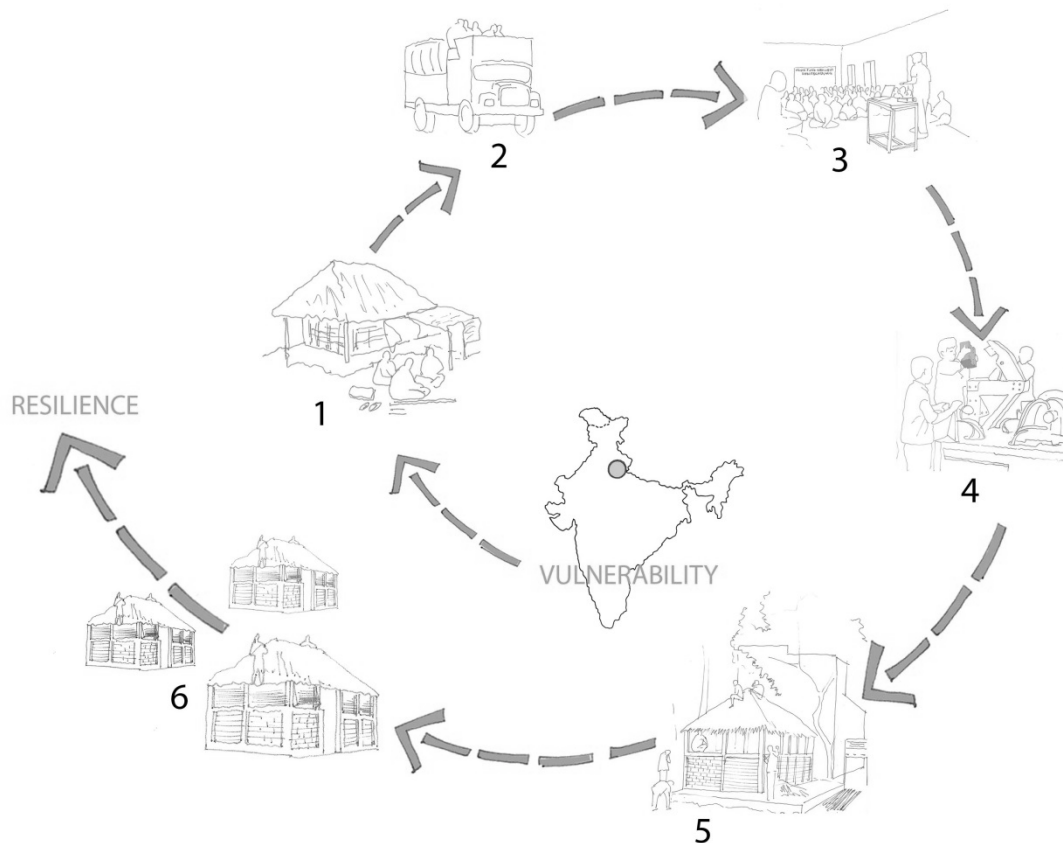


Figure 4: Shelter as a process, not a product: a diagram to illustrate the long-term agenda.
(Source: Sarah Ernst).

1. Assess traditional and contemporary vernacular housing
2. Consider availability of local resources, skills and labour
3. Conduct sensitisation workshops with local community on safe and sustainable construction
4. Organise mason and contractor training workshops in appropriate technology
5. Construct a prototype of a locally appropriate, safe and sustainable shelter
6. Support the process of construction on a larger scale

THE WORKSHOP AS A CATALYST FOR A SAFE AND SUSTAINABLE CONSTRUCTION PROGRAMME

Developing a long-term programme

As part of ASF-UK's working methodology the organisation tries to position workshops as catalysts on two levels. In the short-term to impact on participants and their architectural training, and in the long-term to influence the disaster and development sectors.

A workshop can perform the role of small intervention that triggers a series of developments, which can be increasing in scale. It can be an organic process, partly directed by the motivations of the individuals involved, and opportunities uncovered during the workshop. While the strategy of starting small and getting bigger clearly makes sense, there are common principles that can be used to upscale to a local action agenda in the future.

This workshop marked the start of a new three year project to promote appropriate shelter technologies and processes for disaster and climate resilience in the Himalayan Region. The next stage is a *good practice guide* on appropriate shelter technologies and processes for the region, building on and evaluating existing shelter practices in the area. A series of sensitisation and design workshops will then lead to a built prototype to demonstrate appropriate shelter technologies and train local construction workers and trainers.

The aim is to develop a credible consolidated local knowledge base on shelter construction appropriate to disaster and climate risks in the Himalayan region. Sensitisation of local communities is essential for local people to appreciate appropriate shelter construction, and strive for safe and sustainable houses themselves. At the same time, by sensitising decision makers in government to appropriate shelter construction, state policy can be better informed. The humanitarian aid community will be better positioned to respond to disasters with appropriate shelter rehabilitation interventions and overall levels of disaster and climate resilience in the region will be enhanced.

Phase 1: Guidelines on appropriate shelter technologies and processes (for local government and NGOs)

The *good practice guide* captures the process and many of the lessons learned (from this and other ASF-UK workshops) in a set of guidelines tailored to the context of Almora, but relevant to a multitude of contexts. The guidelines establish technology and process benchmarks for 'building back better' and illustrate approaches to ensure that houses are disaster and climate change resilient, culturally compliant, thermally comfortable, secure and sustainable. They review industrial and indigenous shelter materials and technologies to arrive at appropriate solutions and promote participatory processes not just in assessments, but also in planning, design, construction and monitoring activities.

The guide is designed for local government and Community Based Organisation/Non-Governmental Organisation practitioners, as a set of principles which can help facilitate improved building practices in symbiosis with disaster mitigation and wider development agendas. The guide places building and adaptations to the built environment in an ongoing process of strengthening community and livelihoods, rather than as a singular, one-off event detached from its cultural context.

The guidelines are an attempt to 'scale-up' lessons learned by ASF-UK alongside its partners, and bring them into the debate on safer and more sustainable building practices at government and organisational level. The guide synthesises indigenous and contemporary knowledge on both Disaster Risk Reduction (DRR) and sustainability measures in a context of high risk and scarce natural resources. It is unique in giving equal importance to the topics of resources, shelter and settlement and valuing the process of building over the end product, in particular, how materials and skills are sourced and transferred to deliver new and improved environments.

Phase 1: Laboratory testing of materials and technologies

Appropriate technologies for the region will arise from the intermediate combinations of indigenous technologies and selected industrial technologies. These include stabilised composite earth blocks, lime mortars, natural reinforcements and bamboo formwork. The workshop utilised the participatory tool of harvest mapping to locate local resources, skills and labour. While this visual and interactive tool builds a map of the areas resources, it can also reveal gaps in skills and technology, and suggest opportunities for new enterprise. The workshop mapped out the skills and labour locally available as part of the harvest map process. Groups developed a simple business card system which recorded the contact, skills and location of all masons. It was a simple yet highly effective system which began to form a database of skills and knowledge which was left behind for use and further development by the host NGO. Figure 5 illustrates the difference between sourcing materials locally and importing them from further afield.

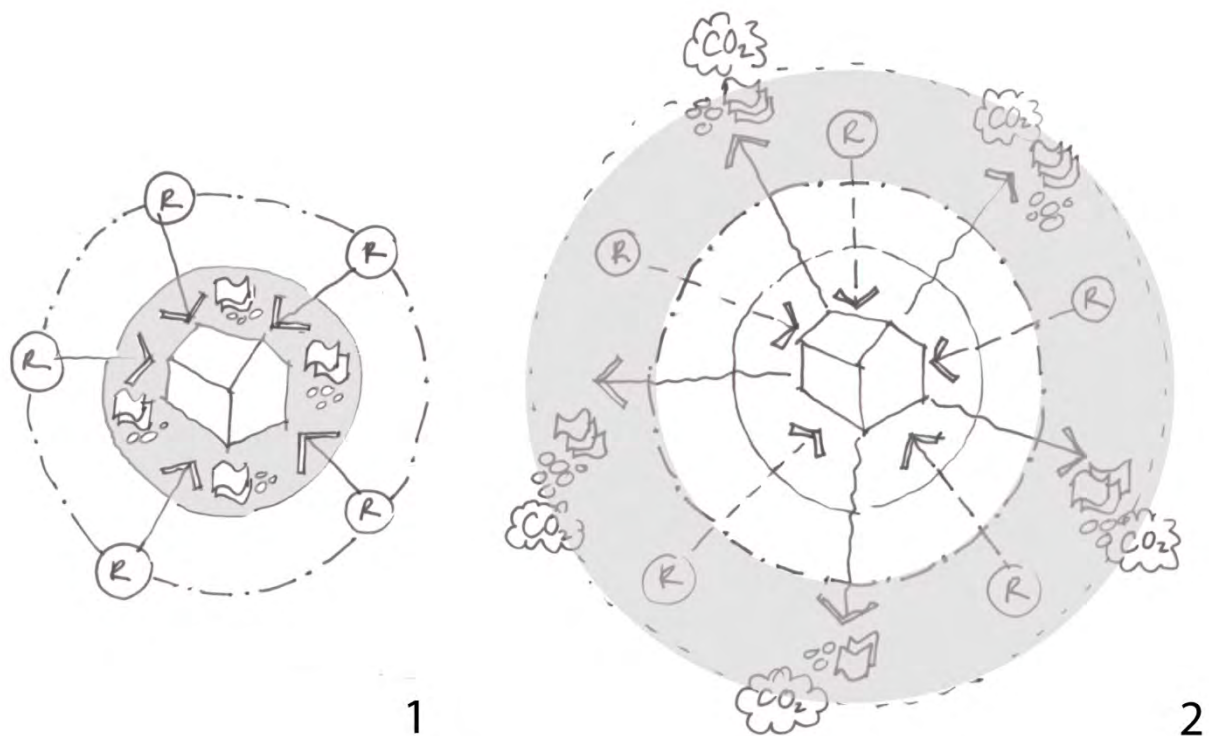


Figure 5: Local resources (Source: Andrew Edwards).

1. Resources and money kept inside locality reducing CO2
2. Resources brought into area money extracted outside increasing CO2.

The workshop compared natural and industrialised materials and components in terms of cost-benefit analysis, considering the environmental impact of each process versus its properties and longevity. A tension remains between the longevity and perceived resilience and strength of industrialised materials over that of natural materials. It is a misconception that all industrialised materials should be rejected on environmental grounds; rather one should consider a material / component in terms of their comparative cost and environmental impact, in relation to their value added. Through research and experimentation during the workshop, students and professionals concluded that intermediate, or hybrid technologies provided the best value. This is illustrated through the comparison of Compressed Stabilised Earth Blocks (CSEB) with a typical Compressed Earth Block (CEB) or mud wall. While the addition of cement in the CSEB block raises the embodied energy, it was concluded from experimentations during the workshop and

additional research by SEEDS, that the additional strength and useful life of the component as a result of this addition is an acceptable trade-off. Furthermore CSEBs acknowledge the growing cultural stigma attached to earth, and the rejection of traditional earth construction in favour of cement-based products. The addition of cement symbolically can change public perception, dramatically improving the rate of adoption of CSEBs.

Intermediate technologies draw on materials that relate to the traditional vernacular and which are locally available, utilising state of the art research and technology to create sustainable intermediate technologies. Local, natural materials are used where suitable, whilst acknowledging the need for the sustainable management of indigenous resources. Traditional materials in the region of Almora are earth, stone, slate and timber, typical of the state of Uttarakhand. Timber and slate are no longer readily available as a result of illegal logging causing widespread deforestation and excessive quarrying leading to a similar ban restricting new excavation. However, the traditional vernacular in the region demonstrates a construction highly attuned to both the climate peculiarities of the region and a resistance to seismic activity which is acutely lacking in almost all modern un-engineered reinforced cement concrete (RCC) homes. The challenge is therefore to achieve a new, contemporary vernacular which draws on the knowledge and expertise of the old, utilising local materials, without further exhausting heavily depleted resources. Technologies such as treated bamboo frame and CSEB represent an intermediate technology which acknowledges the aspirations for the modern without disregarding the lessons of the past.

Exploring low-tech approaches in preference of highly industrialised components and processes will ensure a design is easily adaptable and replicable under varying conditions and constraints. The over-reliance on hi-tech, highly industrialised materials in shelter construction has resulted in a higher dependence on 'foreign' materials and components often imported from a considerable distance. These can bear no relation to the resources available locally and as a result present no benefit to the local economy or local skill base. In addition, hi-tech components frequently result in a dependence on the original manufacturer for installation, maintenance and modification which makes the product unsuitable in changeable environments.



Figure 6: The manual block making machine (Source: Andrew Edwards).

The workshop tested the use of CSEBs manufactured in a manual block making machine (see figure 6) which could be easily transported and therefore implemented locally, without the use of

expert skills or highly technical tools and costly maintenance. In contrast, a hydraulic block making machine can produce blocks of a far greater strength, with a locking profile, which do not require the use of mortar during construction. The hydraulic machine however is not easily transportable, is costly to run using a diesel motor, is approximately 5-6 times the capital cost of the manual machine equivalent and expensive to maintain requiring regular servicing from a specialist engineer. For the remote region of Uttarakhand where transport links are restricted due to narrow and winding roads, the manual machine was more suitable. The workshop considered amendments to the structure and operation of the manual machine to improve the quality of the final product, such as extending the lever arm to improve the level of compression and reducing the size of the block to improve overall strength and reduce cracking. There was insufficient time during the two-week workshop period for sufficient systematic testing of mixes to determine the optimum block mixes based on the soil types available. However, the workshop demonstrated that within a short period of time, several participants could be trained in how to use the machine effectively, and start to experiment and evaluate different mixes and their strengths.

Phase 1: Mason training and sensitisation

From a set of guidelines and continued material testing, the programme will embark on a series of design sensitisation workshops which seek to engage local community and key local stakeholders in the discussion of design for a locally appropriate, disaster resilient prototype shelter built from sustainable resources which in itself becomes a tool for further skills training. A prototype, as with a workshop can be a vital catalytic tool for transferring ideas, skills, knowledge and awareness. From this point the programme will endeavour to grow further, through the training of local masons and networking with local suppliers and manufacturers, to facilitate the building of additional prototypes, adapting to the new challenges specific to each location. This will build on the successful mason training programmes initiated by SEEDS India in post-disaster situations across India and most recently on a large scale in Bihar.

Over 2 million people were displaced by the shock flooding in Bihar in August 2008. Houses were damaged beyond repair by the flood water, and communities were forced to take refuge on higher ground. Due to the scale of the damage and complexity of needs, SEEDS developed a strategy for rehabilitation through training and education in appropriate construction technology. A material hub was established in a centralised location to cater for around 20 villages in 2 blocks close to a local rural market place, a main road and a canal. The hub includes an exhibition area where there are models of disaster resistant construction details, as well as a model house prototype. The prototype promotes local materials; brick and bamboo, and is designed to be earthquake and flood resilient. The hub also offers an opportunity for daily interaction with community members, training programmes for artisans, bamboo treatment and enterprise activity for local skills. The spaces can also be used for meetings with members of surrounding villages and community mapping through focus group meetings.

Phase 2: Scaling up in the region and further a field

Phase 2 of the programme will look at continuing and expanding the field studies and workshops to cover shelter technologies across the two neighbouring states of Uttarakhand and Himachal Pradesh. Documentation of relevant technologies from the region will be supplemented with advanced testing and research on select materials and technologies, and the construction of further prototypes at strategic locations in the region. Advanced guidelines on appropriate shelter will be developed alongside further sensitisation and training workshops for local stakeholders in two states.

By using the same model in one region, and then across the state, and then in neighbouring states, it will be possible to assess the structure and effectiveness of the approach and make adaptations where necessary. The programme structure is designed to be relevant to other regions of India. In each area, region specific guidelines can be developed from the generic *good practice guide* framework alongside a harvest map of resources and skills, and an analysis of traditional and contemporary vernacular. Workshops can be useful at this stage to generate a

lot of information quickly. Following on from the research phase, a region specific intermediate or hybrid technology for appropriate construction can be developed and tested alongside mason training and community sensitisation workshops, before a prototype is built.

The model can be scaled up from local village knowledge centres to regional and even global knowledge hubs to share good practice at all levels and influence the key decision makers in government in appropriate shelter construction to build resilience in communities pre-disaster, and build capacity of both government and the humanitarian aid community to be better positioned to respond effectively to disasters with appropriate shelter rehabilitation interventions. The overall disaster and climate resilience at region and country level will be enhanced.

CONCLUSIONS

The workshop demonstrates the challenges and reveals the opportunities of balancing a learning experience and a long-term agenda. The immediate output through this experience was the exposure of participants to a real and challenging context followed by new links formed with local partners, and the learning experience shared by all stakeholders. It is only through the development and delivery of the longer term programme that the impact on the vulnerability and risk within shelter construction in the area can be assessed.

Lessons for ASF-UK

As ASF-UK's pedagogy evolves, the value of integrating workshops into long-term live projects becomes clearer and more fundamental to our overall approach. By integrating the two, a continual evolution in the process of *learning in action* is possible, which ensures the pedagogy is never stagnant but always free to adapt to new scenarios and fresh challenges. As ASF-UK builds on its own capacity, it continues to engage both practitioners and students with little or no previous experience in development.

The challenges inherent in the workshop are offset by the potential opportunities of positioning a learning experience, such as a workshop, as a catalyst within a long-term agenda. The parameters which form the pedagogy of the workshop can seem simple in isolation, but together they can expose students to the unique roles and responsibilities built environment professionals have when working in this sector and can contribute to a beneficial experience for all stakeholders.

The success of the model/pedagogy can be critically evaluated against the success of this workshop to instigate and sustain a longer term project. The longer term programme is the only way to achieve meaningful engagement, positive change and sustained learning. While the workshop is only two weeks the fast-paced learning scenario, with skilled individuals from seven nationalities and a variety of backgrounds and experiences, can provide the momentum to drive forward a process.

Lessons for the sector

As ASF-UK learns and evolves as an organisation, and adapts its pedagogy accordingly, it will benefit from the experience of other organisations, especially local partners. ASF-UK hope that other organisations can learn from the approach that they are developing and potentially implement learning workshops within their programmes.

There is an ongoing need for better links between learning and practice which needs to be tackled both within academia, to help maintain a focus and pragmatism to theory, and through practice, to explore, test and disseminate advancements in theory. *Learning in action* is a tool that can easily be used by other organisations as a process of exploration, testing evaluation and eventual advancement.

Organisations can benefit from an increased openness towards internship programmes, training and research posts, as well as learning workshops. It is possible to design workshops for new and ever challenging contexts to create interdisciplinary learning experiences as well as promote knowledge sharing and institutional learning. Workshops are a credible starting point for improved practice and raising standards within the humanitarian development sector.

Afterword

The authors presented the good practice guidelines to an audience of development and disaster response practitioners and academics in September 2010 at a conference entitled Improving learning and practice in the NGO shelter sector hosted by the Centre for Development and Emergency Practice (CENDEP) and CARE UK in Oxford. The guidelines were well received and subsequently several attendees reviewed the first draft.

Since then, ASF-UK and SEEDS have continued to share the guidelines with local government representatives and NGOs in India, and have discussed how to enable the activities of Phase 1 to continue and grow into Phase 2. In September 2012, ASF-UK, in collaboration with SEEDS India, the TERRA learning project, and Transition by Design undertook a feasibility study to assess the relevance and viability for establishing a 'building knowledge centre' in India, to act as a repository of information and a living laboratory for appropriate technology (technology which demonstrates disaster resilient characteristics, minimises ecological impact and promotes climate change adaptation).

The results of the feasibility study suggested that the most effective way to build capacity and facilitate knowledge transfer would be through two platforms; an online, virtual building centre, and a physical centre. The virtual building centre will maximize visibility and knowledge sharing amongst regional building centres, NGOs, institutions and professionals. The physical building centre, on the other hand, will be in a strategic location to act as a hub to strengthen and revive the existing network of building centres throughout India, exhibit examples of technological innovation, and facilitate skills training at multiple levels. SEEDS India are approaching potential partners from government, civil society and business to collaborate with in order to realise this vision.

ASF-UK continues to use international workshops to teach inclusive, participatory and empowering methods of working effectively within communities to alleviate poverty and increase community capacity. Between 2010 and 2012 ASF-UK has facilitated workshops in Ghana, Kenya, Cameroon, Brazil and India. All workshops promote the development of partnerships with local organisations that are involved in sustainable development, and develop transferable competencies for participants, that are relevant to practitioners in any context.

REFERENCES

- CENDEP, Oxford Brookes University (2010) *Post-graduate courses* [Online]. Available from: <http://www.brookes.ac.uk/schools/be/postgraduate/courses/dep.html> [Accessed: 04.04.2010]
- CHAMBERS, R. (1992) Rural appraisal: rapid, relaxed and participatory. *IDS Discussion Paper* (311) p. 1.
- EDWARDS, M. (1996) The Getting of Wisdom: educating the reflective practitioner. In HAMDI, N. *Educating for Real*. London: Intermediate Technology Publications, pp. 16-26
- FREIRE, P. (1972) *Pedagogy of the Oppressed*. New York: Continnum, p. 52
- HAMDI, N. (1996) *Educating for Real*. London: Intermediate Technology Publications, p.xv.
- HAMDI, N. (2010a) *The Placemakers Guide to Building Community*. London: Earthscan. pp. 16
- HAMDI, N. (2010b) Engaging *Architecture students with International Development* [Interview] Oxford with S. Ernst. 09.08.2010
- KHAN, H. (1987) Architectural Education: Learning from Developing Countries. *Journal of Architectural Education* 40 (2), p. 31
- LOH, L. (2010) Conserving for change. *Journal of Architectural Education*, 63, (2), pp.71-73.
- MCKIFF, J. with WHITEHEAD, J. (2002) *Action Research: Principles and Practice*. London: RoutledgeFalmer, p. 3.

MOUNTAIN FORUM HIMALAYAS, (2010) *Strategy Paper on the Disaster Management interventions of Mountain Forum Himalayas* [online]. Available from: <http://www.mfhimalayas.org/downloads.php?id=3&sid=21> [Accessed: 09.12.10]

OLIVER, G. Responsive Practice. In RAY, N. (ed.) *Architecture and its ethics dilemma*. London : Taylor & Francis, Taylor & Francis Group, p.66

PARNELL, R. (2001) It's Good to Talk: managing disjunction through peer discussion. *Architectural Education Exchange*. [Online] p.25. Available from: http://www.shef.ac.uk/architecture/theschool/people/staffpages/publications/r_parnell.html [Accessed: 14.02.10]

ROBERTS, A. (2004) Problem based learning and the design studio. *CEBE Transactions*, 1(2) p.1

TILL, J. (2005) The Lost Judgement. *EAAE Transaction on Architectural Education*, (26) p.9

TOVIVICH, S. (2008) Learning from slums: a shift from 'designing for' to 'designing with' and some challenges in integrating the new professionalism into architectural education. In ROAF, S. and

BAIRSTOW, A. (eds.) *Oxford Conference: A Re-evaluation of Education in Architecture*. Oxford: WIT Press, pp. 137-142

TOVIVICH, S. (2009) Learning from Informal Settlements: the New 'Professionalism' for Architectural Practice. *CEBE Transactions*, 6(1) p. 71.

UNDRO (1982). *Shelter After Disaster, Guidelines for Assistance*. New York, United Nations. p. iii.

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BUILD BACK BETTER: LESSONS FROM SRI LANKA'S RECOVERY FROM THE 2004 INDIAN OCEAN TSUNAMI

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Abstract

The concept "Building Back Better" (BBB) was formally introduced following the 2004 Indian Ocean Tsunami, which implies using a collaborative approach to improve the physical, social and economic conditions of a community during post-disaster reconstruction and recovery. This paper introduces eight BBB Principles which contribute towards achieving BBB. The post-tsunami recovery effort in Sri Lanka was examined using the BBB Principles to determine the extent to which BBB has been incorporated in immediate and long-term disaster management practices. Reports, literature, and data collected from a site visit made to Sri Lanka in 2010/2011 were analysed to establish the findings. Although BBB concepts were recognized, failure in execution resulted in a non-BBB recovery. Lessons learnt from shortcomings have been understood and incorporated into current disaster management practices. Good BBB practices currently in effect include: hazard-based land-use planning and risk-based structural regulations; increased awareness; participatory approaches; and stakeholder training. The absence of legislative support to implement BBB initiatives is the only draw-back preventing so far. Lessons from Sri Lanka can benefit disaster management practices worldwide.

Keywords: post-disaster reconstruction; recovery; build back better; sri lanka; indian ocean tsunami.

INTRODUCTION

Restoration of the physical, social and economic impacts of a disaster is a complicated and extensive process. Johnson *et al.* (2006), Lyons (2009) and Halvorson and Hamilton (2010) commented that reconstruction and recovery projects are often poorly managed and tend to focus on quick restoration of affected communities. Long-term consequences of recovery decisions are not considered leading to vulnerable communities that are unable to cope with future hazards. The 2004 Indian Ocean Tsunami disaster which affected 14 countries was a catalyst in bringing forth a new concept to reconstruction and recovery; "Build Back Better" (BBB) (Cosgrave, 2007; Kennedy *et al.*, 2008). The concept of BBB is to take the opportunity during post-disaster reconstruction and recovery to not only restore but improve a community's physical, social and economic conditions to create a new state of normalcy that is resilient and sustainable (Clinton, 2006; Khasalamwa, 2009; Roberts, 2000).

Sri Lanka was the second most affected country by the Indian Ocean Tsunami following Indonesia. Thirteen districts along the Eastern and Southern coast of the country were impacted with 35,322 lives lost and a total of 516,150 people displaced (Asian Development Bank *et al.*, 2005; Frerks and Klem, 2005). The total direct losses from the tsunami were estimated to be \$1 billion (4.5% of the Gross Domestic Product) with further long-term losses incurred from the impacts to the fisheries and coastal tourism industries (Asian Development Bank *et al.*, 2005; Boano, 2009).

This paper aims to discuss the effectiveness of the post-tsunami recovery effort in Sri Lanka using BBB as a benchmark and obtain lessons to improve future recovery efforts in Sri Lanka as well as other countries worldwide. The first objective of this study was to understand BBB as a concept based on findings from existing literature. The findings have led to introducing eight core principles that represent BBB. The second objective of the study was to assess the degree of implementation of the “BBB Principles” in Sri Lanka. This can be used as a tool to determine whether the recovery effort in Sri Lanka was a success or failure in terms of BBB. Adoption/non-adoption of the principles during the reconstruction period and their long-term implications are studied.

BUILD BACK BETTER

Kennedy *et al.* (2008) explained the term “Build Back Better” as “the need to link humanitarian relief and post-disaster reconstruction with longer-term disaster mitigation and vulnerability reduction efforts in order to ensure that reconstruction would not lead to conditions which could result in a similar disaster recurring”. BBB has been mentioned as a necessary component for recovery by the United Nations Office for Disaster Risk Reduction (UNISDR), the United Nations Development Programme (UNDP) and Practical Action among others, as well as in recovery efforts after the Indian Ocean Tsunami (Clinton, 2006; James Lee Witt Associates, 2005), the Haiti Earthquake (Christian Century Foundation, 2010; Frist, 2012) and the 2009 Samoan Tsunami (NZ Red Cross, 2009).

The means by which BBB can be put into practice have been presented in various guidelines including: “Key Propositions for Building Back Better: A Report by the UN Secretary-General’s Special Envoy for Tsunami Recovery” by former United States President Bill Clinton (2006), “Building Back Better: Way Forward” by the Disaster Relief Monitoring Unit of the Human Rights Commission of Sri Lanka (2006), “Building Back Better: Creating a Sustainable Community after Disaster” by Monday (2002), and “Rebuilding for a more Sustainable Future: An Operational Framework” by the Federal Emergency Management Agency, USA (FEMA, 2000).

BUILD BACK BETTER CATEGORIES AND PRINCIPLES

Examination of existing guidelines surfaced three key categories which are required to BBB: (1) Risk Reduction, (2) Community Recovery and (3) Implementation.

Risk Reduction

Risk reduction addresses improving a community’s physical resilience to natural hazards. Risk Reduction in terms of BBB can be represented by two principles: Principle 1 Improvement of Structural Designs and Principle 2 Land-Use Planning. Extensive damage from the world’s major natural disasters have been due to the lack of recognition of accurate risk exposure levels and insufficient mitigation mechanisms to withstand these risks (Batteate, 2006). Risk reduction is primarily executed through enforcement of building codes and regulations to ensure that structures are designed to resist the hazards they are exposed to (Kennedy, 2009; Omidvar *et al.*, 2010). However, issues such as increased cost; unavailability of resources and increased pressures discourage the adoption of new building regulations (Chang *et al.*, 2010; Edwards, 2010; Egbelakin *et al.*, 2011). BBB advocates putting measures in place to ensure that new building regulations are adhered to. Legal backing and education and training is needed to implement the changes (Clinton, 2006; Reddy, 2000). Long-term funding mechanisms can be put in place to improve affordability (James Lee Witt Associates, 2005). Quality assurance needs high priority using skilled builders and conducting regular inspections (Lewis, 2003).

The use of hazard and risk-based land-use planning tools to manage developments is another risk reduction technique (Principle 2) (Haigh *et al.*, 2009; Mora and Keipi, 2006; United Nations, 2005). In Australia following the Victorian Bushfires revised maps were introduced

indicating bushfire risk levels and corresponding building and planning controls to minimize risk (2009 Victorian Bushfires Royal Commission, 2010). All developments were banned along the coastal strip to eliminate future tsunami risk following the Indian Ocean Tsunami and Samoan Tsunami (Potangaroa, 2009; Ruwanpura, 2009). In both countries relocation for protection from the tsunami hazard led to the creation of further vulnerabilities. For example, communities were exposed to new types of hazards such as flooding and landslides, and lost their sea-dependent livelihoods as a result of relocation (Khazai *et al.*, 2006; Mulligan and Shaw, 2007).

Land-use planning in accordance with BBB must balance safety with the interests of the community. Risk zone maps based on multi-hazard assessments must be created to determine appropriate land-uses in conjunction with building regulations (Haigh *et al.*, 2009). Buy-back schemes and land-swap schemes as that adopted in Australia are possible ways of avoiding developments on high risk lands (2009 Victorian Bushfires Royal Commission, 2010).

COMMUNITY RECOVERY

Disasters have a considerable impact on the psycho-social and economic situations of affected communities. Clinton's BBB Propositions stated that "a sustainable recovery process depends on reviving and expanding private economic activity and employment and securing diverse livelihood opportunities" (Clinton, 2006:12,18). Two BBB Principles have been extracted under Community Recovery: Principle 3 Social Recovery which addresses improving psycho-social aspects of the community and Principle 4 Economic Recovery to improve the economic climate.

The 2009 Victorian Bushfires recovery displayed a good example of BBB-based social recovery under Principle 3: each affected family was individually supported and guided through the recovery process by "case managers"; information centres were established including a counselling service; and social, entertainment and cultural programmes were put in place catering to all members of the community (VBRRA, 2010).

Economic recovery is normally supported through business grants, subsidized loans, provision of equipment, training programmes for up-skilling, and attempts to attract new businesses (Christchurch City Council, 2011; GoSL, 2005b; James Lee Witt Associates, 2005; VBRRA, 2009). Risk reduction priorities can impede economic recovery by moving people away from employment opportunities (Khasalamwa, 2009). BBB-based recovery based on Principle 4 focuses on thorough data collection and providing tailor-made economic recovery solutions to suit the local community. Funding provided should be attractive and flexible (Monday, 2002). Business support and counselling services can be established to help people with decision-making (VBRRA, 2010). New livelihood options and low-cost training programmes should be introduced based on local skills and trades (DNS and PA, 2005).

IMPLEMENTATION

The term Implementation identifies the means by which Risk Reduction and Community Recovery are to be put in place in an efficient and effective way. Principles that contribute to BBB-based Implementation are: Principle 5 Stakeholders, which represents clear role allocation and coordination; Principle 6 Legislation and Regulation, to control and facilitate implementation; Principle 7: Community Consultation, to provide fitting solutions; and Principle 8: Monitoring and Evaluation to ascertain compliance and extract lessons learnt to improve future practices.

Inadequacies in clear role allocation and coordination of different stakeholders have hindered the efficiency of recovery efforts in the past (DN and PA, 2008; James Lee Witt Associates, 2005; Johnson *et al.*, 2006). Principle 5 recommends creating a national-level recovery authority such as the Victorian Bushfire Reconstruction and Recovery Authority (VBRRA) in Australia (2009 Victorian Bushfires Royal Commission, 2010), or the Bureau of Rehabilitation and Reconstruction (BRR) in Indonesia (Meigh, 2009) to coordinate stakeholders and prepare integrated recovery plans with clear roles for all stakeholders. Training should be

provided to ensure stakeholders are competent with their roles (Boano, 2009). Grass-roots level involvement is necessary (Lloyd-Jones, 2006; Lyons, 2009).

Clinton's tenth proposition (2006) said that "legal frameworks must be in place to ensure disaster reduction becomes a priority at national and local levels". Principle 6 requires legislation and regulation to be used to enforce compliance to introduced risk reduction and community recovery initiatives (Lewis, 2003). Legislation should also be used to facilitate recovery activities by simplifying permit procedures for example (Meese III *et al.*, 2005).

Over-centralized recovery programmes without sufficient consultation and participation at the grass-roots level have created unsatisfactory results (Baradan, 2006; Clinton, 2006; DN and PA, 2008). Grass-roots level involvement is integral for BBB in accordance with Principle 7 (Haigh *et al.*, 2009; James Lee Witt Associates, 2005). The community must be kept informed and gathered for regular community meetings to explain recovery activities (Baradan, 2006; DN and PA, 2008). Community consultation groups must be established to act as a liaison between the community and other stakeholders to facilitate communication (Florian, 2007).

Principle 8 requires putting in place long-term monitoring schemes to check for compliance of disaster risk reduction (DRR) practices (Clinton, 2006; Lloyd-Jones, 2006). Regular progress reports should be produced including lessons learnt (Mikko, 2009). Continuous education and training must be provided for stakeholders on disaster risk reduction (Bakir, 2004). All lessons must be transferred to Government organisations to improve post-disaster recovery practices in the future (FEMA, 2000).

RESEARCH METHODOLOGY

The level of implementation of BBB concepts and their short-term and long-term implications for reconstruction and recovery in Sri Lanka following the Indian Ocean Tsunami were studied using the proposed eight BBB Principles.

Data on immediate post-disaster recovery was obtained from progress reports published by the Sri Lankan Government and international non-governmental organisations (NGOs) who participated in the recovery efforts. A research visit was made to Sri Lanka from January to February 2011, where qualitative data was collected from semi-structured interviews. The interviews were approximately 1 hour in duration where the participants were questioned on their understanding of BBB and the work implemented under each BBB Principle in post-tsunami and current disaster management practices, their implications and interviewees' recommendations. The data collected seven years after the tsunami presented a valuable opportunity to observe what impacts the post-tsunami recovery process has had on the long-term recovery of affected communities with respect to BBB; whether common perceptions of the recovery effort displayed any changes over time; and to what degree lessons learnt on BBB practices have been adopted in current disaster management systems.

The participants were professionals who had direct involvement in post-tsunami recovery and current disaster management activities from a range of multi-level organizations to provide a cross-sectioned view of the recovery effort (see table 1). Interviewees from the Coastal Conservation Department (CCD) and Urban Development Authority (UDA) who overlooked coastal developments, and an interviewee from the National Building Research Organisation (NBRO) were chosen to explain the central government-level processes and regulations that were in place to deal with the resettlement of these communities, while interviewees from the Galle Municipal Council and Galle Divisional Secretariat were chosen to provide a local government view on how the reconstruction and livelihood development activities were implemented and their impacts on the community. NGOs such as Practical Action, United National Development Programme (UNDP), Asian Disaster Preparedness Centre (ADPC) and Care International were selected as they were leading NGOs involved in the primarily NGO-led recovery effort who dealt with rebuilding as well as socio-economic community recovery. A senior

staff member of a heavily impacted school provided feedback on how the community received donor recovery efforts. Officials from the Disaster Management Centre (DMC), which is an organisation established under the Sri Lanka Disaster Management Act No. 13 of 2005 for the purpose of creating safe and sustainable communities, were interviewed to gain an understanding of current disaster management practices in Sri Lanka developed through lessons learnt from the tsunami experience. The validity of the information provided by the interviewees was ensured through a process of triangulation where the findings were cross-verified with data from documents and the other participants. The interviewees were not made aware of the details of other participants interviewed to prevent bias and guarantee the dependability of the information provided.

An inductive approach using Grounded Theory and Constant Comparative Method was used to analyse the data using the computer programme NVivo 9. The interview data was transcribed then coded under the BBB principles identified.

Table 1: Profile of interviewees (Source: Authors).

	Number of interviewees	Organization	Interviewee Code
International level	4	Asian Disaster Preparedness Centre (ADPC)	P1
		United Nations Development Programme (UNDP)	P2
		Practical Action (PA)	P3
		Care International	P4
National level	8	Disaster Management Centre (DMC)	P5-P9
		Coastal Conservation Department (CCD)	P10
		National Building Research Organisation (NBRO)	P11
		Urban Development Authority (UDA)	P12
Local level	3	Galle Municipal Council	P13
		Galle Divisional Secretariat	P14
		Peraliya School	P15

SRI LANKA'S POST-TSUNAMI RECOVERY AND CURRENT DISASTER MANAGEMENT PRACTICES

The results from the data analysis are presented under the eight BBB principles. The post-tsunami reconstruction and recovery as well as current disaster management practices are discussed under each BBB principle to evaluate the extent at which BBB has been considered and incorporated along with recommendations for future BBB-based recovery efforts.

RISK REDUCTION

Principle 1: Improvement of Structural Designs

Principle 1 refers to implementing structural design improvements to improve the resilience of the built environment to natural hazards. P11 and P13 stated that the large-scale reconstruction faced by Sri Lanka after the tsunami was overwhelming and led to building and construction standards being overlooked due to the urgency with which tsunami project plans were prepared. P4 said that owner-building also led to neglecting structural soundness in favour of aesthetics. Pathiraja and Tombesi (2009) commented that the tsunami rebuild has created sub-standard vulnerable structures.

In the long run lessons from the tsunami rebuild have caused a change in direction in development practices in Sri Lanka according to P1 and P10. The CCD official said “now we are trying to incorporate DRR into the structures for the long-term case. I believe that stricter building regulations and specifications are the best way to go”. DMC with the support of ADPC have already implemented the “Priority Implementation Partnership” (PIP) projects to mainstream DRR into the housing sector (ADPC, 2009). P5 and P6 from DMC said that a risk profile for the country which is to be used to develop construction guidelines is underway.

Principle 2: Land-Use Planning

Principle 2 proposes the utilization of a hazard-based approach in land-use planning to minimize risks. “Coastal buffer zones” were introduced in Sri Lanka as a risk reduction strategy during post-tsunami reconstruction. Construction was prohibited on coastal land, and people who previously lived within the buffer zone area were relocated (Boano, 2009; Frerks and Klem, 2005; Kennedy *et al.*, 2008). Relocation was problematic due to the scarcity of suitable land for new settlements (GoSL, 2005b; Mulligan and Shaw, 2007). P3 along with Kennedy (2009) and Khazai *et al.* (2006) reported that the rush to rebuild resulted in omitting proper hazard assessments, exposing people to new hazards such as flooding in relocated areas. P11 said that “the resettlement was done without much consideration. There is a big gap in creating a proper resettlement policy which needs to be looked at”.

The UDA interviewee explained the new zoning system which was introduced and implemented in Hambantota as a result of the lessons learnt after the tsunami experience in accordance with Principle 2: “First information on physical, social, and environmental aspects, land uses and hazard information were compiled. Then a zoning map was produced with permissible and prohibited uses. Alternative land-uses such as beach parks and areas for fisheries and harbour were introduced in high risk areas not fit for commercial and residential developments”.

COMMUNITY RECOVERY

Principle 3: Social Recovery

Principle 3: Social Recovery describes the need to improve the psycho-social aspects of affected people to support overall recovery. P12 said: “The biggest disaster in post-disaster recovery was not understanding the socio-economic situation and cultural patterns of the people”. The lack of consideration of traditional settlement patterns, housing types and layouts, and cultural and ethnic issues due to non-participatory reconstruction practices caused conflicts and resentment among locals (Boano, 2009; Mulligan and Shaw, 2007; Ruwanpura, 2009; Silva, 2009). P3 pointed out that there was a lack of formalized psychological support given to people in Sri Lanka which needs attention. On the other hand owner-driven housing construction programmes resulted in community cohesion which contributed towards psychological recovery (Asian Development Bank *et al.*, 2005).

P12 showed how improvements made based on the tsunami experience were adopted in the new Hambantota development programme: “We have identified those who have close

connections with the sea and have located them in safer areas whilst still maintaining views of the sea. They are still able to maintain the connection with the sea, which was considered an important part in the development strategy”.

Principle 4: Economic Recovery

The Economic Recovery principle highlights the necessity to improve the economic climate of the impacted community alongside rebuilding operations. The industries most heavily impacted by the tsunami and the recovery process were fisheries and tourism with an estimated loss of US \$ 330 million (Frerks and Klem, 2005). There were several livelihood recovery programmes set up to assist the community such as: “cash-for-work” schemes to involve locals in rebuilding, and medium and long-term micro-credit interventions where concessionary loans were given to micro, small and medium enterprises (Asian Development Bank *et al.*, 2005; GoSL, 2005b). However, the livelihood recovery programmes faced criticism for not paying attention to community needs and traditional livelihoods such as fishing (Lyons, 2009; Mulligan and Shaw, 2007). P14 said, “A lot of hotels built near the sea wanted to rebuild immediately after the tsunami, but weren’t granted permission due to the coastal buffer zone rule. There were also problems with fishermen being relocated 4-5km away from their original locations near the sea and therefore unable to work”.

Experienced NGO organisations such as Care International and Practical Action worked to support local businesses and livelihoods, shared P4: “Care supported a lot of livelihood projects by providing funds and resources. In some cases small shopping areas were built to allow merchants to start small shopping stalls, market places, small boutiques etc.”, and P8: “Practical Action started projects such as rain water harvesting in dry areas; boat building and fishery; lagoon rehabilitation etc. to introduce new livelihoods to the communities and support existing ones”.

IMPLEMENTATION

Principle 5: Stakeholders

This principle requires coordination and clear role allocation between stakeholders involved in the recovery effort to improve efficiency. The creation of the Post-Tsunami Recovery and Reconstruction Strategy and Guiding Principles (GoSL, 2005a) were a promising start. The decision taken by the Sri Lankan Government was to conduct a non-Governmental donor-led operation where donors from public and private sectors were asked to bid for projects and take responsibility of different districts/towns under the overall supervision of the coordinating bodies TAFREN and RADA (GoSL, 2005a).

There was a large influx of local and international NGOs to conduct recovery operations who were in competition with each other and worked under pressure to achieve fast results in an uncoordinated manner resulting in a disjointed recovery effort (Boano, 2009; Khasalamwa, 2009). P10 recounted the unsatisfactory job done by NGOs due to their lack of awareness about the local community and their competitiveness with other agencies.

The post-tsunami experiences led P12 to recommend that “District, Divisional and Provincial Level authorities need to be educated about respective planning/building guidelines. Then these authorities need to advise NGOs to adhere”. P4 agreed with the importance of Government-led recovery efforts: “Government agencies should take a lead role in the reconstruction and recovery process. It’s about empowering local authorities and facilitating availability of data through all tiers for decision-making”.

P9 and RADA (2006b) identified that the low disaster management capacity in Sri Lanka is a cause for the poorly executed recovery operations. P11 commented that “in Sri Lanka the problem is we have all the resources at the top: guidelines, expertise, knowledge, qualified people. But when you go to ground-level where the programmes will actually be implemented

they are very helpless". P2 and P13 mentioned that various training programmes have been introduced to build the disaster management capabilities in the country to educate stakeholders such as the Coastal Community Resilience Training Workshop (US Aid Asia, 2007) and the Guidelines on construction in disaster-prone areas training programme (DMC, 2010). P6 and P11 explained the on-going Priority Implementation Partnership (PIP) projects launched in 2008 to develop and test a coordinated multi-stakeholder approach towards DRR incorporated developments (NHDA) (DMC *et al.*, 2011a; DMC *et al.*, 2011b).

Principle 6: Legislation and Regulation

Principle 6 refers to the use of legislation and regulation to control and facilitate risk reduction and community recovery operations. The introduction of the coastal buffer zone as a legislative measure for risk reduction was consistent with Principle 6, but was unsuccessful because of the ambiguity with which it was enforced (Boano, 2009; Mulligan and Shaw, 2007). The regulation was changed several times which led to confusion and illegal housing construction within the buffer zones according to P13 and Silva (2009). P14 pointed out another issue: "The problem is most of our administrative procedures are very long, so NGOs weren't willing to spend time on these things. The local Government officials weren't interested in doing final checks which led to low quality construction".

The 2010-2011 floods in Sri Lanka affected 1,055,262 people with 362,646 people displaced (UN, 2011). P1 attributed the destruction caused by these floods to poor permit procedures: "From the recent floods it can be seen that housing construction on flood-prone lands have somehow been approved without looking at the hazards". This shows that the adoption of Principle 6 has not seen effect despite the lessons learnt. P5, P10 and P12 stated that attempts are being made to convert risk reduction guidelines produced such as the "Guidelines for building at risk from natural disasters" (Society of Structural Engineers, 2005) into legislation and to revise permit procedures to incorporate DRR checks without causing extra delays to promote adoption.

Principle 7: Community Consultation

Principle 7 refers to consultation and participation of the community to provide locally fitting solutions. Village Rehabilitation Committees (VRCs) were formed including villagers with knowledge about the community to help identify community needs as recommended under BBB Principle 7 (Disaster Relief Monitoring Unit of the Human Rights Commission of Sri Lanka, 2006).

However findings by Boano (2009), Mulligan and Shaw (2007) and Khazai *et al.* (2006) show that community consultation was not carried out sufficiently in post-tsunami recovery activities. P3 and P13 shared that the low level of community consultation during the resettlement and donor-driven construction process resulted in people being unsatisfied with their new homes and locations. There were complaints regarding poor quality, unsuitability for local lifestyle and culture, and discontent about not being consulted.

Contrary to the common experience P14 recollected a successful recovery operation carried out in Habaraduwa (RADA, 2006a) as a result of thorough community consultation: "First we distributed applications to all the affected people asking for their personal details. Then we gave them information about the new land sites available and a choice of the type of house. Meetings were held for each housing site to compromise and match people with their requirements as much as possible".

Principle 8: Monitoring and Evaluation

The final Principle, Monitoring and Evaluation, refers to putting systems in place to monitor and evaluate reconstruction and recovery activities to ensure sustainability and obtain lessons for the future. National and local Government as well as most NGOs involved had no previous

experience in large-scale post-disaster environments (Frerks and Klem, 2005). The lack of experience and pre-planned systems contributed to an ad-hoc recovery effort without sufficient attention to long-term impacts which did not fulfil BBB standards (Kennedy, 2009; Khasalamwa, 2009).

P12 held the opinion that the enormity of the reconstruction and recovery experience following the tsunami provided a valuable learning experience: "In immediate post-tsunami construction quality and incorporation of BBB couldn't be looked at properly. It was the first experience in Sri Lanka and we tried to incorporate whatever knowledge we had into the reconstruction, but the results varied. Now there's a very good understanding of these things, and everything's in place so reconstruction will be successful in the future". P10 was also confident that DRR-incorporated developments will be seen in the future. P13 claimed that from the Galle Municipal Council's point of view: "We haven't done any assessments or monitoring to pick up lessons learnt. So if a disaster happens, a similar situation might occur again", and P1 agreed that BBB is still just a concept that professionals have awareness of, but with no proper system to incorporate it.

P11 was disappointed with the slow response to the 2010-2011 flood events in Sri Lanka: "The 2010-2011 floods were considered the second largest disaster after the tsunami. They finally got an opportunity to practice what was learnt after the 2004 tsunami, but nothing was put into use. They completely 'missed the bus' this time. This shows that although they have the knowledge, they still don't understand how to use it in practice".

DISCUSSION

The key issue which prevented producing structurally resilient buildings following the tsunami in accordance with Principle 1 was the lack of proper building codes and legal enforcement. Owner-building was an important component of the recovery process in Sri Lanka (Boano, 2009). If quality assurance mechanisms such as regular inspections and education and support services were provided as suggested under Principle 1, owner-built construction would have been successful. Lessons learnt from the tsunami experience have led to some positive changes. The implementation of risk-based building regulations, if applied with sufficient legal backing will create resilient structures for the future. Considering the affordability of the changes and providing appropriate funding and incentives will promote adoption.

Although a coastal buffer zone and relocation process attempted to move communities to safer areas, poor execution with no consideration for other hazards and community needs impeded a positive outcome in accordance with Principle 2. Having observed the poor rebuilding operation, land use planning regulations, land-use mapping and zoning suitable to communities are now being adopted in Sri Lanka. The concept that high risk lands shouldn't be abandoned, but rather utilized wisely by using building controls and introducing alternative land-uses are steps towards BBB. Legislation, education and support must be provided to encourage conformance. A comprehensive resettlement strategy identifying available low risk lands with livelihood, business, educational and recreational opportunities for communities needs to be created for the future.

Social recovery in terms of BBB Principle 3 requires the provision of social, cultural and psychological support to aid community recovery (Lyons, 2009; Silva, 2009), which were not well-implemented in Sri Lanka. However changes have been introduced in the long-term to pay more consideration to social aspects in line with BBB from lessons learnt. Incorporating community needs with safety has now been identified as an important part of recovery. Social recovery can be further enhanced in the future by allowing more communication and transparency with the community by holding regular community meetings and establishing community groups. Owner-driven construction was a good initiative which allowed communities to actively get involved in their own recovery. Providing formalized support for owner-building would have ensured social

recovery along with the creation of resilient structures. The psychological impact of experiencing a disaster was not well understood and supported in Sri Lanka. In the future, support through services such as counselling, information centres, regular updates through media and personal case managers assigned to each family must be considered.

The economic recovery experience showed both successes and failures in terms of BBB Principle 4. The provision of grants and low-interest loans, as well as local livelihood projects set up by NGOs, were helpful in re-establishing sources of income. The key issue was precedence given to safety over livelihood opportunities during relocation. The importance of considering factors such as traditional trades, skills, and preferences in DRR strategies have now been understood following the tsunami experience. Having a database including relevant community information would help in creating appropriate recovery strategies which take these factors into consideration in the future. In cases where relocation is inevitable, providing training and creating new job opportunities based on local skills is important.

The creation of coordinating bodies like TAFREN and RADA were a good start for managing stakeholders in accordance with Principle 5. However the results show that in practice the pressures existent in the post-disaster environment and the lack of formal arrangements resulted in an uncoordinated ad-hoc response. It is mostly likely that external organisations such as NGOs who may not be familiar with local processes will be utilized for recovery activities in developing countries like Sri Lanka. Therefore empowerment and inclusion of local authorities is essential. It was learnt from the tsunami experience that if all the organisations who were involved had been provided some basic training about local regulations and requirements, and had been supervised by Government bodies, the outcome may have been more positive. The training programmes launched show promise in creating disaster-literate stakeholders. Future post-disaster recovery operations would benefit from employing these trained stakeholders with clear role allocation.

Principle 6: Legislation and Regulation has not been effectively adopted to control and facilitate recovery activities to achieve BBB in Sri Lanka. Time-consuming permit procedures and weakly enforced legislative measures have resulted in the creation of vulnerable post-tsunami communities. The tsunami experience failed to influence an improvement in the adoption of national housing standards which contributed towards the extensive damage during the 2010-2011 floods in Sri Lanka. The flood disaster showed that people were still living in non-resilient structures built on high risk lands ignoring DRR regulations. BBB in Sri Lanka requires a stronger legal framework and strict enforcement carried out by national and local Government authorities. Permit procedures must also be simplified and shortened to ensure wide adoption. Education of communities about the importance of these regulations for their well-being and providing incentives in the form of funding or grants to promote adoption might influence adherence.

Although community consultation was considered a priority in the BBB Guiding Principles (GoSL, 2005a), the highly-centralized NGO-governed approach taken to recovery overlooked community consultation and grass-roots level involvement in practice. There were exceptions like Habaraduwa where community consultation led to generating satisfactory recovery operations which reflected Principle 7. The formation of community societies such as the VRCs was a good initiative. The formal use of VRCs as a community consultation platform will help recovery efforts in the future.

The destruction and ad-hoc recovery following the 2010-2011 floods in Sri Lanka show that although lessons learnt from the tsunami experience have been recognized, they have not been properly implemented to improve disaster management practices in the country. If long-term systematic monitoring mechanisms had been put in place during post-tsunami recovery, lessons learnt may have been picked up and turned into practice formally. It is important for lessons learnt to be transferred to Government streams and improve their processes for the future. Conducting

regular training sessions for stakeholders would also help update their disaster management knowledge and influence adoption.

CONCLUSIONS

The Indian Ocean Tsunami was a large-scale multi-national disaster which initiated the concept of “Building Back Better” (BBB) to the post-disaster recovery environment. Eight BBB Principles were used to assess the extent to which BBB was adopted in the post-tsunami recovery effort as well as long-term DRR practices in Sri Lanka in order to extract valuable lessons for future post-disaster recovery efforts.

The reconstruction and recovery effort in Sri Lanka suffered from many shortcomings that were not in-line with the recommended BBB Principles and did not result in “building back better”. Although some BBB concepts were recognized and adopted, execution has not been completely successful. Data collected seven years following the tsunami showed that long-term implications of the shortcomings in post-tsunami recovery have led to the recognition and adoption of BBB practices in Sri Lanka.

The findings show that non-adoption of BBB Principles adversely affected the effectiveness in Sri Lanka’s post-tsunami recovery effort. The systematic changes adopted in Sri Lanka in the long-term based on lessons learnt from the tsunami experience affirmed the importance of the introduced BBB Principles for successful post-disaster recovery and improving community resilience. Effective adoption of all BBB Principles during post-disaster reconstruction and recovery will assist in building back better to create resilient communities.

These lessons may be applicable for countries worldwide. The research presented in this paper focuses on Sri Lanka as a case study and therefore the lessons are limited to countries of similar nature. Further research on case studies from different countries using the proposed BBB Principles will allow testing the universality of the principles for wider adoption.

REFERENCES

- 2009 Victorian Bushfires Royal Commission 2010. Final Report - Summary. 2009 Victorian Bushfires Royal Commission.
- ADPC 2009. Detailed Scope of Work for Priority Implementation Partnership on Mainstreaming Disaster Risk Reduction into Housing Sector in Sri Lanka (Phase II). Asian Disaster Preparedness Centre.
- Asian Development Bank, Japan Bank for International Cooperation & World Bank 2005. Preliminary Damage and Needs Assessment. *Sri Lanka 2005 Post-Tsunami Recovery Programme*. Colombo: Asian Development Bank, Japan Bank for International Cooperation and World Bank.
- Bakir, P. G. 2004. Proposal of a National Mitigation Strategy Against Earthquakes in Turkey. *Natural Hazards*, 33.
- Baradan, B. 2006. Analysis of the Post-Disaster Reconstruction Process following the Turkish Earthquakes, 1999. In: Group, I. R. (ed.) *International Conference on Post-Disaster Reconstruction Meeting Stakeholder Interests*. Florence: University de Montreal.
- Batteate, C. 2006. Urban Disaster Risk Reduction and Regeneration Planning: An Overview. *Focus: Journal of the City and Regional Planning Department*, 3, 11-17.
- Boano, C. 2009. Housing anxiety and multiple geographies in post-tsunami Sri Lanka. *Disasters*, 33, 762-785.
- Chang, Y., Wilkinson, S., Potangaroa, R. & Seville, E. 2010. Resourcing challenges for post-disaster housing reconstruction: A comparative analysis. *Building Research and Information*, 38, 247-264.
- Christchurch City Council 2011. Central City Plan: Draft Central City Recovery Plan for Ministerial Approval. Christchurch: Christchurch City Council.

Christian Century Foundation 2010. Build back better. *Christian Century*, 127, 7-7.

Clinton, W. J. 2006. Lessons Learned from Tsunami Recovery: Key Propositions for Building Back Better. New York: Office of the UN Secretary-General's Special Envoy for Tsunami Recovery.

Cosgrave, J. 2007. Synthesis Report Expanded Summary: Joint evaluation of the international response to the Indian Ocean tsunami. In: Houghton, R. (ed.). London: Tsunami Evaluation Coalition.

Disaster Relief Monitoring Unit of the Human Rights Commission of Sri Lanka. Year. Building Back Better: Way Forward. In: National Workshop on Guiding Principles, 2006 Colombo, Sri Lanka. Practical Action - South Asia Programme.

DMC 2010. Disaster Management Centre Annual Report 2010. Disaster Management Centre.

DMC, ADPC & NHDA 2011a. Mainstreaming Disaster Risk Reduction in site planning of Aislaby and St. Clair's Estate Housing Projects managed by National Housing Development Authority. In: Centre, D. M., Centre, A. D. P. & Authority, N. H. D. (eds.). Colombo: DMC, ADPC and NHDA.

DMC, CCD & ADPC 2011b. Mainstreaming Disaster Risk Reduction into approval permits of development activities in the coastal areas of Sri Lanka. In: Disaster Management Centre, Coast Conservation Department & Asian Disaster Preparedness Centre (eds.). Colombo: DMC, CCD and ADPC.

DN & PA 2008. Disaster and Development in South Asia: Connects and Disconnects. *South Asia Disaster Report* Colombo: Duryog Nivaran & Practical Action.

DNS & PA 2005. Tackling the Tides and Tremors: South Asia Disaster Report 2005. Duryog Nivaran Secretariat & Practical Action - South Asia Programme.

Edwards, W. 2010. State Building Codes Remain Inadequate Five Years After Hurricane Katrina Hit. *National Underwriter / P&C*, 114, 28.

Egbelakin, T. K., Wilkinson, S., Potangaroa, R. & Ingham, J. 2011. Challenges to successful seismic retrofit implementation: a socio-behavioural perspective. *Building Research & Information*, 39, 286-300.

FEMA 2000. Rebuilding for a More Sustainable Future: An Operational Framework. *FEMA Report*. Washington, DC: Federal Emergency Management Agency.

Florian, S. 2007. Housing reconstruction and rehabilitation in Aceh and Nias, Indonesia—Rebuilding lives. *Habitat International*, 31, 150-166.

Frerks, G. & Klem, B. 2005. Tsunami Response in Sri Lanka: Report on a Field Visit From 6-20 February 2005. Wageningen: Wageningen University & Clingdael University.

Frist, W. H. 2012. Helping Haiti build back better. *The Washington Times*.

GoSL 2005a. Post-Tsunami Recovery and Reconstruction Strategy. Colombo.

GoSL 2005b. Post Tsunami Recovery and Reconstruction: Joint report of the Government of Sri Lanka and Development Partners. Colombo.

Haigh, R., Amaratunga, D., Baldry, D., Pathirage, C. & Thurairajah, N. 2009. ISLAND - Inspiring Sri Lankan Renewal and Development. *RICS RESEARCH*. Salford: University of Salford, United Kingdom.

Halvorson, S. J. & Hamilton, J. P. 2010. In the aftermath of the Qa'yamat: the Kashmir earthquake disaster in northern Pakistan. *Disasters*, 34, 184-204.

James Lee Witt Associates 2005. Building Back Better and Safer: Private Sector Summit on Post-Tsunami Reconstruction, Washington DC, James Lee Witt Associates, LLC.

Johnson, C., Lizarralde, G. & Davidson, C. H. 2006. A systems view of temporary housing projects in post-disaster reconstruction. *Construction Management & Economics*, 24, 367-378.

- Kennedy, J. 2009. Disaster mitigation lessons from "build back better" following the 26 December 2004 Tsunamis *In: Ashmore, J., Babister, E., Kelman, I. & Zarins, J. (eds.) Water and Urban Development Paradigms*. London: Taylor and Francis Group.
- Kennedy, J., Ashmore, J., Babister, E. & Kelman, I. 2008. The Meaning of 'Build Back Better': Evidence From Post-Tsunami Aceh and Sri Lanka. *Journal of Contingencies & Crisis Management*, 16, 24-36.
- Khasalamwa, S. 2009. Is 'build back better' a response to vulnerability? Analysis of the post-tsunami humanitarian interventions in Sri Lanka. *Norwegian Journal of Geography*, 63, 73 - 88.
- Khazai, B., Franco, G., Ingram, J. C., Rio, C. R. d., Dias, P., Dissanayake, R., Chandratilake, R. & Kanna, S. J. 2006. Post-December 2004 Tsunami Reconstruction in Sri Lanka and Its Potential Impacts on Future Vulnerability. *Earthquake Spectra*, 22, S829-S844.
- Lewis, J. 2003. Housing construction in earthquake-prone places: Perspectives, priorities and projections for development. *The Australian Journal of Emergency Management*, 18, 35-44.
- Lloyd-Jones, T. 2006. Mind the Gap! Post-disaster reconstruction and the transition from humanitarian relief. London: Royal Institution of Chartered Surveyors (IRCS).
- Lyons, M. 2009. Building Back Better: The Large-Scale Impact of Small-Scale Approaches to Reconstruction. *World Development*, 37, 385-398.
- Meese III, E., Butler, S. M. & Holmes, K. R. 2005. From Tragedy to Triumph: Principled Solutions for Rebuilding Lives and Communities. *Heritage Special Report*. Washington DC: The Heritage Foundation.
- Meigh, D. 2009. Aceh emergency support for irrigation - building back better. *Proceedings of ICE Civil Engineering*, 162, 171-179.
- Mikko, K. 2009. Managing for innovation in large and complex recovery programmes: Tsunami lessons from Sri Lanka. *International Journal of Project Management*, 27, 123-130.
- Monday, J. L. 2002. Building Back Better: Creating a Sustainable Community after Disaster. *Natural Hazards Informer* [Online], 3. Available: <http://www.colorado.edu/hazards/publications/informer/infrmr3/informer3b.htm> [Accessed 27.02.13].
- Mora, S. & Keipi, K. 2006. Disaster risk management in development projects: models and checklists. *Bulletin of Engineering Geology and the Environment*, 65, 155-165.
- Mulligan, M. & Shaw, J. 2007. What the world can learn from Sri Lanka's Post-Tsunami experiences. *International Journal of Asia-Pacific Studies*, 3, 65-91.
- NZ Red Cross. 2009. Focus moves to long-term recovery and rebuilding in Samoa Available: <http://reliefweb.int/report/samoa/focus-moves-long-term-recovery-and-rebuilding-samoa> <http://www.redcross.org.nz/mediareleases> [Accessed 27.07.12].
- Omidvar, B., Zafari, H. & Derakhshan, S. 2010. Reconstruction management policies in residential and commercial sectors after the 2003 bam earthquake in Iran. *Natural Hazards*, 54, 289-306.
- Pathiraja, M. & Tombesi, P. 2009. Towards a more "robust" technology? Capacity building in post-tsunami Sri Lanka. *DISASTER PREVENTION AND MANAGEMENT*, 18, 55-65.
- Potangaroa, R. 2009. Native Engineering Technologies: The 2009 Samoan Tsunami and its Significance for New Zealand.
- RADA 2006a. Divisional Livelihood Development Plan, Habaraduwa Division, Galle District. Reconstruction and Development Agency.
- RADA 2006b. Sri Lanka: Mid-year review - Post tsunami recovery and reconstruction - June 2006 The Reconstruction and Development Agency.

- Reddy, S. D. 2000. Factors Influencing the Incorporation of Hazard Mitigation During Recovery from Disaster. *Natural Hazards*, 22, 185-201.
- Roberts, P. 2000. The Evolution, Definition and Purpose of Urban Regeneration. *In*: Roberts, P. & Sykes, H. (eds.) *Urban Regeneration: A Handbook*. London: Sage Publications.
- Ruwanpura, K. N. 2009. Putting houses in place: rebuilding communities in post-tsunami Sri Lanka. *Disasters*, 33, 436-456.
- Silva, M. W. A. d. 2009. Ethnicity, politics and inequality: post-tsunami humanitarian aid delivery in Ampara District, Sri Lanka. *Disasters*, 33, 253-273.
- Society of Structural Engineers, S. L. 2005. Guidelines for Buildings at Risk from Natural Disasters: A response to the Tsunami of 26/12/2004 and a contribution to the task of reconstruction. Colombo: Society of Structural Engineers, Sri Lanka.
- UN 2011. Sri Lanka Flash Appeal. United Nations.
- United Nations 2005. Hyogo Framework For Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. Hyogo: United Nations.
- US Aid Asia 2007. Coastal Community Resilience (CCR) National Training Workshop Sri Lanka. US Aid Asia.
- VBRR 2009. Nine Month Report. *Victorian Bushfire Reconstruction and Recovery Authority*. Victorian Bushfire Reconstruction and Recovery Authority
- VBRR 2010. 12 Month Report. *Victorian Bushfire Reconstruction and Recovery Authority*. Victorian Bushfire Reconstruction and Recovery Authority

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TECHNICAL REPORT- SHELTERING, FROM RELIEF TO RECONSTRUCTION: One Year after the 2010 East Azerbaijan Province Earthquake

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Abstract

On 11th August 2012, at 16:53 and 17:04 (local times), two major earthquakes measuring 6.4 and 6.3 respectively on the Richter scale, hit the East Azerbaijan Province, in the North-West of Iran. Although the timing of these strong tremors meant that few residents were at home, approximately 250,000 people and 327 villages were affected by the resulting disaster. The main impacts were felt around the towns of Ahar, Varzaghan and Herees to the North-East of Tabriz, leaving more than 300 residents dead, 4500 injured and 72,000 with damaged or destroyed properties.

Considering the climatic and topographic conditions of East Azerbaijan Province, the Housing Foundation of Iran (HF) managed to mobilize and accelerate its activities to minimize the threats posed by the upcoming winter on the people affected by the earthquakes. Using the new concept of "transitional accommodation" in its reconstruction policy, earthquake survivors were initially provided with "multi-functional units," which sheltered them from the cold while permanent houses were being constructed. This technical report aims to review the shelter provision process, based on the author's careful observations and qualitative data collected from the field, a year after the disasters.

The report concludes that, although most families are now housed in their permanent shelters, a number of them are still struggling with recovery from the impact the disasters had on their lives. Despite this, great feats have been made in the reconstruction of public service facilities, social and cultural centers, site works and amenities, which are all in the process of being completed.

Keywords: sheltering; post-disaster reconstruction; East-Azerbaijan Earthquake; Iran.

INTRODUCTION

During the holy month of Ramadan when most residents were practicing the spiritual act of fasting, twin earthquakes claimed more than 300 lives, injured thousands and left tens of thousands homeless. The shocks were felt in the towns of Harees, Varzeqan, Ahar, and the provincial capital, Tabriz. The first 6.4 magnitude quake struck 60 km. northeast of the city of Tabriz at a depth of 9.9 km, while the second, striking 11 minutes later, measured 6.3 on the Richter scale and jolted 50 km. northeast of Tabriz at a depth of 9.8 km. (Fig. 1).

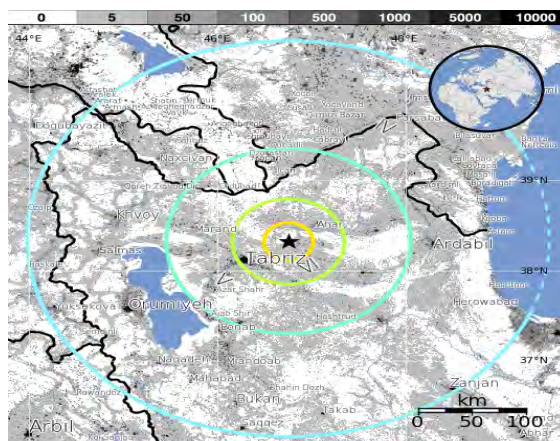


Figure 1: The epicenter of earthquake in East-Azabaijan Province (Source: HF 2012 report1).

East-Azabaijan Province is located in a high-risk seismic zone to the northwest of Iran and has frequently experienced major earthquakes for centuries, with the City of Tabriz having a long history of destruction and reconstruction, as a result of these natural disasters. In the 2012 catastrophe, twelve villages in Varzaqan were completely destroyed and approximately 60 others were extremely damaged by the earthquake. The natural disaster also afflicted the area with an estimated four billion dollars in damage. Overall, almost 29,000 units in three devastated areas in Ahar, Varzigan and Harees, suffered various degrees of damage (Press TV, 2012).

EMERGENCY AND REHABILITATION PHASES

The Iranian Red Crescent and Housing Foundation¹ (HF) established a joint rescue operation, adding to the efforts already commenced by the local neighboring survivors. As the earthquakes struck during the afternoon, most male residents were working in their agricultural fields. This meant that the fatalities mostly comprised of women, children and the elderly. The rescue operation lasted for a few days, and emergency shelters, such as tents and other essential needs, were provided by the relief agencies. (Fig. 2) In addition, as the housing pattern in the affected areas were predominantly adobe and unreinforced brick masonry, such buildings were not stable and therefore, most of them collapsed or received major destruction during the earthquakes – intensifying the reconstruction efforts required.



Figure 2: Tents as emergency shelters (Source: Author).

¹ Housing Foundation of Islamic Republic of Iran (HF) founded in 1979 aims to provide housing for low-income people in rural and urban regions as well as reconstruction of areas suffering damage from natural and man-made catastrophes within the framework and policies of the government of Iran.

An issue which became an obstacle to achieving an effective and speedy relief operation related to distrust felt towards the relief items deliveries. Indeed, in the early days of the disasters, propaganda and rumors were broadcasted by neighboring countries by sending messages to people's cell phones indicating that public donation might not be delivered to the survivors. This caused some residents from neighboring areas insisting on delivering their own relief items to the devastated zones, resulting in heavy traffic around the affected areas hampering the speed of operations. However, the Red Crescent immediately made a statement denying such a false rumor².

As the majority of rural households have high dependence upon their livestock as a means of both income and food, over 7,000 livestock shelters were constructed by the Housing Foundation (HF) and the Ministry of Jihad-e Sazandegi to speed up the economic recovery of the affected population. These shelters, built using corrugated galvanized steel in the shape of a semi-cylinder, aimed to ease the health and security concerns of survivors for their animals by providing shelter for the livestock and protection from freezing weather conditions (Fig. 3).



Figure 3: Animal sheltering in rural areas (Source: Author).

Debris management became problematic over the course of the recovery process, particularly during the relief and rescue period. The HF attempted to mitigate this problem by organizing almost 1000 units of machinery, including trucks, loaders, excavators and bulldozers, to remove over 3 million tons of debris in less than two months. These machineries were sourced from the HF of other provinces, The Ministry of Roads and Urban Development as well as from the private sector, and continued to be utilized for the transportation of materials after debris removal phase (HF Report No. 1, 2012). Given the size and heaviness of these vehicles however, they were at time unable to pass through roads and forced to stop causing traffic.

Despite the efforts listed above, it was frequently observed that in some areas, debris was left on the side of roads or even on floodways. The fact that the disaster occurred in a mountainous region with sharp and sloppy rural road networks increased the risk of pollution to water supplies, and led to the Health Organization announcing the need to ensure debris was located far away from human settlements and water supply resources.

TRANSITIONAL ACCOMMODATION

Although at the beginning of the operation, it was decided that the reconstruction phase would immediately follow the emergency period, completely bypassing the stage of temporary

² Aysan and Davis, 1993, mention this as a political commitment, stating that 'While most governments in the immediate aftermath of a disaster declare their intentions of making up for all losses, with the progress of time, they can easily lose the initial momentum. As media attention drops, the public loses faith in receiving support and the authorities shift their focus on other issues' (p. 22).

sheltering, it soon became clear that freezing weather conditions would not permit the long-term use of tents by survivors. In addition, based on past reconstruction experiences within Iran, where the concept of transitional accommodation could be linked as part of permanent housing, recipients had been satisfied with results (Fallahi, 1993). For instance, after the 1990 and 2003 earthquakes in Manjil and Bam respectively, the survivors were involved in allocating the location of their transitional accommodation within their plot of lands. As a result, those units became parts of the final residences (Fallahi, 1996, 2007). Given these positive experiences, a transitional accommodation policy was employed for the East Azarbaijan Province operation, considering the cold climate together with the essential need of people towards rebuilding permanent housing.

The Housing Foundation (HF) was assigned as the responsible organization for transitional accommodation, as well as, permanent housing. Due to the large area affected comprising mostly rural areas; the H.F. utilized the capacity of 11 other provincial offices, so called the 'Auxiliary Headquarters' (AHs). Accordingly, the devastated area was divided into 11 zones with each being allocated to one individual Auxiliary Headquarter, based on its professional capacities and experiences. Priority for sheltering was given to residents who owned a house prior the disaster, while seasonal residents who did not own a house, were promised secondary accommodation (HF Report No. 1, 2012). Every 50 houses were supervised technically by a resident architectural engineer.

Accordingly, a number of 12 square meter pre-fabricated units or 'multi-functional spaces' were allocated to house the survivors. This meant that, the residents, following a short period of living in tents, were provided with units sheltered them from the winter cold. These units included steel frames and sandwich panels in construction of the roofing and walls. They provided safety against wind and seismic loads benefits in the form of heat insulation and noise protection. (Fig. 4) The architectural and structural elements, such as sandwich panels, steel studs, etc. were transported onto sites, and used in constructing foundations and part assembly by respective contractors and technicians employed by the Housing Foundation. In order to speed up economic recovery, the suppliers of construction materials and logistical needs and manpower were recruited locally.

The families who were moved to their new units received household incentive packages that included essential home appliances such as a refrigerator, oven, carpet, and heater. These 12 square meter units would be utilized as a store, study room or extra living space subsequent to the completion of the reconstruction phase.



Figure 4: Transitional accommodations beside emergency shelters (Source: Author).

RECONSTRUCTION PHASE

It was announced that the process of providing 12 sq-m prefabricated units would be conducted in parallel and simultaneously with permanent housing in rural and urban areas, due to the cold season. It was for the first time the construction of multi-functional units and permanent housing would take place together on a large scale. 60 square meter permanent housing was allocated for those individual households that experienced more than 30% irreparable damage to their property by the disaster. (Fig. 5)

These units benefit from reinforced concrete foundations and the structures were designed considering weight and seismic loads to make them compatible with the soil characteristics of the region. Most of these units were built with prefabricated steel frames and bolted connections and a limited number by confined masonry and concrete structures. Two types of building roofs were implemented, “the joist slab reinforced concrete” roofing and “galvanized gabled sloped”. Although galvanized gabled sloped roofing was not common in the region, they were constructed, for the sake of insulation in cold climate when concreting was not possible. This approach also reduced the risk of freezing weather conditions impeding the progression of the reconstruction phase.



Figure. 5: 12 sq-m prefabricated units provided in parallel with permanent housing (Source: Author).

At the time of writing this report, steel frames and confined masonry structures of more than 98% of the damaged rural residential units had been erected. It is worth mentioning that the HF professional experience in reconstruction activities enabled them to shelter all survivors effectively and prior to first snow falling in the region. In terms of community participation in the process of permanent housing, it varied village to village. Despite the announcement from the Vice President during his visit in early days of the disaster, where he stated that ‘we will reconstruct the entire region within two months’ the result was a rise in people’s expectations which adversely affected their participation in the efforts. However, the outstanding numbers of erected structures and roofs as well as the threat of the cold winter in the rural areas raised the motivation of the local people to demonstrate more participation and contribution to the project (HF Report No. 2, 2012) (Fig. 6).



Figure 6: Householders, particularly women, participate actively in permanent sheltering (Source: Author).

In general, the HF policy supports the need to enhance the level of local people involvement in the reconstruction process. This not only assists in accelerating operations but also positively contributes to the psychological recovery of the affected population. In this reconstruction, community participation was conducted through the bureaucratic processes for reconstruction administrative activities; people participate in choosing the construction site, locating the transitional accommodation on their land and working as laborers. The last activity would be regarded as a valuable supplementary source of income for the households to reduce the reconstruction costs as well as psychological recovery – assisting in the building of their new homes.

In terms of financial mechanisms, a number of methods were practiced in the field. For instance, emergency grants and low interest loans were the most common forms of financial assistance. As bank loans required collateral guarantees and survivors no longer possessed such assets, the government played the role of guarantor for all the loan recipients. The repayment periods of previous loans were also extended for the affected population. The government had also taken the responsibility for design, technical supervision, material transportation and other overhead costs incurred as part of the reconstruction operations. (Figs. 7)



Figure 7: A typical reconstructed house which householder still uses his emergency shelter as storage (left), interior open kitchen (right). (Source: Author).

As mentioned earlier, animal farming and agriculture are two major sources of income in the rural stricken areas. Therefore, the provision of appropriate livestock shelter units was of great

importance for the affected families. HF, in cooperation with the Ministry of Jihad-e Sazandeghi constructed two types of sheltering units: 24 square meter curved roofing and 18 square meters sloped roofing units. These units possessed steel frames and the roofing cover included metal sheets covered with a layer of thermal isolation, resistant against wind and earthquakes.

In order to prevent rising construction material prices due to high demands in the region, the HF attempted to procure as much of the materials from the local market as possible – this would not only stimulate the market and assist in economic recovery but would also minimize negative inflationary impacts on these markets. As such, doors and windows, steel frames of multi-functional units and steel bars for instance were purchased from local sources.

CONCLUSION

The East Azerbaijan Earthquake was an exceptional case in the Iranian reconstruction experiences. Apart from the timing of the disaster, which took place during the holy Muslim month of Ramadan, the number of aftershocks was relatively high and imposed social pressure on the residents, HF staff and contactors in the region. The rebuilding policy emphasized on providing both transitional and permanent accommodations simultaneously in the devastated areas mainly because of the cold weather. While the former would protect the families against freezing environment, the latter would form a stable and long-term base for recovery. A HF report prepared four months after the disaster indicated that over 9,000 rural permanent residential units, accounting for 95 % of the total 9,500 seriously damaged residential buildings, were fully constructed in 82 days of the catastrophe. As the first snowfall of the year blanketed the earthquake-affected areas, the HF stated that it would “stand shoulder to shoulder with people even if the hardest difficult weather occurs in the winter”.

However, a number of shortcomings were also observed. For instance, neither all the transitional units, nor all newly built permanent shelters were occupied by beneficiaries. There was a tendency among survivors not to leave emergency shelters since they were anxious about losing the facilities they received, if they would be transferred to their new residence. In this respect, the authorities promised that delivery would continue even after households’ transfer to new residences and secondly, setting a household incentive package including home appliance such as refrigerator, oven, carpet, heater and so on.

In terms of economic recovery, it was decided to utilize the maximum local capacities to provide construction materials. Most of the contractors and labor force of the reconstruction were supplied through local resources. Moreover, the transportation of materials and personnel were accomplished with the priority of using local capacities. Particular attention was also given to livestock shelters to accommodate animals and agricultural storage. In order to avoid increasing construction materials, the HF attempted to bulk purchase all essential items, such as steel frames, cement and bricks and distributed in subsidized prices.

Although the HF flexible financial rules and regulations enabled it to provide budgets for upcoming demands promptly, there was much less progression in other aspects of residents’ lives. In other words ‘too often rural people are abandoned when the official books on a disaster are closed’ (Blaikie *et al*, 1994: 213). It should be recognized that the survivors still need to be recovery process includes the need to rebuild public service facilities, religion and cultural centers, site works, and amenities. As such, It seems that there is still a long way towards a sustainable reconstruction and the key note is to ensure survivors are supported at every point throughout the process.

REFERENCES

Aysan, Y. and Davis, I., 1993, Rehabilitation and Reconstruction, 1st Edition, Disaster Management Training Programme, UNDP, DHA

Blaikie, P. Cannon, P., Davis, I. and Wisner, B., 1994, At Risk, natural hazards, people's vulnerability and disasters, Routledge, London.

Fallahi, A. 1996, Shelter Provision in Rural Areas of the 1990 Manjil Earthquake in Iran, Disasters, Environment and Development, New Delhi, Oxford Publication, India, pp. 229-240.

Fallahi, A. 2007, Lessons learned from the housing reconstruction following the Bam earthquake in Iran, vol. 22, No.1, The Australian Journal of Emergency Management, February, pp. 26-35.

Fallahi, A., 1993/94, Learning From The Lessons Of The Post-Earthquake Reconstruction Projects In Iran: An Introduction, The Australian Journal of Disaster Management, The Macedon Digest, Vol. 8, No. 4, Emergency Management Australia, pp. 19-23.

Housing Foundation of Islamic Republic of Iran, 2012, Iran-Azarbaijan Sharghi Province Earthquake, Situation Report No. 1, 30 October 2012, pp. 1-8.

Housing Foundation of Islamic Republic of Iran, 2012, Iran-Azarbaijan Sharghi Province Earthquake, Situation Report No. 2, 7 November 2012, pp. 1-5.

PRESS TV (documentary TV report), 2012, Azarbaejan Earthquake 2012 Press Tv report, IRANTODAY@PRESSTV.IR

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AN ANALYSIS OF AN INTERNATIONAL NGOS DESIGN DECISION-MAKING IN POST DISASTER DEVELOPING COUNTRY CONTEXT A Sri Lanka Case Study

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Abstract

The purpose of this paper is to explore the current design and delivery approaches of a selected INGO operating in the field of post disaster housing design and delivery in developing country contexts and clearly map out their approach from inception to completion of a housing project. The research utilizes a case study analysis involving a leading European INGO operating in post disaster housing delivery in Sri Lanka in the aftermath of the 2004 Indian Ocean tsunami. The research highlights the main challenges and opportunities in relation to the design and delivery of low cost sustainable housing in developing countries as identified in current literature on the subject. An in depth analysis of the selected INGO's overall design and delivery approach was undertaken utilizing a causal mapping interview procedure with lead designers within the organization who were involved in the project's design and implementation. The results identify and discuss the specific approaches, challenges and considerations that informed their decision-making as an INGO in a post disaster developing country context which. The results of this research study provide a concise insight into the design decision-making process and considerations of leading foreign INGO's operating in developing countries and will be beneficial to policy makers, NGOs, government bodies and community organizations in practice as it offers unique evidence based insights into an international bodies housing design decision-making process.

Keywords: Sustainable housing; developing countries; decision-making; knowledge transfer.

INTRODUCTION

The frequency and devastation of natural disasters are becoming more common and extreme in recent decades worldwide. Many developing countries are innately more vulnerable to natural disasters and have experienced disproportionate levels of devastation as a result of disasters resulting in large numbers of displaced populations in many developing countries throughout the world (IFRC 2001, Schilderman 2004) This vulnerability is often caused by common issues which are experienced in many developing countries including development in areas susceptible to natural disasters, unsettled governments, poor construction standards and techniques, insufficient resources and knowledge in post disaster recovery. The built environment is often worst effected by many natural disasters with housing often making up a large proportion of the damage resulting in large number of displaced populations in developing countries throughout the world.

The permanent reconstruction phase of recovery following disasters can be viewed as an opportunity to build back better and offers the opportunity to governmental bodies and

implementing agencies to undertake a holistic approach to ensure sustainable long-term solutions for affected populations. Opportunities to strengthen local capacity in relation to future disasters, livelihood generation, equity and quality of life can be capitalised on through the use of appropriate design solutions and implementation which is sensitive to the local context. This is no more so relevant then in relation to post disaster housing reconstruction given the impact dwellings can have on the everyday lives and wellbeing of their inhabitants. As such appropriate and sustainable post disaster housing design and delivery is essential to ensure the successful long-term sustainable return to normality for affected communities.

Many design and planning professionals have a poor understanding of the effects of their designs in post disaster housing contexts (Salazer 1994). Many current approaches to post disaster housing view the dwelling as a mere product or output and this often results in inappropriate repetitive constructions and typologies which ironically can have adverse effects on the end users long-term needs and wellbeing in terms of environmental, social, cultural and economic development. Many approaches rely on the manufacture and import of many of the materials used which result in houses that are not affordable for the masses of population that require them (Adeyemi 2002) as well as being environmentally unsustainable. Current approaches employed are often associated with developed countries and many developing countries race to imitate them in post disaster housing often due to the effects of globalisation and the perceived affluence and prosperity of the western developed countries. This approach lack any clear understanding of sustainable development by the decision makers involved and often has resulting detrimental social, cultural and environmental effects on the communities it serves.

The design and delivery of affordable and sustainable post disaster housing is a complex multifaceted approach involving many relevant stakeholders and diverse considerations on aspects including social, environmental, cultural and economic sustainability (UNDRO 1982).

“A house is merely the end product of a long chain of social, economic, technological, environmental, political and other interactions” (UNDRO 1982 piii).

Many developing country governments lack the capacities to adequately design and implement appropriate housing, particularly in a post disaster context when additional pressure of the need for immediate shelter often are given priority over long-term sustainable solutions. This, coupled with vast influxes of internal aid in the immediate aftermath of natural disasters, has often resulted in governments looking to external international assistance and expertise in relation to post disaster reconstruction. This assistance is often in the form on international non-governmental organizations (INGOs). However international assistance does not automatically imply successful outcomes in relation to post disaster housing. Many INGOs have also lacked the expertise and strategies in relation to the effective design and delivery of post disaster housing and further compounded the devastating effects of the disaster. INGOs often face additional challenges in that they are foreign to the context they are working in and this has resulted in many introducing inappropriate design solutions which do not cater for the beneficiaries' long-term needs. This is often as a result of time and resource pressure in a post disaster context as well as insufficient knowledge of the local context in terms of its social, cultural, economic and environmental makeup.

Improved approaches to the design and delivery of post disaster housing in developing countries are required now more than ever. If designers and decision makers are to play an integral role in providing affordable and sustainable post disaster housing solutions they need aspects such as affordability, sustainability and knowledge of the norms, codes and values of the society they are working in to be high up the agenda in their decision-making process. INGO's responsible for the design and delivery of post disaster housing have a responsibility to ensure context specific, sustainable and appropriate design approaches that enable communication, participation and empowerment of the communities they are working within. INGOs involved in

post disaster housing provision also face a number of additional challenges as they must remain loyal to their core principles of empowerment and community involvement while preserving independence from the many different external organizations which may exert influence on them such as donors and local governments. To achieve this they must insure they have the correct protocols and approaches which ensure that design decision-making is fully informed and catered to the people and community it serves. Access to relevant information and knowledge transfer are essential for the designer to obtain.

Design Decision-making

Harrison (1999) defines a decision as,

“a moment in an on-going process of evaluating alternatives for meeting an objective, at which expectations about a particular course of action impel the decision maker to select that course of action most likely to result in attaining the objective”.

Human performance in decision-making has been the topic of research from a number of different perspectives. From a psychological perspective, it is necessary to examine individual decisions in the context of a set of needs, preferences an individual has and values they seek. From a cognitive perspective, the decision-making process must be regarded as a continuous process integrated in the interaction with the environment. From a normative perspective, the analysis of individual decisions is concerned with the logic of decision-making and rationality and the invariant choice it leads to (Kahneman & Tversky, 2000).

Different professions refer to decision-making differently i.e. architecture may refer to decision-making as design (Simon 1977). All architects and engineers as designers and project managers, make many decisions on a daily basis in relation to their work. The process of designing reconstruction projects, infrastructure, public space, etc involves many decisions to be taken on many different levels. On a very simple level a typical design process involves 3 main stages (Cuff 1991):

- Initial concept stage.
- Design development (problem solving stage).
- Working drawing/implementation phase.

As every project is unique these 3 basic main stages may vary from project to project. However regardless of what stage a project is at or what context it is located in, design decisions, like all decisions, are based on some rational or logic as well as been conducted in the context of that particular project (Holm, 2006). Logical decision-making is an important part of all science-based professions within which architects and engineers are deemed to exist, where specialists apply their knowledge in a given area to making informed decisions. Professional decision-making is often seen as being the skilful application of technical knowledge within ethical limitations (Holm 2006).

However architects and engineers, working within INGO's in post disaster contexts often face unique challenge in relation to the design decision-making process in reconstruction projects due to the unique circumstances and contexts that they are operate in the aftermath of disasters. Much research to date (Fallahi, 2007, Pugh, 1994, Randolph *et al.*, 2008) has demonstrated that the design responses after many disasters leaves much to be desired in terms of appropriate long-term sustainable design responses that best serve the needs of those displaced. As such the need for a clear understanding of the design decision-making process of the various actors within INGO's is required now more than ever to inform future work within this field.

FOCUS OF THE PAPER

The purpose of this research is to gain an in-depth understanding of the design approach, decision-making and project protocols of a leading European NGO operating in the field of post disaster reconstruction and housing worldwide. The study identifies the main design considerations, challenges, objectives, strategies and solutions undertaken within the organisations design and delivery approach and discusses their rational in detail. The detailed findings and understanding of the organisations approach to post disaster housing are further established with the formation of a graphical sequential chart clearly based on the data and analysis undertaken.

METHODOLOGY

This paper examines a leading European NGO's designers and project managers as part of a case study analysis in relation to the design and delivery of post disaster housing in developing country contexts. Yin (1994) describes case study research as follows:

"A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon are not clearly evident"

The research was exploratory in nature and utilised a variety of data sources which resulted in multiple sources of evidence including interviews, archival data and empirical field data. Appropriate analysis techniques including decision analysis utilising Banxia Decision Explorer were utilised to complement the various data gathered from the various sources to provide the findings and conclusions of the research.

Scoping Study

An extensive scoping study review was undertaken as part of the overall research to identify the main barriers and drivers for affordable and sustainable housing design in post disaster developing country contexts. Bruen et. al (2013) highlight the main findings of this study. This approach was deemed appropriate to this research area given the numerous sources of information available from various organizations and bodies i.e. academic journals, industry journals, international housing organisations, non-governmental organisations (NGO's) etc. In-depth and broad findings on the topic were sought from current available literature to enable conclusions and findings to be established to inform the current research on the subject.

INGO Profile

The selected INGO from this research wished to remain anonymous. Although this paper specifically looks at 1 NGO, it fits into a research framework as part of a wider study focusing on multiple disasters and multiple INGOs. The selected INGO for this study is European based and in operation for over 35 years in urban and rural post disaster contexts in developing countries worldwide. To date the organisation has operated in housing design and delivery, in both post disaster and general housing, in numerous countries and regions worldwide contributing to significant knowledge accumulations. Geographical experience includes: Cameroon, Ethiopia, Kenya, Lesotho, South Africa, Tanzania, Afghanistan, Bhutan, India, Indonesia, Laos, Nepal, Pakistan, Philippines, Sri Lanka, and Vietnam, Brazil, Cuba, Guatemala, Honduras, Nicaragua, Azerbaijan, Bosnia, Czech Republic, Kyrgyzstan, Tajikistan, Ukraine, Egypt and Palestine. The organisation has a mandate to fight poverty and support to the livelihoods of disadvantaged and marginalised people through collaboration with partners from all continents.

The organisation works in a multi-disciplinary, integrated and participatory way and applies its knowledge through collaboration with local partners from all continents in the design and implementation of a large variety of projects. The organisations advocates working in an integrated manner in order to achieve affordable and sustainable solutions giving consideration to

aspects such as technical, environmental, economic social/cultural and institutional aspects and how they may impact on design in a local context. Planning, design and implementation of projects are undertaken through a participatory approach that includes the perceptions of all stakeholders. An integral part is the socio- economic aspect of building activities, whereby the needs of the poor and most vulnerable are addressed with regard to employment opportunities and affordable housing.

Exploratory Interviews

Unstructured interviews were conducted with 3 senior designers and project managers operating in the field of post disaster housing in developing country contexts. It was essential to ensure that the experience of the selected staff was sufficient and they had demonstrable hands on field experience to further enrich the research (Table 1).

Table 1: Profile of interviewees from selected INGO (Source: Authors).

	Position	Years of experience in housing design and delivery in post disaster developing country contexts
Interviewee 1	Architect, Planner and Project Manager (head of settlements department)	25+
Interviewee 2	Architect and Urban Planner (sustainability specialist)	10+
Interviewee 3	Project Manager (knowledge Management specialist.)	10+

Due to the exploratory nature of the research unstructured interviews were deemed to be the most appropriate. No standardised questions were prepared but key findings from the scoping study were utilised to direct the conversation around key themes in the organisations approach to post disaster housing design and delivery. Questions were asked in a manner that worked best with Decision Explorer i.e. how, why, who, when etc in order to establish information on the organisations approach in terms of objectives, strategies, barriers faced, outcomes etc. and also to enable the interviewee to speak freely and obtain the interviewees explicit and tacit knowledge in relation to the subject. Where required, follow up questions were used to clarify any unclear or ambiguous information.

The interviews were conducted at the organisations European headquarters and recorded, with the interviewee's permission, to be mapped out utilising Banxia Decision explorer. The interviewees were asked to speak openly of their experiences in various countries worldwide and the design and delivery of the organisations approach from inception to completion. For the purpose of this study one particular post disaster case study was selected to focus on in in-depth detail in order to provide context to the study. The selected case study this research study relates to is a 100 dwelling post disaster coastal housing reconstruction project in Sri Lanka following the Asian Tsunami in 2004 which caused catastrophic damage to the coastline of Sri Lanka (fig 1). The primary author undertook field research in the form of post occupancy evaluations and inhabitant interviews on the selected case study as part of wider study focusing on multiple disasters and multiple INGOs.

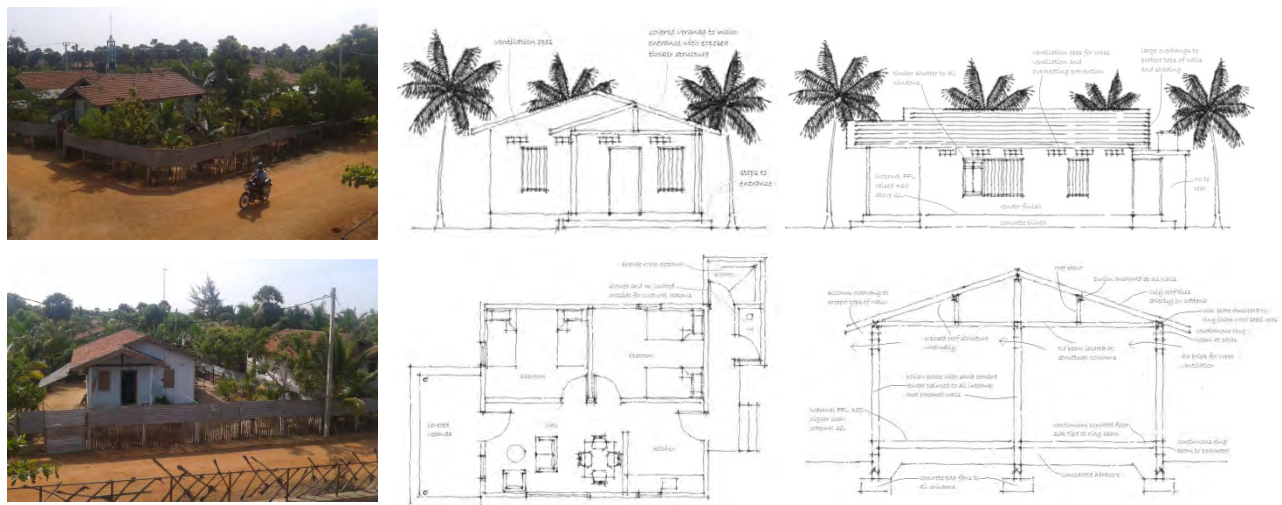


Figure 1: Pictures and field notes of Sri Lanka case study (Source: Authors).

The use of unstructured interviews enabled additional findings beyond that of the scoping study that would have perhaps being missed out had an alternative more structured approach being utilised for data collection. The ability to elicit expert's experiences, design considerations and overall approaches to post disaster housing design and delivery enables an overall picture to be developed of the organisation design and delivery approach to post disaster housing.

Cognitive Mapping and Decision-making

The main objective of this piece of research is to obtain the designers and organisations representation/cognitions in relation to the design and delivery of post disaster housing in developing country contexts. As such it was decided to undertake further analysis of the interviews through the use of cognitive mapping. Cognitive mapping is a form of empirical research that uses a theoretical and methodological approach that contends that cognitive maps represent the interviewees' causal knowledge (Hurby 2006). Fiol & Huff (1992) define cognitive maps as graphic or visual representation of thought or sense making that locate people in relation to their information environments and can be linked to decision-making. Bryson et. al. (2004) refers to causal mapping as the complex causes and consequences of every issue we encounter.

For the purpose of this study an event mapping procedure was utilised to reconstruct a post disaster housing project from inception to completion with all the associated linkages along the journey. This approach is a hybrid of both cognitive and causal mapping techniques and is utilised to develop an in-depth picture of the project cycle and the key considerations that informed decision-making along the way as well as barriers and challenges faced, objectives set, strategies employed and outcomes. The maps are used to gain an insight into the nature of the cognitive process of architects and project managers in relation to post disaster housing design and delivery. It is not intended to try and map the interviewee's entire thinking but rather to provide a wider context of the environment in which the interviewee operates and how these representations and considerations are formed.

Individual maps were constructed for each individual interview. To further develop an understanding of the overall organisations approach all 3 individual maps were merged in to one global map representing the overall organisations design and delivery approach to post disaster housing projects in developing country contexts. This resulted in a global map with 212 individual identified concepts (fig 2). To further investigate the results, the interview maps were entered into a software package called Banxia Decision Explorer. This software package enables a more detailed and reliable analysis to be undertaken and enabled the maps from the individual interviews to be merged to enable an overall analysis to be undertaken.

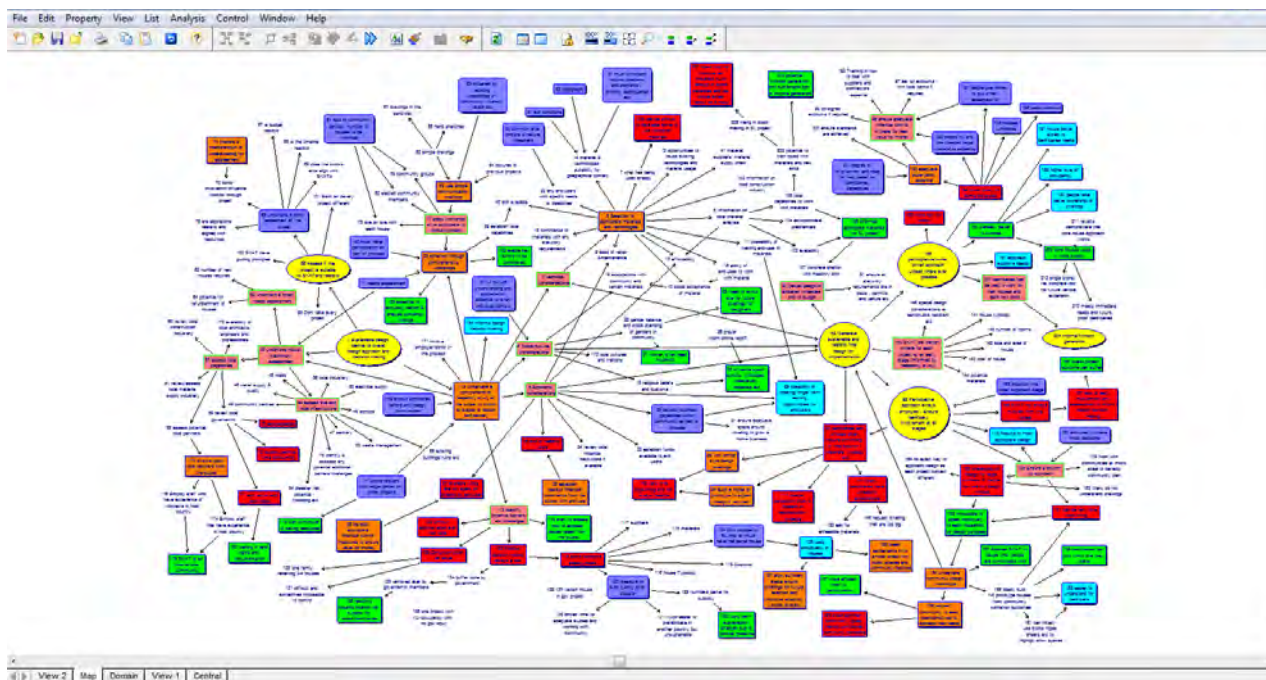


Figure 2: Screen shot global map on Decision Explorer (non-legible text for demonstration purposes only)
(Source: Authors).

Additional documentary data as well as a site visit and interviews with the dwelling inhabitants by the author was also undertaken for the case study in question as part of a larger research framework focusing on multiple disasters and multiple INGOs. This additional information provided more context for the case study in question and was also utilised to provide secondary information for this paper. This secondary data combined with the analysed data from this paper were utilised to formulate a sequential graphical flow chart demonstrating the organisations approach to post disaster housing projects in developing countries highlighting the main stages in the process and the main design and delivery decision-making consideration at each stage of the process. Figure 3 highlights the overall methodology for this paper.

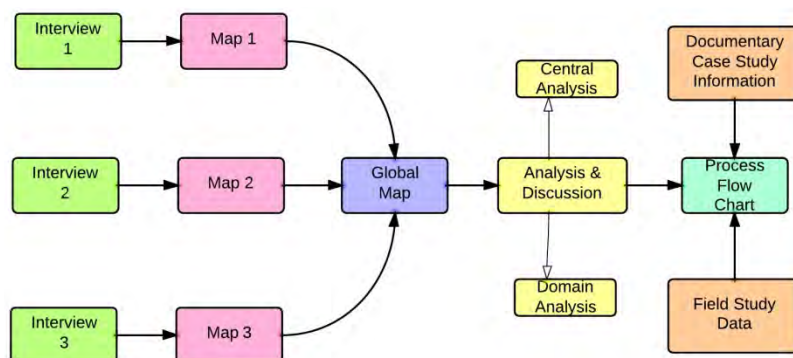


Figure 3: Methodology Design (Source: Authors).

The Decision Explorer software is a proven tool for managing "soft" issues - the qualitative information that surrounds complex or uncertain situations and decision-making. It allows you to

capture in detail thoughts and ideas, to explore them, enabling new understanding and insight to be gained. The advantages of using cognitive mapping and Decision Explorer include: (Eden & Ackermann 1998):

- Understanding the central themes, key issues and activities.
- Visualisation of complex issues and lines of reasoning.
- Capacity to process complex data.
- Minimisation of risk of researcher bias.
- Ease of traceability and verification of results.
- Provision of simplified graphical information for individuals and organisations.
- Process is not constrained by a formal structure.

Banxia Decision Explorer enables several different analysis techniques to be carried out on the maps. These enable the extraction of critical concepts and links from the global map which are identified and discussed in detail. For the purpose of this study it was decided to use the Domain and Central analysis to identify the most important concepts and their implications as identified from the global map.

Central Analysis

The central analysis identifies the importance of each concept in relation to the wider group of concepts and not only the neighbouring ones. It is an indication of the importance and influence of a concept within the overall map. Higher scoring concepts in the central analysis have more multi-layered networks associated with them and highlight the significance of that concept and its wider implications. The top 10 identified concepts from the central analysis are discussed in detail.

Domain Analysis

The domain analysis is used to identify those concepts that have many links to and from them. This indicates that the concept has been expanded upon a lot during the interview. It establishes linkages with other concepts in its immediate domain. The analysis indicates the richness of meaning of each individual issue but only calculates local complexity and completely ignores the wider context of the issues. However the Domain analysis is more easily influenced by personal bias than central analysis and as such it used in conjunction with the central analysis to give a more balanced view of the important concepts in the map.

FINDINGS AND DISCUSSION

The top 10 identified concepts from both the central and domain analysis are extracted and discussed in detail. Following this discussion a detailed graphical overview is formulated from the data and analysis to demonstrate the organisations approach to a post disaster housing project in a developing country context.

Central Analysis

Table 2. Top 10 scoring concepts from Central analysis of global map (Source: Authors).

Rank	Concept	Category
1	Undertake comprehensive feasibility study at the outset to inform all stages of design and delivery.	Solution
2	Generate sustainable and realistic final design for implementation.	Objective

3	Economic considerations	Strategy/Approach
4	Technical considerations	Strategy/Approach
5	Social/cultural considerations	Strategy/Approach
6	Undertake robust preliminary assessment	Strategy/Approach
7	Achieved through a comprehensive workshop	Solution
8	Selection of appropriate materials and technology	Solution
9	Participative/owner driven approach utilised wherever possible.	Objective
10	Sustainable design central to overall design approach and decision-making	Objective

Solutions

There are 3 solutions that appear in the top ten central concepts. Ranked at number one, "Undertake comprehensive feasibility study at the outset to inform all stages of design and delivery," highlights the central importance placed by the organisation on feasibility studies at the outset in relation to how it informs its design decision-making and delivery throughout all stages of the project. Highlighted within this process was the need to involve the donor and beneficiaries in the feasibility process from the outset and that the process must always be undertaken prior to commencing design.

Out of this central concept are a number of other solution concepts which are ranked within the top ten concepts of the global map. "Achieved through a comprehensive workshop" ranks at number seven and highlights the organisations participative approach in relation to obtaining a comprehensive feasibility study at the outset. Again the need for participation in the process is highlighted as well as the need to accurately record and interpret its findings. This is a process the organisation believes it has strong competencies in following over 30 years of experience and the relevant personnel in knowledge management and knowledge transfer available to undertake it accompanied by field specialists.

The benefits of the workshop approach are highlighted as enabling the organisation to establish local capabilities in a number of areas and also enable key factors to be considered at design stage. The organisation employ a number of different workshop process which vary from project to project depending on context, local community dynamics, size of community, number of houses, literacy levels etc. Key to the workshop process is the ability to adapt a workshop and participative process within the project parameters and constraints to ensure beneficiary's requirements are met and their knowledge obtained and utilised within the overall process. To achieve this, the organisation employs various techniques with effective communication central to all. Depending on context these include one on one consultation, election of community representatives or groups in larger communities where time or finances do not permit one on one consultation. The interviewees believed that key to a successful workshop is the ability to use simple communication methods suitable to the community been served. This may involve simple hand drawings, sketches, models etc.

"Selection of appropriate materials and technology" ranked eighth in the top ten concepts and highlights the importance placed on this aspect of design by the organisation. The design decisions in relation to the use of appropriate materials and technology are informed from research from the design and feasibility workshops as well as knowledge from previous projects in similar contexts. The organisation gives a large variety of aspects consideration in relation to selection of materials ranging from technical, social, economic and environmental aspects i.e. performance, statutory requirements, maintenance and repair aspects, skilled workforce available or ability to train a workforce, supply chain, logistics in using material, potential for training and

entrepreneurial spin out, social perception, health aspects, green credentials, longevity, appearance and affordability. The organisations approach demonstrates that appropriate material and technology use is central to them achieving the overall objectives and as such the believe it is essential to afford it adequate time and resources to ensure decision-making is fully informed at all stages.

Objectives

Three objectives were highlighted within the top ten concepts and this highlights that the organisation has clear objectives at the outset and the central importance placed on achieving these as part of the overall design decision-making process. "Generate sustainable and realistic final design for implementation" is highly ranked at number two and this reflects the organisations overall ethos in relation to all its work. Emphasis was placed on the use of the word realistic by the interviewees as very important as the organisation believes it is all too easy to talk about sustainability and propose various approaches and technologies which have little basis in the real life context in which they are to be implemented. The interviewees highlighted that delivery of the project in the allocated time and budget is central to this concept. The organisation believes it is essential for them to achieve both time and budget goals for the beneficiaries' sake and their own reputation and future work. As such they believe the initial feasibility study is imperative in obtaining this key objective for the organisation as it enables them to set project specific criteria and parameters early in the design process in order to manage the design and delivery process through all stages and mitigate against greater risk of failure in one or more areas.

The interviews highlighted that convincing beneficiaries or donors of their proposed long-term solution was one of the main challenges in realising this objective. Issues with perception of certain building materials i.e. earth, certain building typologies and beneficiaries unrealistic expectations i.e. large house sizes and unfeasible materials, were highlighted as common challenges which had to be overcome. The organisation often resorted to constructing prototype dwellings or visiting similar dwellings if possible and educating the beneficiaries and donors of the merit of their approach where required. However it was stated that this was time and cost consuming and not always feasible on every project and as such is very project specific.

"Participative/owner driven approach utilised wherever possible" which is ranked at number nine is again another key objective the organisation set for each and every project and believe it is essential in order to obtain the most appropriate final outcome for the beneficiaries. This applies to all stages of the project from inception to completion. The organisation believe key to obtaining this is a bottom up approach working at both a macro and micro scale with the community to ensure that all decisions are made by or with agreement of the community as much as possible.

"Sustainable design central to overall design approach and decision-making" is ranked at number 10 in the overall concepts and this demonstrates the importance of this objective in informing and driving the organisations overall approach to design decision-making and delivery of its work. As such the drive to achieve this key objective is the seed for many other top ten concepts. the interviewees highlight that they undertake an assessment at the outset of every project when approached in order to assess if the project is suitable for them as adherence to their key objectives and guiding principles are central in their decision whether to undertake a project or not.

This process involves undertaking a donor and project requirements assessment which involves analysing aspects such as budget and time resources, donor aspirations and ethos i.e. does it align with the organisations, donor involvement/influence on design and delivery process etc. Should the project be favourable to all parties the organisation prepare a Memorandum of Understanding (MoU) which highlights what they are appointed to undertake and the manner in which it will be undertaking. This forms part of the organisations appointment to a project and is used to ensure all parties are clear from the outset of the projects deliverables and guiding principles.

Strategy/Approach

Strategies and approaches in design decision-making featured strongly in the top ten concepts. Economic, technical and social/cultural considerations were ranked third, fourth and fifth respectively. This highlights the organisations central emphasis on a holistic approach to sustainability as each concept can be viewed as a key pillar of any sustainable model and as such are often interrelated in many ways when it comes to design decision-making. Economic considerations highlighted that influence the design and delivery process include assessing the funding available and affordability of the final designed dwelling and ensuring that both are aligned and realistic. This was highlighted as a challenge as often project budgets and client aspirations are not aligned and need to be addressed from an early stage.

The expenditure of donor money on other essentials not involving their dwelling was highlighted as a common problem area, particularly after natural disasters and conflict where essentials such as food and clothing are often higher up beneficiaries priority list. As such the organisation set strict economic constraints and controls of budgets are set at an early stage in each project. The long-term economical sustainability was highlighted as vital in informing the decision-making process and aspects such as material selection i.e. affordability, maintenance and repair costs etc. The potential of livelihood generation was also highlighted as a key consideration in design decision-making. The organisation actively explore if possibilities of training and potential start up business are possible as part of the design/implementation process to facilitate a legacy of potential business and livelihood generation when the project is complete. This can inform design decision-making in unusual ways such as material and technology choice and aspects such as plot layout to ensure future space of business growth.

Technical decisions were highlighted as central to the design process and cover various aspects and are closely related to and informed by the use of appropriate materials and technology as outlined above. The interviewees highlighted that technical decisions cannot be considered in isolation and must be assessed in relation to economic, environmental and social/cultural criteria at all stages. The interviewees highlighted that a robust analysis of local capabilities and feasible materials is essential to inform this aspect of design and decisions are often made on a tripartite assessment of the social/cultural, economic and environmental aspects of a particular technical element of the design be it materials, technology, house typology etc. to arrive at a final balanced decision in the best interest of the beneficiary.

All interviewees considered social and cultural aspects of the design decision-making process of the utmost importance. It was highlighted that Sri Lanka had a diverse religious and cultural heritage, as do many countries, and aspects such as religious beliefs, customs and tradition must be given due attention throughout the dwelling design and delivery process. Aspects including prayer/shrine rooms as well as various gender roles were highlighted as been of importance in relation to housing layout and how the project was implemented.

"Undertake robust preliminary assessment" was ranked 6 and highlights the need to undertake a broad holistic overview of the project at the outset even before commencing detailed workshops with the beneficiaries. The interviewees highlighted the preliminary assessment is more macro in scale and includes an assessment of the site and local infrastructure i.e. roads, local construction industry, utilities supplies (water, electric, sewer, waste management), schools, shops, community centres etc. A review of local capabilities in relation to potential partners is also undertaken i.e. architects, engineers, suppliers etc. The organisation highlighted that they employ many nationalities and see themselves as an international community and actively recruit qualified staff who are either from or have worked in the host country in order to develop local contacts or obtain access to local knowledge. This they feel is something that has contributed to their successful completion of many projects throughout the world.

Domain Analysis

Table 3. Top 10 concepts from domain analysis of global map (Source: Authors).

Links	Concept	Category
15	Selection of appropriate materials and technology	Solution
12	Assess site and local infrastructure	Strategy/Approach
11	Economic considerations	Strategy/Approach
11	Undertake comprehensive feasibility study at the outset to inform all stages of design and delivery.	Solution
9	Generate sustainable and realistic final design for implementation.	Objective
8	Social and cultural considerations	Strategy/Approach
8	Achieved through comprehensive workshops	Solution
7	Some decisions already made	Challenge/Barrier
7	Skat set certain criteria for each project at an early stage (informed by feasibility study)	Strategy/Approach
6	Participative approach always employed – ensure beneficiary involvement at all stages.	Objective

Solution

A total of 3 solution concepts appear in the domain analysis top ten. Of these all three, “Selection of appropriate materials and technology” (15 links), “Undertake comprehensive feasibility study at the outset to inform all stages of design and delivery” (12 links) and “Achieved through comprehensive workshops” (8 links) also appear in the top ten central analysis concepts. This highlights that not only are these concepts central to the organisations design decision-making approach but they also were discussed in interview as been particularly vital.

Strategy/Approach

A total of 4 Strategy/approach concepts appear in the domain analysis top 10. Of these 2 concepts, “Economic considerations” (11 links) and “Social and cultural considerations” (8 links) appear in the central analysis top ten concepts again highlighting their vital role in helping the organisation to achieve its overall objectives. “Assess site and local infrastructure” (12 links) is highly rated within the domain analysis. This was discussed at length by all interviewees as a full understanding of the local context; physical, geographical, social/cultural, economic and political was essential at the outset.

This strategy/approach formed part of the initial preliminary assessment and is undertaken on all projects to identify any potential challenges or barriers and opportunities and help establish a framework and parameters to move forward with on the project. This was highlighted as been of particular importance in post disaster contexts in relation to risk identification and mitigation of future risks. “set certain criteria for each project at an early stage (7 links) also featured highly throughout the interviews. This was highlighted as a key task to undertake at an early stage in relation to the design and delivery of the project as informed parameters had to be set to work within in order to maintain adequate management of the overall process.

Objectives

2 objective concepts, “Generate sustainable and realistic final design for implementation” (9 links) and “Participative approach always employed – ensure beneficiary involvement at all stages” (6 links) were identified within the top ten domain analysis concepts. Both concepts appear in the central analysis and were previously discussed in detail. Both objectives are central to the organisations ethos and overall approach to design and hence referred to on a number of occasions throughout the interviews as much of their approach can be traced back to these central concepts as their driver. As such they can be viewed as critical success factors which the organisation consider central to the success of their design approach and implementation.

Challenge/Barrier

“Some decisions already made” (7 links) is the only challenge/barrier concept to feature in the domain analysis top ten concepts. The interviewees stressed on a number of occasions the importance of initial stages of any project and the need to get a full overview of context and set project parameters from the outset. However on occasion the organisation is often asked to advise or take over a project after the initial stages are already completed by another party. This they feel can often have detrimental effects on the projects final outcome and long-term sustainability. Examples were given of certain decisions on aspects already been made by government bodies or at times donors i.e. house typology, suppliers and materials to be used, land zoning, time limits which can have detrimental effects on the final outcome or are short sighted and are often politically motivated or related back to political corruption, particularly after disasters, resulting in the full potential of the project not been realised. The interviewees highlighted that the beneficiaries are ultimately the ones who will face the consequences of this in the long run.

Process Flow Chart

Following analysis of all interviews and additional documentary and empirical field research findings a process flow chat was formulated to demonstrate graphically the main stages in the organisations approach to post disaster housing reconstruction and the main aspects and considerations that informed decision at each stage (Fig 3). The organisations approach can be logically divided in to 4 main stages with each stage fundamental to the overall success of the project. These stages involved an initial stage prior to commencement to gauge if the organisation could work with the donor or funding body and if they had the capabilities to undertake the works. If the initial stage requirements were satisfied the organisation moved on to an intense research and feasibility stage which involved obtaining a thorough understanding of the local context and relevant stakeholders. The organisation highlighted stage 2 as paramount to undertake in sufficient detail as it informed the third design stage. Stage 3 design involves numerous workshops and participation from beneficiaries and relevant stakeholders. The final implementation stage covered more practical aspects of logistics and project management that were critical in order to deliver the organisation proposals in a challenging post disaster context.

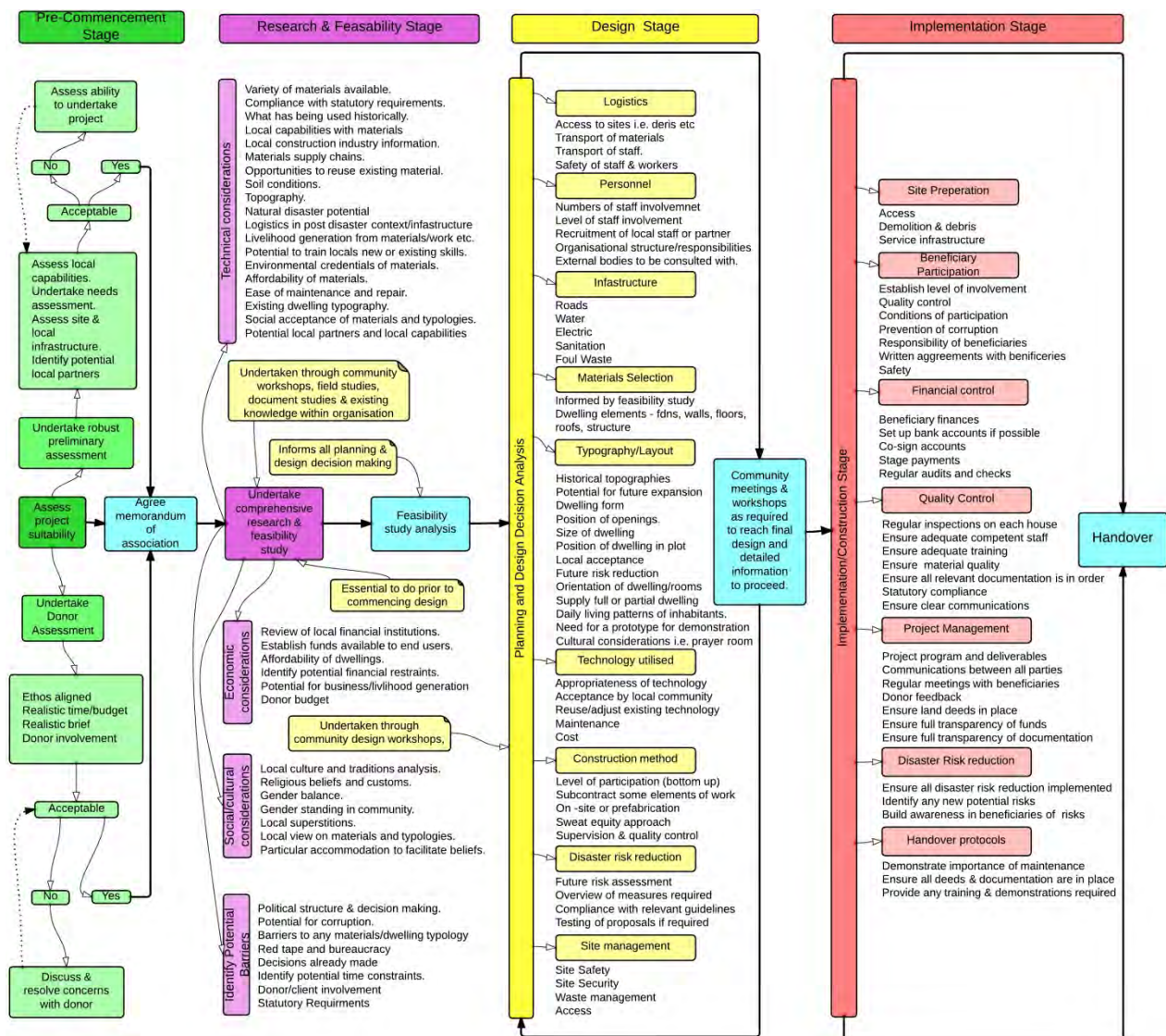


Figure 3: Process flow chart highlighting INGO's approach to housing design and delivery in post disaster contexts (Source: Authors).

CONCLUSIONS

This study involved a rigorous in depth study of an experienced INGO's approach to the design and delivery of affordable and sustainable post disaster housing in developing country contexts. The study offers valuable insights in to the challenges, barriers, objectives, strategies and drivers that an INGO faces in relation to housing design and delivery in a post disaster context. The research identified the aspects of design and project management which are central to the overall process and the emphasis placed on these at each stage of the process. Particularly evident was the organisations holistic approach to sustainable development and the means in which it identified the various elements of this and obtained relevant information on this aspect of the project and implemented it through a participatory approach at the various stages. Identification of potential barriers and challenges that were highlighted by the organisation as common when operating in a post disaster housing context are essential to identify and analyse from an early

stage in order to undertake adequate mitigation strategies so as not to impact on the quality of the overall project.

The identification of and separation of the main stages of the organisations approach in to a simplified flow chart enables a clear understanding of the organisations decisions making process in relation to design and project management. This study demonstrates the methodical approach a leading INGO employs for affordable and sustainable housing design and delivery in challenging post disaster contexts and its findings will be of benefit to policy makers, NGOs, government bodies and community organisations in practice as it offers unique evidence based insights into an international bodies housing design decision-making process. The study highlights the importance of appropriate design coupled with adequate project management in order to meet the long-term needs of effected communities in relation to post disaster housing.

REFERENCES

- Adeyemi, A.Y. (2002). "Affordable housing production: The influence of traditional construction materials." XXX IAHS world congress on housing, housing construction: an interdisciplinary task, Vols 1-3, pp. 827-832.
- Bruen, J., Hadjri, K., Von Meding, J., (2013), Design Drivers for Affordable and Sustainable Housing in Developing Countries, *The Journal of Civil Engineering and Architecture*, Vol 7, Issue 11, pp. xx, Nov 2013. (in press)
- Bryson, J.M., Ackermann, F., Eden, C. & Finn, C.B. 2004, Visible Thinking: Unlocking causal mapping for practical business results, John Wiley & Sons, Ltd, Chichester.
- Cuff, D., (1991), "Architecture: The story of practice", Cambridge Mass., MIT Press.
- Eden, C., Ackermann, F., (1998) "Making Strategy: the journey of strategic management". London: Sage Publications Ltd.
- Fallahi, A. 2007, "Lessons learned from the housing reconstruction following the Bam Earthquake in Iran." *The Australian Journal of Emergency Management*, Vol. 22 No. 1, February 2007.
- Fiol, C.M., & Huff, A.S., (1992), "Maps for managers: Where are we? Where do we go from here?", *Journal of Management Studies*, Vol. 29, No. 3, pp 267-285.
- Harrison, E. F. (1999), "The managerial decision-making process", 5th ed, Houghton Mifflin, Boston, MA.
- Holm, I., (2006), "Ideas and beliefs in architecture and industrial design" Doctoral Thesis, Oslo Scholl of Architecture & Design.
- Hurby, J.,(2006) "Managerial cognition and the international strategy making process in European telecom MNCs", Doctorial Colloquium, Oslo, University of Graz, 2006.
- International Federation Of The Red Cross And red Crescent Society, (2001), "*World Disasters Report, focus On Recovery*" www.ifrc.org/PageFiles/89755/2001/21400_WDR2001.pdf (Accessed August 06 2013).
- Kahneman, D, Tversky, A., (2000). Choice, Values, Frames. The Cambridge University Press.
- Pugh, C. 1994, Housing Policy Development in Developing Countries: The World Bank and Internationalization, 1972–93. *Cities* 11(3), 159–180.
- Randolph, B., Kam, M., Graham, P. 2008, "Who can afford sustainable housing." In: Nelson, A., (Ed.), "*Steering sustainability in an urbanizing world.*", Ashgate, Aldershot, United Kingdom.
- Salazer A., (1994) "The crises and modernity of housing disasters in developing countries: Participatory housing and technology after the Marathwada (1993) Earthquake, <http://www.grif.umontreal.ca/pages/i-rec%20papers/alex.PDF> (Accessed 26-03-10).
- Schilderman, T., (2004) "Adapting traditional shelter for disaster mitigation and reconstruction: experiences with community-based approaches" *Building Research & Information*, (September–October 2004) 32(5), 414–426
- Simon, H. A., (1977), "The new science of management decision" Englewood Cliffs, NJ: Prentice Hall.

United Nations Office of the Disaster Relief Co-ordinator (UNDRO). 1982. Shelter after disaster: Guidelines for assistance. <http://cidbimena.desastres.hn/docum/crid/Septiembre-Octubre2005/CD-1/pdf/eng/doc3968/doc3968.htm> (accessed June 20, 2013).

Yin, R.K., (1994), Case Study Research: Design and Methods, 2nd ed., Sage Publications, 1994

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THE ROLE OF LOW-COST HOUSING IN THE PATH FROM VULNERABILITY TO RESILIENCE

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Abstract

It is well known that low-cost housing not only reflects, but also greatly influences the vulnerability of a community. This means that post-disaster housing programs can improve the living conditions of affected families or make them even more vulnerable. However, it is still unclear how different post-disaster housing strategies enhance community resilience. This article seeks to bridge the theoretical gap that exists between vulnerability and resilience theories and to clarify how post-disaster housing programs can potentially enhance community resilience. Four different housing strategies used after the 2003 earthquake in Bam, Iran, illustrate the role of housing in the path that can potentially lead communities from a vulnerable state to resilience. These strategies include: (A) Prefabricated units built on temporary camps located in the city and in the outskirts and developed by the central government, (B) Masonry units built by a public stakeholder on the yards of destroyed houses (C) Prefabricated units built by the central government in partnership with a private firm and located in the yards of destroyed houses, and (D) High-tech imported units built on the outskirts of the city. Analysing these strategies through the lens of a new framework based on a systems approach permits to identify the different impacts of post-disaster housing programs. Whereas strategies A, C and D had negative consequences in various sub-systems of the affected community, strategy B positively enhanced community resilience. The findings of the study provide insightful information that can help architects and decision makers identify the appropriate housing strategy to be implemented after disasters.

Keywords: post-disaster housing; resilience; Iran; reconstruction; vulnerability; systems.

INTRODUCTION

First contributions in disaster management literature (and in architectural studies interested in this field) attempted to explain why disasters occur. They ultimately created the vulnerability theory, which demonstrated that disasters are not 'natural' but created by societies (Adger, 2006; Cutter *et al.*, 2003b; Gallopín, 2006). According to this theory, societies accumulate unsafe conditions (such as poverty, unsafe use of land, lack of insurance) that become disastrous when triggered by a natural hazard. Nonetheless, later contributions noted that some communities do not necessarily accumulate unsafe conditions but also develop appropriate mechanisms of adaptation to the environment (Adger, 2000; Coles *et al.*, 2004). This argument has been consolidated in the emergent theory of resilience. Some authors now argue that rather than being contradictory, the two theories can in fact be complementary (Cutter *et al.*, 2008; Cutter *et al.*, 2003a). This implies that it is theoretically possible for a community to evolve from a state of vulnerability to a state of resilience. However, the relationship between enhancing resilience and effective vulnerability reduction has been insufficiently explored in disaster literature (Djalante *et al.*, 2011; Miller *et al.*, 2010). In response, this article seeks to illustrate how housing can contribute to move communities from a state of vulnerability to resilience. In order to do this, the study examines the case of post-disaster housing solutions developed after the earthquake that destroyed the city of Bam, Iran, in 2003.

However, this objective implies developing an analytical framework that combines the concepts of vulnerability and resilience and that relates them to post-disaster housing. This framework is explained in the first section. General Systems Theory has been usefully applied to the understanding of vulnerability (Cutter *et al.*, 2008; Cutter *et al.*, 2003a), resilience (Alexander, 2013) and post-disaster housing (Johnson *et al.*, 2006; Lizarralde *et al.*, 2009). Given this common approach and the advantages of examining the complex relationships between elements and their environment (Von Bertalanffy, 1973), this framework adopts a systems approach. The second section presents the qualitative research methods used for the empirical work. We then present the results in the form of a qualitative assessment of community resilience. Finally, in the section of discussion, we present practical and theoretical implications of this study and the principal findings in the section of conclusions.

Vulnerability

Although different definitions of vulnerability exist, the term is broadly used to define the potential and the degree of loss for a given system resulting from the occurrence of a natural phenomenon (Cutter, 1996). The vulnerability of a system corresponds to sensitivity to disorders and difficulties to recover the functions of a system (DHA, 1992; Mehta *et al.*, 2008; Pelling, 2003). Several contributions in the field attempt to identify and assess the conditions that make people and assets vulnerable to natural events (Anderson, 1995; d'Ercole *et al.*, 1994; Thouret *et al.*, 1996).

The vulnerability theory - and notably the Pressure and Release Model - presupposes that root causes (often historic economic, political and social conditions) lead societies to dynamic pressures (such as rapid rural migration, lack of infrastructure and poverty) that eventually materialize in unsafe conditions that put people and assets at risk (Blaikie *et al.*, 1994; Hewitt, 1997). These unsafe conditions (created by the society itself) can be sparked by a natural hazard to create a disaster.

Post-disaster low-cost housing

Post-disaster housing interventions often take three distinct forms: emergency shelters, temporary units and permanent houses. Emergency shelters (often more or less sophisticated tents), attempt to deal with, and moderate, the particularly hostile post-disaster conditions. However, the long-term use of the tents, their uncomfortable conditions, their elevated cost (compared with locally produced houses) and difficulties in their distribution are frequent drawbacks found in this first stage of recovery (Davis, 1977; Duyne, 2010; UNDR, 1982).

Temporary housing is often simultaneously regarded as a challenge for long-term sustainable reconstruction and as a necessary step to settle temporarily the affected families during and after a disaster (Fayazi, 2011; Johnson, 2007). In fact, it is often an expensive investment that can delay the construction of permanent solutions. Besides, it usually consists of sub-standard solutions that become permanent, perpetuating vulnerable conditions and stigmatization. However, it might also enable the families to resume daily activities (Jha *et al.*, 2010; Johnson, 2007), to plan for future living solutions and to create the conditions for recovery (Quarantelli, 1995). In order to succeed, temporary housing must not only provide a roof, but also enhance community capacities that create income, consolidate social ties, avoids social segregation and permit long-term development in general (Fayazi *et al.*, 2013; Lizarralde *et al.*, 2009).

Permanent housing often appears as a third step in the process. However, permanent solutions are often too expensive for poor households to afford and thus they must be largely subsidized. Other common drawbacks include the use of unfamiliar technologies, and of the rubberstamped repetition of a basic module, that often ignores different family size, income, priorities and expectations (Aysan *et al.*, 1987; Barenstein, 2010; Fayazi & Lizarralde, 2013). Duyne Barenstein (2010) identifies five approaches of housing reconstruction: cash approach, owner-driven reconstruction, community-driven reconstruction, agency-driven reconstruction in-situ and, agency-driven reconstruction in relocated sites. She highlights in particular the positive

effects of owner-driven reconstruction, a strategy that has proved to help reduce costs; improve safety; restore livelihoods; empower affected households, and enhance capacity building.

Resilience

The concept of resilience - first introduced in ecology and disaster-related research by Holling (1973) - has multiple definitions often used interchangeably (Klein *et al.*, 2003). Initial contributions emphasized preservation in ecological systems and adaptation enhancement in communities (Alexander, 2013). More recent contributions highlight the capacity of a system to withstand, mitigate, recover and adapt to a disturbing event (see Table 1). For many, resilience is a “measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables” (Cutter *et al.*, 2008).

Within the field of global environmental change, resilience is defined as the ability of a social system to respond and recover from disasters. It includes inherent conditions that allow the system to absorb impacts and to cope with them as well as adaptive processes that allow it to reorganize, change, and learn (Adger *et al.*, 2005; Klein *et al.*, 2003).

Resilience includes pre- and post-event measures (Bruneau *et al.*, 2003; Tierney *et al.*, 2007), hence implying inherent qualities that function well during non-crisis periods, and adaptive capacities in response to disasters (Cutter *et al.*, 2008). In fact, several authors now accept that community resilience emerges from adaptive capacities (Norris *et al.*, 2008) - that is, dynamic attributes of resources that are robust, redundant or rapidly accessible and that allow the system to adjust to change, moderate the effects, and cope with a disturbance (Brooks *et al.*, 2005; Burton *et al.*, 2002). Consequently, Norris *et al.* (2008, p. 130) argue that resilience is “a process linking a set adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance”.

Table 1: Relevant definitions of resilience - after Fayazi and Lizarralde (2013) (Source: Authors).

Authors	Definitions	Emphasis on the ability to:			
		withstand against hazard	mitigate impacts of hazard	recover after hazards	adapt community capacities
Brown <i>et al.</i> (1992)	The ability to recover from or adjust easily to misfortune or sustained life stress.	X			
Sonn <i>et al.</i> (1998)	The process through which mediating structures (schools, peer groups, family) and activity settings moderate the impact of oppressive systems.		X		
Adger (2000)	The ability of communities to withstand external shocks to their social infrastructure.	X			
Paton <i>et al.</i> (2001)	The capability to bounce back and to use physical and economic resources effectively to aid recovery following exposure to hazards.			X	

Bruneau <i>et al.</i> (2003)	The ability of social units to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future earthquakes.		X	X		
Ganor <i>et al.</i> (2003)	The ability of individuals and communities to deal with a state of continuous, long-term stress; the ability to find unknown inner strengths and resources in order to cope effectively; the measure of adaptation and flexibility.				X	X
Ahmed <i>et al.</i> (2004)	The development of material, physical, socio-political, socio-cultural, and psychological resources that promote safety of residents and buffer adversity.	X	X			
Kimhi <i>et al.</i> (2004)	Individuals' sense of the ability of their own community to deal successfully with the ongoing political violence.	X	X			
Coles and Buckle (2004)	A community's capacities, skills, and knowledge that allow it to participate fully in recovery from disasters.				X	
Pfefferbaum <i>et al.</i> (2007)	The ability of community members to take meaningful, deliberate, collective action to remedy the impact of a problem.		X	X		
Tierney and Bruneau (2007)	Pre-event measures to prevent hazard-related damage and losses (preparedness) and post-event strategies to help cope with and minimize disaster impacts.		X	X		
Norris <i>et al.</i> (2008)	A process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance.					X
Martin-Breen <i>et al.</i> (2011)	For an object: Bouncing back faster after stress, enduring greater	X	X	X	X	X

	stresses, and being disturbed less by a given amount of stress. For a system: Maintaining system function in the event of a disturbance. For an adaptive system: The ability to withstand, recover from, and reorganize in response to crises.		
(Howell, 2012)	A national system of resilience has three attributes: Robustness, redundancy and resourcefulness. Its performance can be measures according the response and recovery.	X	X

Analytical Framework: The Process of Enhancing Resilience (PER)

A system adopts adaptive characteristics through sufficient performances during a continuous Process of Enhancing Resilience (PER). This process might start from a vulnerability state, which corresponds to limited or insufficient access to 'hard' and 'soft' resources (material and non-material assets) (Lizarralde *et al.*, 2009). The system is often composed by several subsystems including; economy, social, natural environment, built environment, governance, and information and communication. These subsystems correspond to adaptive capacities and dimensions of resilience that have been identified by Arner-Erly *et al.* (2013), Fayazi and Lizarralde (2013) and Cutter *et al.* (2008).

However, there are also different scales of vulnerability and resilience at which the system can be analyzed: individual, family, community, city and national scales. They eventually interact with each other; for instance, community resilience enhances or diminishes the resilience of individual families – and vice versa. Arguably, these dimensions are not static; they evolve before, during and after the disaster: physical destruction and loss of lives and damages, for instance, influence people's attitudes towards risk in the immediate phase after the disaster. Keeping in mind these dynamic attributes, and the scales of the system and its subsystems, we propose a first model that relates the different variables that must be considered in a holistic assessment of the system (see Fig. 1). This first model recognizes that the subsystems interact between each other at different scales - much like Russian puppets of different sizes embedded in each other (Lopez, 2013).

A second model represented in Fig. 2 borrows a basic concept of the Pressure and Release model proposed by Blaikie *et al.* (1994) and Hewitt (1997), to illustrate that the complex system represented in Fig 1. can become vulnerable because of their deeply rooted economic, political, social and environmental conditions (originally called by the authors "root causes"). These conditions lead the system to dynamic pressures (such as inefficient government or infrastructure, increased social inequality), which eventually translate into unsafe conditions (such as instable building structures, informal settlements in flood-prone areas, and other dangerous situations). These unsafe conditions make the system more or less vulnerable to three types of exposures - that might happen separately or that interact with each other: (1) continuous exposure, including threats such as air and noise pollution; (2) recurrent exposure, that corresponds to periodic threats such as seasonal floods and tropical storms; and (3) sudden exposure which includes high-impact events that cause immediate severe damages, such as hurricanes, earthquakes and tsunamis (note that in Figure 2, the system of the first model is represented as a white circle).

For example, an informal settlement (certainly a complex system) located in a flood-prone area (in an unsafe condition) is vulnerable to seasonal floods (a recurrent exposure). Its sub-systems' vulnerabilities can include, for instance: 1) unstable structures and infrastructures (built environment subsystem), 2) flood prone shorelines (natural environment subsystem), 3) illiterate households (social subsystem), 4) lack of investment due to the threat of seasonal floods (economic subsystem), 5) unenforced urban planning codes and construction standards (institutional subsystem), and 6) lack of communication between households and responsible organizations (communication and information subsystem). Arguably, these conditions make the system vulnerable to others threats (earthquakes, hurricanes, droughts, or even man-made threats such as crime).

The exposures can spark or not a disaster. If a disaster does not occur, the system can benefit from actions that can lead to a state of preparedness, becoming less vulnerable and more resilient. These actions range in a continuum between institutionalized measures and vernacular ones. They might include policy-making and enforcement, plans, programs and projects that increase access to material and immaterial resources. If a disaster does occur, recovery might include three phases: emergency action, temporary solutions and permanent reconstruction (Warfield, 2008; Wisner *et al.*, 2002). Our model captures this principle and illustrates that the system requires a period of recovery before developing preparedness measures. The system ultimately becomes resilient when it adopts the following characteristics in the last step of the PER model: redundancy, robustness, and resourcefulness. Even though both processes are closely related, it should not be assumed that vulnerability reduction is equivalent to resilience development. In fact, resilience is enhanced by actions that help develop adaptive capacities of the system to withstand, recover from, and reorganize in response to crises, and maintain its function in the event of a disturbance (Howell, 2012; Martin-Breen & Anderies, 2011).

Vulnerability reduction occurs when there is increased access to 'soft' and 'hard' resources that create safe conditions for the system (within the system and its environment). Given this framework of analysis, what is the role of post-disaster housing in the different steps of the process of enhancing resilience?

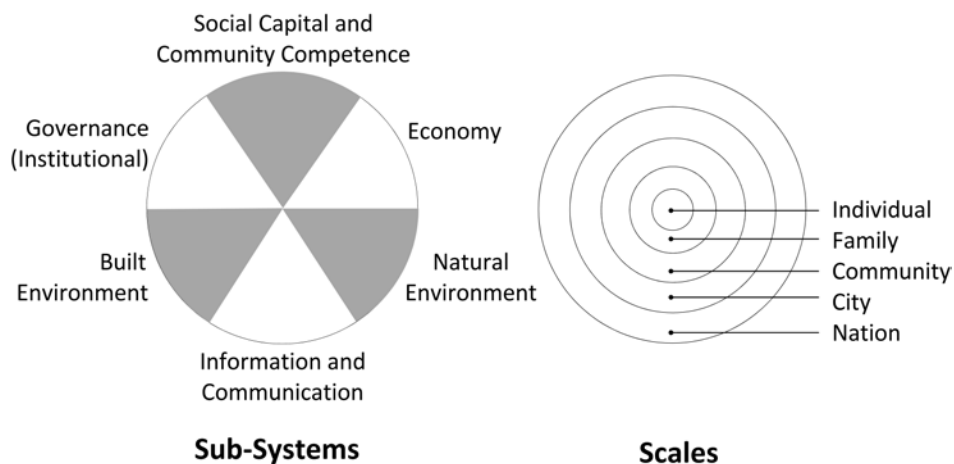


Figure 1: The variables of the system: scales and sub-systems (Source: Authors).

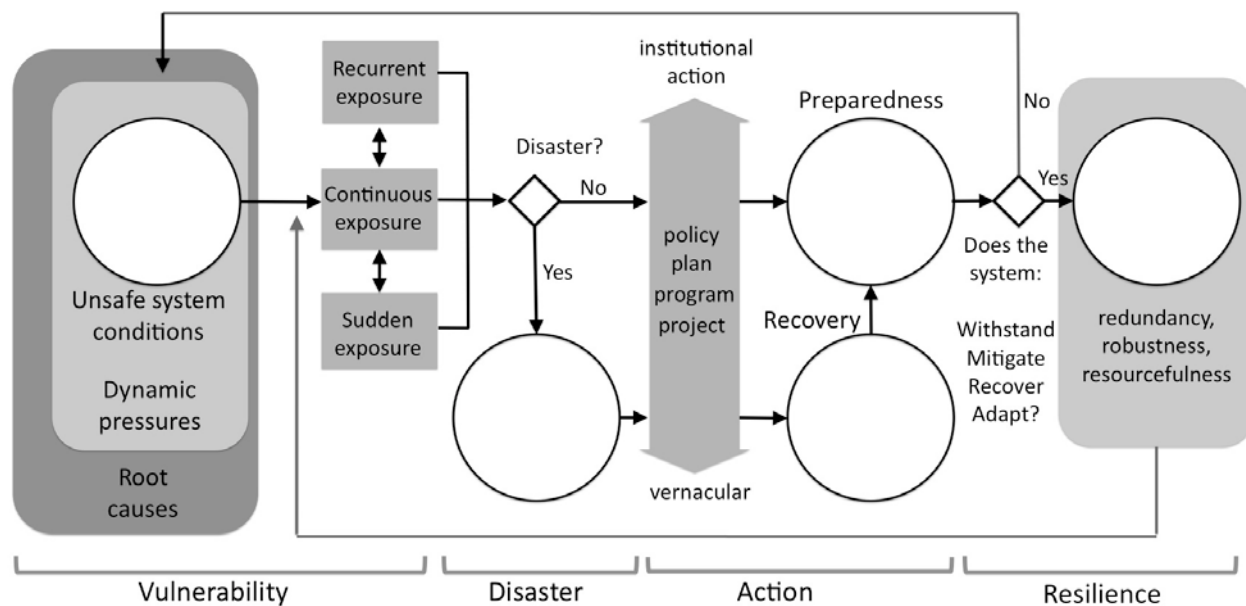


Figure 2: The Process of Enhancing Resilience (PER) Model (Source: Authors).

RESEARCH METHODS

In order to answer this question, we conducted an empirical study that examined the effects of different housing strategies used in the reconstruction after the earthquake that significantly destroyed Bam, Iran, in 2003. Case study methodology, through qualitative analysis, is the most suitable for this study because it allows an empirical approach to complex social and human phenomena within its own context (Yin, 2008). Information for building this case was obtained from the following five sources:

1. The Bam Reconstruction Documentation Project (BRDP), conducted by the Iranian Housing Foundation Organization (HFO). The HFO is responsible for providing affordable houses to low income families, and for post-disaster reconstruction in the country. The BRDP was published in eleven thematic reports¹; the first author of this article was involved in the BRDP and supervised the sub-project "Temporary Housing project after Bam earthquake 2003" between 2008 and 2012.
2. Additional printed information, including reports prepared by the directions of the ministries involved in the project, minutes of project meetings, contractual documents and agreements, press releases and construction documents.
3. Narrative reports which explain chronologically the phases of reconstruction.
4. Answers to 85 questionnaires (conducted within the sub-project "Temporary housing project after Bam earthquake 2003" of the BRDP) given by temporary housing residents. These questionnaires had three main sections: demographic information, questions related to the temporary housing process, and open-ended questions to address the residents' opinions.
5. Data obtained from 70 interviews aimed at understanding the planning, decision-making and implementation process. They include: twelve interviews with members of the

¹ The publications by the BRDP project include the following themes: 1- Relief and rescue process, 2-Debris removal process 3-Temporary housing process, 4- Participatory approach in Bam reconstruction, 5- Project management in Bam reconstruction, 6- Resource management in Bam reconstruction, 7- Permanent housing process (planning and designing), 8- Involved Non-Government Organizations (NGOs) in Bam reconstruction, 9- Needs assessment and damage assessment, 10- Control and monitoring techniques, and 11- Indexing resources.

Steering Committee for Reconstruction of Bam - SCRB², three interviews with HFO's managers, three interviews with officers of the local government, four interviews with presidents of private companies, three interviews with members of the city council and 45 interviews with affected families.

The qualitative analysis assessed specific indicators in each of the sub-systems (economy, social, natural environment, built environment, governance, and information and communication). These indicators were subdivided into variables that assessed the particular role of temporary housing in each sub-system, which were subsequently broken down into analytical criteria. See Table 2 for an example of the analysis of the economic subsystem indicator; this table compares the four strategies of temporary housing according to the chosen variables and criteria. A similar table was prepared for each of the subsystems but they are not presented in this paper. They are included in Fayazi and Lizarralde (2013).

Table 2: Example of the analysis of the economic subsystem indicator, including a comparison of the four strategies (Source: Authors).

Indicators	Variables of temporary houses	Criteria of analysis of the variables		Strategies				Comments on the criteria
				A	B	C	D	
Equity in the distribution of the resources	Duration of the benefits	Only during temporary housing phase		X		X		The program led to inequity of resource distribution.
		Remained after temporary housing phase	Use as secondary space		X	X		
			Use as secondary living space		X			The affected families did not have the same opportunity to receive temporary housing units at the same time. Affected families and native landowners received temporary units after passing several months on emergency shelters.
			Use as permanent houses				X	
	Waiting time for receiving temporary houses	Less than 2 months		X				
		Between 2 and 6 months		X	X	X		
		Between 6 months and one year			X			
		More than one year					X	
Level and diversity of resources	Level & diversity of temporary houses	Location	Camps outside of city	X			X	Allocating different types of
			Camps within the city	X				
			The yard of destroyed houses		X	X		
		Material	Complete units				X	

² The SCRB consisted of the Iranian vice president, the ministers of interior, housing and urban development, transition, information technology and communication, health, agriculture, power and suppliers, economy and finance, the governor-general of the Kerman province, parliamentary representatives of Bam, the president of the Housing Foundation Organization, and additional experts.

		and structure	installed in situ			temporary houses to distinctive groups of vulnerable communities reinforced differences between social groups and exacerbated vulnerabilities.
			Prefabricated units assembled in situ	X	X	
Fairness of risk and vulnerability to hazard	Risk and vulnerability of affected communities	Natives	Masonry materials	X		
			Landowner native residents	X	X	
			Native tenants	X		
		Non-natives	Vulnerable affected families	X		X
			Temporary non-native residents	X		X
			Low-income non-native immigrants	X		X

Research Results

On December 26th 2003, a 6.7 magnitude earthquake severely damaged the city of Bam, Iran (Ghafory-Ashtiany *et al.*, 2008). The majority of houses were destroyed, and more than 75000 residents were left homeless (Gharaati, 2006). Because of the earthquake intensity, the time of occurrence and the instability of traditional mud-straw houses, the event led to high rate of casualties and damages: approximately 25500 people died, more than 75000 residents were left homeless, and nearly 93% of urban buildings were destroyed (Statistic Center of Iran, 2003).

During the emergency phase, several camps of tents were set up to settle survivors. Afterward, the adverse conditions (including harsh climate conditions) forced the national and the local authorities to move affected families to temporary units until permanent reconstruction could be completed. However, demographic changes complicated the temporary housing efforts. A large number of low-income families arrived in Bam from other settlements and villages with the hope of obtaining financial aid. They were settled among affected families in the camps of emergency tents in the primary weeks after the earthquake. The rapid arrival of so many immigrants made difficult the assessment of needs and, consequently, led to poor management of the limited resources available. Around 37900 houses were ultimately built by adopting four distinctive strategies to settle affected families (Fallahi, 2005), each of them are explained below. Table 3 summarizes the main characteristics of the units built in each strategy.

Strategy A: In order to facilitate the removal of debris in affected urban areas, national authorities first opted for the construction of temporary shelters in camps. About twenty sites in the city and in the outskirts were selected for building 9050 prefabricated units. The majority of these units (around 8100) were assembled by the national government in partnership with the Defense Industrial Organization (DIO) and a private company called Consulting Engineers of Rashestan Co. They were located in 16 camps developed six months after earthquake. The rest of the units (around 950) were assembled by the regional government of eleven provinces³ in four sites located in the city (see Figure 3).

³ Tehran, Yazd, Khorasan, Kordestan, Isfahan, Gilan, western and eastern Azarbaijan, Mazandaran, Boshehr and Sistan-Balochestan



Figure 3: Camps of prefabricated units (Source: Authors).

Strategy B: Despite the large number of prefab units built by the government, the majority of native families refused to move to the camps, stayed on their emergency tents, and requested to live near their remaining assets and destroyed houses. In response, authorities proposed, almost three months after the earthquake, the construction of temporary shelters on the yards of destroyed houses. Around 5800 masonry units were then built by the HFO during a period of five months. The specific location of these units within existing yards was selected by the landlord with the supervision of a representative of the municipality and HFO experts (see Figure 4). Despite their modest design, the units were designed to be used after the temporary housing phase besides the permanent reconstructed houses (Ghafory-Ashtiany & Hosseini, 2008).



Figure 4: Units made of steel frame and masonry walls in the yard of destroyed houses (Source: Authors).

Strategy C: In response to the beneficiaries' refusal to settle in the camps, the national government also opted - about six months after the earthquake - to transfer about 2500 units developed in strategy A and that were not occupied by the beneficiaries to the yards of affected houses (see Figure 5). Moreover, the government built additional prefab units (identical to the ones built in strategy A) in the yards of new beneficiaries.



Figure 5: Prefabricated units assembled in the yard of destroyed houses (Source: Authors).

Strategy D: Three donor countries donated 1400 high-tech units imported from Turkey, Japan, and South-Korea. They were built at "Dosty", a camp located in the outskirts of the city, about 2kms away from the Bam city center. These units arrived in Iran about 15 months after the

earthquake, when temporary shelters were no longer needed. Inevitably, these units settled permanently the families who did not have had access to any sort of temporary shelters and had stayed on their emergency tents up to that time (see Figure 6).



Figure 6: Complete high-quality units (Source: Authors).

Table 3: Main characteristics of the units developed in strategies A, B, C, and D (Source: Authors).

	Strategy A	Strategy B	Strategy C	Strategy D
Number of units built	9050	5800	21655	1400
Location	20 camps in the city and outskirts	Yards of destroyed houses	Yards of destroyed houses	Camps in the outskirts of the city
Beginning of construction	Two months after the earthquake	Three months after the earthquake	Six months after the earthquake	12 months after the earthquake
End of construction	Six months after the earthquake (all dismantled by 2009)	Eight months after the earthquake (remained permanent)	Nine months after the earthquake (some dismantled)	15 months after the earthquake (remained permanent)
Built area	19m ² (6×3.17)	18 m ² (6×3) and 20 (6×3.34) m ²	19m ² (6×3.17)	45 m ² (5×9) (units provided by Japan and Turkey). 36 m ² (4×9) (units provided by South-Korea)
Area of the plot	Users do not own the land	Units in existing yards	Units in existing yards	Users do not own the land
Number of bedrooms	1	1	1	1
Indoor kitchen	No	Yes	No	Yes
Indoor washroom	No	Yes	No	Yes
Area for washing clothes	Yes (outside of the unit)	No	No	No

Foundations	10 cm thick slab-on-grade	Spread footing in concrete	10 cm thick slab-on-grade	Spread footing in concrete
Structure	Frame of rectangle box profiles	Frame of rectangle box profiles	Frame of rectangle box profiles	Various pre-fab systems
Walls	Sandwich panels of galvanized sheets and polyurethane foam	Clay brick with mortar and covered with plaster (a few units built with panels)	Sandwich panels of galvanized sheets and polyurethane foam	Sandwich panels of galvanized sheets and polyurethane foam (units provided by Japan and Turkey) Cement panels (units provided by South-Korea)
Roof	Sandwich panels of galvanized sheets, polyurethane foam and plaster	Sandwich panels of galvanized sheets, polyurethane foam and plaster	Sandwich panels of galvanized sheets, polyurethane foam and plaster	Sandwich panels of galvanized sheets and polyurethane foam (units provided by Japan and Turkey) Clay roof tiles (units provided by South-Korea)
Access to running water	Yes	Yes	Yes	Yes
Access to electricity	Yes	Yes	Yes	Yes
Access to public sewage	Yes	No	No	Yes
Access to telephone line	No	No	No	No
Access to schools in the camps	No	N/A	N/A	No
Access to health care centers in the camps	Yes (just in eight camps)	N/A	N/A	Yes
Access to public transportation in the camps	No	N/A	N/A	No

In the following section, the four strategies will be compared through the lens of the PER framework with a particular emphasis on the recovery and reconstruction phases. This empirical comparison explains the potential contribution of different post-disaster housing strategies on the different steps of the PER model. Table 4 summarizes the indicators that were used for the analysis and the most relevant references that have previously examined them.

Table 4: Indicators used to assess each of the six subsystems of the PER framework ((Source: Authors).

Economy	Social (Social Capital and Community Competence)	Natural Environment	Built Environment	Governance (Institutional)	Information and Communica tion
Equity in the distribution of resources (Norris <i>et al.</i> , 2008)	Citizen participation (Norris <i>et al.</i> , 2008) Community action (Norris <i>et al.</i> , 2008)	Environmental risk mitigation, particularly disaster mitigation (Lizarralde, 2008)	Flexible and adaptable functions (Cutter <i>et al.</i> , 2010) Appropriate access to community services such as; schools, health centers, community centers, mosques, recreational facilities, etc. (Lizarralde <i>et al.</i> , 2010)	Allied institutional arrangements in risk management process (Cutter <i>et al.</i> , 2008) Empowered and coordinated institutions (Norris <i>et al.</i> , 2008) Connection with auxiliary (assistance) institution to maintain function (Norris <i>et al.</i> , 2008) Experienced institutions (Cutter <i>et al.</i> , 2008)	Reliable information sources (Norris <i>et al.</i> , 2008) Effective narratives (Norris <i>et al.</i> , 2008)
Fairness of risk and vulnerability to hazard (Norris <i>et al.</i> , 2008)	Flexibility and creativity (Norris <i>et al.</i> , 2008) Collective efficacy empowerment (Norris <i>et al.</i> , 2008)	Reduction of environmental impacts (Adger <i>et al.</i> , 2005; Lizarralde, 2008)			
Level and diversity of resources (Norris <i>et al.</i> , 2008)	Social capacities to respond to the alerts received (Norris <i>et al.</i> , 2008) Place attachment (Norris <i>et al.</i> , 2008) Sense of community (Norris <i>et al.</i> , 2008) Critical reflection and problem solving skills (Norris <i>et al.</i> , 2008)	Optimization of resources and conservation of natural resources (Bell <i>et al.</i> , 2008; Lizarralde, 2008)	Appropriate access to infrastructure such as; roads, water, sewage, electricity, etc. (Lizarralde <i>et al.</i> , 2010)		

Housing and Economy

Arguably, housing solutions - as a primary physical and financial aid distributed to affected families - have economic impacts on economic resilience. "The capacity to distribute post-disaster resources to those who most need them seems vitally important for resilience" (Norris *et al.*, 2008, p. 137). Three indicators (equity of resource distribution, level and diversity of resources, and fairness of risk and vulnerability to hazard) are examined in four distinctive variables: benefit duration, waiting time for temporary houses, level and diversity of temporary houses and vulnerable affected community.

The pre-existing diversity of vulnerabilities in Bam was exacerbated after the earthquake by the new immigrants. It was then necessary to respond to two target groups: the native affected families (landowners, and tenants), and the temporary low-income immigrants (Farhoudian *et al.*, 2006). This demographic distortion led to fictitious assessments of needs, increased demand and a competitive atmosphere. It eventually kept out of the program hundreds of affected families, many of which lost the head of the family and faced psychological problems (mostly in strategy

D). This diversity of beneficiaries also reflected on different attitudes towards the various types of temporary houses. Whereas native landowners preferred to settle near their destroyed houses (mostly in strategies B and C), native tenants and low-income immigrants (mostly in strategies A and D) did not have any choice but to accept the temporary units in the camps. Hundreds of immigrants - mostly in strategy D - were settled permanently in the high-tech units provided by donor countries (Fayazi, 2012).

Allocating different types of temporary houses to distinctive groups of vulnerable communities ultimately reinforced differences between social groups. All affected families did not have the same opportunity to receive temporary units timely. Instead, there was unequal benefit duration, and inequity of resources distribution, greatly affecting overall resilience.

Housing and the Social Sub-System

Two capacities are analyzed in this subsystem: Social Capital and Community Competence. The former is, according to Norris *et al.* (2008), a capacity that forges a sense of community, place attachment, and creative and active public participation. The latter is a critical resource that enables the community to learn about their risks and options, and work together flexibly and creatively to solve problems (Edelstein, 1988; Norris *et al.*, 2008).

Considering social capital, it can be argued that the pre-existing sense of community helped the native affected families expose their concerns about the temporary units provided in the camps and eventually challenge (in strategies B and C) the authorities. It also helped them present their own solution to live temporarily in proximity to their destroyed houses. These temporary houses built besides the destroyed houses facilitated the native inhabitants' emotional, physical, and financial connection to place. In contrast, the lack of sense of community among immigrant families led them to inevitably occupy the camps (mostly in strategies A and D).

Moreover, the large number of immigrants exacerbated the already hostile conditions. Native tenants expressed their preference to live in proximity to their rented houses and even besides their pre-disaster landlords. However, the mix of opportunistic immigrants and native (affected) tenants did not permit to identify deserving beneficiaries and thus the solution was rejected by the authorities. The immigrants were less prepared and could not support native tenants' attempts to challenge the authorities, to expose their needs and to propose alternative solutions.

Place attachment and connection to place also helped the native affected families (mostly in strategies B and C) to keep their connection with their previous social organizations and to continue their livelihood activities⁴. Whereas native owners who settled beside their destroyed houses had a quick adaptive recovery process, the other groups of families (immigrant families, temporary residents and native tenants) struggled with security problems, public health issues (including an epidemic of cholera), lack of jobs, and social troubles in the camps.

Not surprisingly, native owners also had increased participation on formal decision-making processes and their involvement in formal organizations eventually accelerated the recovery process. Results show that temporary units built besides the destroyed houses were the most successful to enhance social capital capacities and that proximity played an important role in creating emotional, physical and financial connection to place.

Not always, but typically, a community is a social entity that shares geographic boundaries and common features (Norris *et al.*, 2008; Sliwinski, 2010). The different responses given by communities to the housing strategies became themselves indicators of community competence. The community action against the inconvenient camps reflected the collective effort in identifying common problems and reacting to them. Expansion and modifications to the units are additional indicators of community competence among the residents of units built in the yard of destroyed houses (see Fig. 7). The residents of units built besides the destroyed houses (strategies B and C) were more easily involved in the reconstruction process, and played critical roles on planning,

⁴ Most traditional houses in Bam include a "Date garden" which plays a critical role on livelihoods.

designing, managing and building their permanent houses. They were responsible for choosing the plan and structure (among solutions provided by private companies), managing the allocated financial aids and loans, buying the materials, contracting companies and controlling the construction process. This involvement allowed them to learn about construction and disaster mitigation and thus to further promote their capacities. The flexibility and creativity demonstrated by native residents contrasted with the immigrants' and native tenants' lack of choices to make decisions about their own living conditions (Fayazi & Lizarralde, 2013).

However, at the end of the temporary housing phase, and after the Statistical Center of Iran and the Iranian Red Crescent had finally distinguished between tenants and immigrants, the native tenants recovered their community competence and demanded that the authorities recognized their differences and particular needs. They eventually pushed the national and local authorities to allocate resources for building housing projects especially for them. These residential projects were ultimately built on land owned by the local government on the eastern side of the city (Fallahi, 2007; Fayazi, 2012).



Figure 7. Left: modification of temporary units according to the inhabitants' values and use of space. Right: expansion of temporary units using local materials (Source: Authors).

Housing and the Natural Environment

The resilience of a natural environment is, according to Cutter *et al.* (2008), influenced by factors such as biodiversity, redundancies, response diversity and spatiality. However, in order to analyze the particular role of housing in the resilience of this subsystem we adopted indicators that involve the fragile relations between the natural, the built and the human environments. They include environmental risk mitigation, reduction of environmental impacts, optimization of resources, and conservation of natural resources and ecosystems (Bell & Morse, 2008; Cutter *et al.*, 2008; Lizarralde, 2008). All these indicators assess the pressure of the intervention on the ecosystem and natural resources.

In strategy A, the government built two crowded camps (one in Amir-Kabir with 750 residents, and one in Golestan with 248 residents) that negatively impacted vital water sources in Bam (Fayazi, 2012). In fact, sewages polluted the soil and, according to a health report and to Kouadio *et al.* (2012), also water sources. The disposal of non-recyclable materials of the dismantled prefab units also polluted pieces of land in the outskirts of the city. Arguably, the relentless pressure on natural resources through building masonry units (in strategy B) also had an irrecoverable impact on the natural environment (particularly due to the extraction of sand and gravel from the edge of the Poshtrood River in the north of Bam and the production of clay bricks).

Housing and the Built Environment Sub-System

Three indicators are particularly examined here: (1) flexibility and adaptability of uses, (2) appropriate access to community services, including schools, health centers, community centers, mosques and recreational facilities, and (3) appropriate access to infrastructure, including roads, water provision, sewage and electricity. In terms of flexibility, there was an important contrast between strategies B and C and strategy A. The capacity of masonry units (strategy B) and prefab units built on the yard of destroyed houses (strategy C), to be adapted to permanent

secondary living spaces, storage, or parking augmented the useful lifespan of these solutions. Instead, the prefabricated units built in the camps (strategy A) were dismantled in the following years (Fayazi & Lizarralde, 2013).

All strategies address the access to services and infrastructure in a different manner. The camps located in the outskirts of the city (in strategy A) involved some sort of community services –health centers, community centers, prayer rooms, and primary schools. On the other hand, the beneficiaries of the camps located inside the city (strategy A), and the dispersed units (strategies B and C) used the community services that were provided in temporary prefab buildings located besides the destroyed or affected facilities. The residents of the permanent camps –in strategy D– suffered the lack of community services (except a health care center and a prayer room located in the camp).

The camps located in the outskirts of the city (strategies A and D) were provided with new roads and sewage systems at the time of the delivery of housing units. Electricity and running water were provided temporarily (through diesel portable generators and tanks of drinkable water) until connection to public services and network was completed. On the other hand, the residents of temporary units located within the city (in strategies B, C, and partially in strategy A) benefited from traditional water supply systems (water wells and aqueducts) before the reconstruction of the water supply network. In addition, they had access to the electricity network, which was repaired before building the units in strategies B and C.

Housing and Governance

Resilience can be enhanced through institutional empowerment in planning, inter-organizational collaboration, the development of flexible and adaptable structures, and the consolidation of necessary resources (Cutter *et al.*, 2008; Tierney & Bruneau, 2007). We adopted the following indicators in this subsystem: organizational structure, organizational collaboration, and organizational experience and knowledge (Tierney & Bruneau, 2007).

Strategy B was developed by a performing organizational structure within the HFO. The local units of the HFO received the collaboration of eleven auxiliary departments (ad-hoc contributions by other regional offices) that worked under the supervision of a local department in Bam and the national headquarters in Tehran. The integration of auxiliary departments and the local and national departments reinforced the HFO institutional capacities, notably by reinforcing organizational experience, training, and structure. Moreover, the organizational capacities of the HFO were also enhanced through its official responsibility for building permanent houses. In fact, its continuous responsibility from the temporary to the permanent housing phases created a good opportunity to learn from the effects of different temporary housing strategies on the reconstruction program. This experience reinforced the professional experiences, knowledge, and organizational structure of the HFO, and subsequently its institutional resilience. In contrast, the private companies and the organizations deployed by donor countries (notably in strategy D) had a negligible effect on enhancing the capacities of local institutions to respond to disasters flexibly and adaptively.

Housing and Information and Communication

Information may be one of the most important primary resources that enable community members to recover adaptively. By means of communication (where there is opportunity for members to articulate needs, views and attitudes) the community is also able to create common meanings and understandings (Norris *et al.*, 2008). Yet, the different housing strategies in Bam promoted different levels of access to information and communication.

The communities who had access to the formal information resources (such as national or local media) were able to receive timely important announcements from the authorities. Access to reliable information helped the affected families to be consciously aware of the new challenges and opportunities. In fact, the families who had access to reliable information were more able to adapt to the post-disaster challenges than the families who only had access to fictions or

incomplete information. Access to reliable information published by responsible organizations played a critical role on reducing the uncertainties of residents. Indicators show that the native owner families – mostly in strategy B - were constantly informed about the reconstruction plans, the amount of financial aid available (including loans), time tables, involved companies and contractors, and about the process of design and construction of permanent houses. They also enjoyed access to HFO technical support, something that beneficiaries of strategies A, C and D did not have.

Communication among the community of native owners became an important asset. It is important to underscore here that social scientists agree that community recovery depends partly on collectively telling the story of the community's experience and response (Landua *et al.*, 2004). The variables explain that native owners– in strategy B- adapted quickly to post-disaster challenges by sharing their understandings of reality and experiences among their neighbors. In contrast, families living in camps had limited chance to make narrative communication with their unfamiliar neighbors, and thus to adapt to the new challenges. Isolated tenants and immigrant families, according to Farhoudian (2008), suffer strongly from post-traumatic stress disorder and its symptoms (Farhoudian *et al.*, 2006). This argument is supported by our own study. In fact, the tenants who lived among the immigrant families in camps had limited possibilities to make communication with others and thus to reduce their post-traumatic stress disorder.

DISCUSSION

Resilience has been defined in different manners in the literature, with varied emphasis on immediate recovery, redundancy of systems and long-term adaptation to the environment. Norris *et al.* (2008) assume an adaptive-systems approach and underscore the importance of adaptive capacities in the development of community resilience. Despite these important contributions, insufficient knowledge still exists about how the recovery process, particularly the housing process, can enhance community resiliency. In fact, recent studies demonstrate that the assessment of community resilience and the identification of units of measure is still one of the main gaps in the field (Cutter *et al.*, 2013; Howell, 2012)

The variables presented in the PER framework attempt to assess the role of post-disaster housing in the construction of community resiliency. The results show that housing strategies that addressed housing solutions closer to the original affected units (such as the units made of masonry materials and built in the yard of destroyed houses in strategy B) were more successful in enhancing community resilience in Bam. The prefabricated units assembled in the yard of destroyed houses (strategy C) had the second highest capacity to enhance resilience. In contrast, the prefabricated units built in remote camps (notably in strategies A and D) represented the lowest capacity to enhance community resilience.

These results demonstrate that not all low-cost housing strategies influence in the same manner short-term recovery and long-term development. In fact, proximity to the destroyed units plays a fundamental role in the development of social capital and community competence. Information and communication also influence the capacity of the housing program to achieve community resilience. Furthermore, an unequal distribution of resources with unequal advantages for different groups of beneficiaries can exacerbate social differences and thus lead to greater social and economic gaps. Moreover, housing strategies have significant environmental impacts notably through disposal of non-recyclable materials used for temporary solutions and through relentless pressure on natural resources due to exploitation of construction materials. Flexibility and adaptability also play a fundamental role in building resilience, notably by optimizing the use of resources and allowing a smooth transition from temporary solutions to permanent ones. A continuous organizational engagement from the temporary to the permanent housing phases (as seen in strategy B) creates an opportunity to reinforce professional experiences, knowledge, and organizational structures, enhancing in this way institutional resilience. Finally, results also show that low-income immigrants (some would say “opportunistic immigrants”) might cause demographic distortions and logistic difficulties. They certainly create ethical debates regarding

who is a deserving beneficiary of post-disaster housing projects – an issue that still needs further analysis in the literature.

The cause-effect relationships between the characteristics of housing strategies and the development of adaptive capacities cannot be easily demonstrated by this study (it is difficult to distinguish the direction of causality between these variables). However, the study identifies relevant relationships between these variables, which eventually have both practical and theoretical implications. From the practical point of view, the study shades light on the advantages and disadvantages of different housing strategies. From the theoretical point of view, the results not only illustrate the importance of the theoretical framework for the analysis of housing strategies but they also open the door to additional studies that can explore the cause-effect relationships between the different variables.

One of the most important limits of this study is that it is based on data developed by the BRDP project. However, we are confident that the primary – and neutral - role played by the first author in the collection of data guarantees the scientific rigor that validates the results. Most of the data and information was gathered five years after earthquake (between 2008 and 2012). Hence, equal access to different types of inhabitants was difficult. This limitation was partially reduced by the use of data provided by 85 questionnaires that were completed by households.

CONCLUSIONS

This study presents a framework for assessing the impact of post-disaster housing programs on community resilience. By doing so it adopts an adaptive systems approach and examines six dimensions of adaptive capacities identified in the literature (and adopted here as subsystems). The low-cost housing program conducted after the Bam earthquake clarifies how different physical and social aspects impact community adaptive capacities and resiliency. The study finds that the housing process and its final outcome have important effects on resilience by affecting the primarily resources and capacities of the affected community.

Four types of housing strategies were used in Bam, each with different benefit duration, timelines and outcomes. These strategies were all affected by a demographic change that eventually distorted the assessment of needs and thus the scope of the housing program. The inequity and diversity of houses led to increased social and economic differences among beneficiaries and generally decreased the capacity of economic development in the city. The strategy that opted for constructing permanent units in the yard of destroyed houses had a positive relationship with community resilience; this strategy eventually brought opportunities to owners to increase their social capital. This was in part the result of their possibility to settle within their own land and community. This proximity to their community helped them to adapt quickly, sharing their understandings of reality and their experiences. Furthermore, access to reliable information, through closed relationship with responsible local organizations, facilitated their recovery process. This strategy also helped involve the affected families in making decisions collectively and flexibly, and subsequently enhanced community competence. The permanent structures and appropriate location of low-cost units in this strategy permitted flexible and adaptable uses after the temporary housing phase. Also the continuous engagement of the HFO in this strategy (from providing temporary units to developing permanent solutions) created a good opportunity for reinforcing institutional frameworks and structures.

On the other hand, the strategies that relied on construction of camps in the outskirts of the city brought negative consequences to the development of social capacities (notably to the development of collective narratives and meanings and thus psychological recovery) and in environmental impacts. Even though they provided community services and infrastructure, these strategies did not create a smooth transition from temporary solutions to permanent ones.

Architects and other decision makers are responsible for examining the long-term consequences of low-cost housing strategies. As such, they must consider the capacity of the strategy to enhance adaptive capacities that can conduct to long-term resilience. If resilience is to be achieved in post-disaster action, scholars and advocates still need to refine frameworks and

units of assessment of community resilience and to adapt them to the particular context of housing development.

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REFERENCES

- Adger, W Neil. (2000). Social and ecological resilience: are they related? *Progress in human geography*, 24(3), 347-364.
- Adger, W Neil. (Ed.) (2006) *Global environmental change* (Vols. 16).
- Adger, W Neil, Hughes, Terry P, Folke, Carl, Carpenter, Stephen R, & Rockström, Johan. (2005). Social-ecological resilience to coastal disasters. *Science*, 309(5737), 1036-1039.
- Ahmed, Rashid, Seedat, Mohamed, Van Niekerk, Ashley, & Bulbulia, Samed. (2004). Discerning community resilience in disadvantaged communities in the context of violence and injury prevention. *South African Journal of Psychology*, 34(3), 386.
- Alexander, DE. (2013). Resilience and disaster risk reduction: an etymological journey. *Natural Hazards and Earth System Sciences Discussions*, 1, 1257-1284.
- Anderson, Mary B. (1995). Vulnerability to disaster and sustainable development: A general framework for assessing vulnerability. *Disaster Prevention for Sustainable Development: Economic and Policy Issues*. Washington, DC: World Bank, 41-59.
- Amer-Erly, Reyes, & Lizarralde, Gonzalo. (2013). Urban resilience: Short-term recovery and long-term adaptation after floods in Canada. Paper presented at the 6th international i-Rec conference Ascona, Switzerland.
- Aysan, Yasemin, & Oliver, Paul. (1987). *Housing and Culture after Earthquakes: A guide for future policy making on housing in seismic areas*: Oxford polytechnic.
- Barenstein, Jennifer Duyne. (2010). Reconstruction Approaches. In A. K. Jha, J. D. Barenstein, P. M. Phelps, D. Pittet & S. Sena (Eds.), *Safer Homes, Stronger Communities - A Handbook for Reconstructing after Natural Disasters* (pp. 93-107). Washington DC: The International Bank for Reconstruction and Development / The World Bank.
- Bell, Simon, & Morse, Stephen. (2008). *Sustainability indicators: measuring the immeasurable?* : Routledge.
- Blaikie, P Cannon, Cannon, T, Davis, I , & Wisner, B. (1994). *At risk: natural hazards, people's vulnerability, and disasters*. Disaster and society—from hazard assessment to risk reduction, Berlin, 75-82.
- Brooks, Nick, Neil Adger, W, & Mick Kelly, P. (2005). The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Global Environmental Change*, 15(2), 151-163.
- Brown, Barbara B, & Perkins, Douglas D. (1992). *Disruptions in place attachment* Place attachment (pp. 279-304): Springer.
- Bruneau, Michel, Chang, Stephanie E, Eguchi, Ronald T, Lee, George C, O'Rourke, Thomas D, Reinhorn, Andrei M, et al. (2003). A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthquake Spectra*, 19, 733.
- Burton, Ian, Huq, Saleemul, Lim, Bo, Pilifosova, Olga, & Schipper, Emma Lisa. (2002). From impacts assessment to adaptation priorities: the shaping of adaptation policy. *Climate policy*, 2(2), 145-159.

- Coles, Eve, & Buckle, Philip. (2004). Developing community resilience as a foundation for effective disaster recovery. *Australian Journal of Emergency Management*, 19(4), 6-15.
- Cutter, S.L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., *et al.* (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18(4), 598-606.
- Cutter, S.L., Boruff, B.J., & Shirley, W.L. (2003a). Social vulnerability to environmental hazards. *Social Science Quarterly*, 84(2), 242-261.
- Cutter, Susan L (1996). Vulnerability to environmental hazards. *Progress in human geography*, 20, 529-539.
- Cutter, Susan L, Ahearn, Joseph A, Amadei, Bernard, Crawford, Patrick, Eide, Elizabeth A, Galloway, Gerald E, *et al.* (2013). Disaster Resilience: A National Imperative. *Environment: Science and Policy for Sustainable Development*, 55(2), 25-29.
- Cutter, Susan L, Boruff, Bryan J, & Shirley, W Lynn. (2003b). Social vulnerability to environmental hazards*. *Social science quarterly*, 84(2), 242-261.
- Cutter, Susan L, Burton, Christopher G, & Emrich, Christopher T. (2010). Disaster resilience indicators for benchmarking baseline conditions. *Journal of Homeland Security and Emergency Management*, 7(1).
- d'Ercole, R., Thouret, J.C., Dollfus, O., & Asté, J.P. (1994). Les vulnérabilités des sociétés et des espaces urbanisés: concepts, typologie, modes d'analyse. *Revue de géographie alpine*, 82(4), 87-96.
- Davis, Ian. (1977). Emergency shelter. *Disasters*, 1(1), 23-39.
- DHA, UN. (1992). Internationally agreed glossary of basic terms related to disaster management. UN DHA (United Nations Department of Humanitarian Affairs), Geneva.
- Duyne, Jennifer E. (2010). Safer homes, stronger communities: a handbook for reconstructing after natural disasters: World Bank-free PDF.
- Edelstein, Michael R. (1988). Contaminated communities: The social and psychological impacts of residential toxic exposure: Westview Press.
- Fallahi, Alireza. (2005). Architecture for temporary housing after disaster. Tehran: Shahid-Beheshti University
- Fallahi, Allreza. (2007). Lessons learned from the housing reconstruction following the Bam earthquake in Iran. *Australian Journal of Emergency Management*, The, 22(1), 26.
- Farhoudian, A, Sharifi, V, Rahimi Movaghar, Afarin, Mohammadi, Mr, Radgoudarzi, R, Younesian, Masoud, *et al.* (2006). The Prevalence of Posttraumatic Stress Disorder And Its Symptoms Among Ban Earthquake Survivors. *Advances in Cognitive Science*, 8(3), 58-70.
- Fayazi, Mahmood. (2011). Reconstruction projects by using core housing method in Iran: Case study: Gilan Province experience. *International Journal of Disaster Resilience in the Built Environment*, 2(1), 74-85.
- Fayazi, Mahmood. (2012). Temporary Housing Experience after Bam Earthquake 2003. Tehran: Housing Foundation Organization
- Fayazi, Mahmood, & Lizarralde, Gonzalo. (2013). Temporary housing: an obstacle or an opportunity for enhancing community resilience in Bam, Iran Paper presented at the 6th international i-Rec conference Ascona, Switzerland
- Gallopín, Gilberto C. (2006). Linkages between vulnerability, resilience, and adaptive capacity. *Global Environmental Change*, 16(3), 293-303.
- Ganor, M, & Ben-Lavy, Yuli. (2003). Community resilience: Lessons derived from Gilo under fire. *Journal of Jewish Communal Service*, 79(2/3), 105-108.

- Ghafari-Ashtiani, Mohsen, & Hosseini, Mahmood. (2008). Post-Bam earthquake: recovery and reconstruction. *Natural Hazards*, 44(2), 229-241.
- Gharaati, Mehran. (2006). An overview of the reconstruction program after the earthquake of Bam, Iran. Paper presented at the I-Rec 2006 International Conference on Post-Disaster Reconstruction: 'Meeting Stakeholder Interests.
- Hewitt, Kenneth. (1997). *Regions of risk: A geographical introduction to disasters*: Longman London.
- Holling, Crawford S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, 4, 1-23.
- Howell, lee (2012). *Global Risks 2013* (eight ed.). Geneva, Switzerland: World Economic Forum.
- Jha, Abhas K, Barenstein, Jennifer Duyn, Phelps, Priscilla M, Pittet, Daniel, & Sena, Stephen. (2010). *Safer homes, stronger communities. A handbook for reconstruction after natural disasters*. Washington, DC: The World Bank.
- Johnson, Cassidy. (2007). Strategic planning for post-disaster temporary housing. *Disasters*, 31(4), 435-458.
- Johnson, Cassidy, Lizarralde, Gonzalo, & Davidson, Colin. (2006). A systems view of temporary housing projects in post-disaster reconstruction. *Construction Management and Economics*, 24(4), 367-378.
- Kimhi, Shaul, & Shamai, Michal. (2004). Community resilience and the impact of stress: Adult response to Israel's withdrawal from Lebanon. *Journal of Community Psychology*, 32(4), 439-451.
- Klein, Richard JT, Nicholls, Robert J, & Thomalla, Frank. (2003). Resilience to natural hazards: How useful is this concept? *Global Environmental Change Part B: Environmental Hazards*, 5(1), 35-45.
- Kouadio, Isidore K, Aljunid, Syed, Kamigaki, Taro, Hammad, Karen, & Oshitani, Hitoshi. (2012). Infectious diseases following natural disasters: prevention and control measures. *Expert review of anti-infective therapy*, 10(1), 95-104.
- Landua, Jack, & Saul, Judith. (2004). Facilitating family and community resilience in response to major disaster. In F. Walsh & M. McGoldrick (Eds.), *Living beyond loss: Death in the family* (pp. 285). New York: Norton.
- Lizarralde, Gonzalo. (2008). *Architecture, éthique et développement durable afroum*, 13, 16-20.
- Lizarralde, Gonzalo, Davidson, Colin, & Johnson, Cassidy. (2009). *Rebuilding after disasters: From emergency to sustainability*. London: Taylor & Francis.
- Lizarralde, Gonzalo, Johnson, Cassidy, & Davidson, Colin H. (2010). *Rebuilding after disasters: From emergency to sustainability*: Spon Press New York, NY.
- Lopez, Adriana (2013). *Ecobarrio: Modelo de intervencion urbana sostenible aplicado a asentaminetos con influencia de areas industriales* (unpublished PhD Thesis), Universidad Del Valle, Colombia.
- Martin-Breen, Patrick, & Anderies, J Marty. (2011) *Resilience: A Literature Review*. Bellagio Initiative Background Paper), www.bellagioinitiative.org/wp-content/uploads/2011/11/Bellagio-Rockefellerbp.pdf (accessed 15 June 2012).
- Mehta, Barjor E, & Dastur, Arish. (2008). *Approaches to Urban Slums: A Multimedia Sourcebook on Adaptive and Proactive Strategie*: World Bank Publications.
- Norris, Fran H, Stevens, Susan P, Pfefferbaum, Betty, Wyche, Karen F, & Pfefferbaum, Rose L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American journal of community psychology*, 41(1), 127-150.
- Paton, Douglas, Millar, Marian, & Johnston, David. (2001). Community resilience to volcanic hazard consequences. *Natural Hazards*, 24(2), 157-169.
- Pelling, Mark. (2003). *The vulnerability of cities: natural disasters and social resilience*: Earthscan.

- Pfefferbaum, Betty J, Reissman, Dori B, Pfefferbaum, Rose L, Klomp, Richard W, & Gurwitch, Robin H. (2007). Building resilience to mass trauma events.
- Quarantelli, Enrico L. (1995). Patterns of sheltering and housing in US disasters. *Disaster prevention and Management*, 4(3), 43-53.
- Sliwinski, A. (2010). The politics of participation. Involving communities in post-disaster reconstruction. *Rebuilding after disasters: From emergency to sustainability*, 177-192.
- Sonn, Christopher C, & Fisher, Adrian T. (1998). Sense of community: Community resilient responses to oppression and change. *Journal of Community Psychology*, 26(5), 457-472.
- Statistic Center of Iran. (2003). Summary of Bam Statistic. Tehran: Statistic Center of Iran,.
- Thouret, Jean-Claude, & D'Ercole, Robert. (1996).  Vulnérabilité aux risques naturels en milieu urbain : effets, facteurs et réponses sociales.  Cahiers Sciences humaines 32(2), 407-422.
- Tierney, Kathleen, & Bruneau, Michel. (2007). Conceptualizing and measuring resilience: a key to disaster loss reduction, TR news.
- UNDR, Office of the United Nations Disaster Relief (1982). Shelter After Disaster: Guidelines for Assistance: UN.
- Von Bertalanffy, Ludwig. (1973). *Théorie générale des systèmes*: Dunod.
- Warfield, Corina. (2008). The disaster management cycle: UN/ISDR.
- Wisner, Benjamin, & Adams, John. (2002). Environmental health in emergencies and disasters: a practical guide: World Health Organization.
- Yin, Robert K. (2008). Case study research: Design and methods (Vol. 5): Sage Publications, Incorporated.

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