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Owner-driven housing reconstruction as a means of enhancing disaster resilience of at-risk communities in India

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

VOLUME ONE: Dedicated PhD sections

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Declaration

I certify that, except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and ethics procedures and guidelines have been followed.

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Mittul Vahanvati

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This doctoral research is the highest point I have reached to date in my efforts to make an original contribution to the built environment profession in creating both aesthetically pleasing and environmentally sustainable built assets, but also for those assets to be designed and built in an empowering manner. Part of me continues to be drawn towards the rural population in my home country of India, where I had transformative experiences as an architecture student. I cannot thank enough all my professors, lecturers and colleagues at the Centre for Environmental Planning and Technology (CEPT), who shaped me in one way or another during my professional formative years.

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and those working in the government, who have generously shared their experiences with me. These communities' courage and dignity have been my greatest inspiration. I hope that this research can contribute to improvement in future ODHR policies and practices to ensure that their suffering has not been in vain.

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List of abbreviations and acronyms

ACHR	Asian Coalition for Housing Rights
ADA	Area Development Authority
ADB	Asian Development Bank
ADRC	Asian Disaster Reduction Centre
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
ARTIC	Appropriate Reconstruction Training and Information Centre
ASTRA	Application of Science and Technology for Rural Areas
BBB	Build back better
BPMU	Block project management unit
BSDMA	Bihar State Disaster Management Authority
CAPAM	Commonwealth Association for Public Administration and Management
CARE	Cooperative for Assistance and Relief Everywhere
CHCF	Core Humanitarian Competency Framework
CHS	Core Humanitarian Standards Allliance
CRED	Centre for Research on the Epidemiology of Disasters
CSO	Civil society organisation
DAC	Development Assistance Committee
DDMA	District Management Authority
DDR	Donor-driven reconstruction
DMSU	District magistrate Support Unit
DRR	Disaster Risk Reduction
EAA	Evaluation by Emergency Architects
EDM	Earthquake Disaster Mitigation and Research Centre
EM-DAT	Emergency Events Database
GDP	Gross domestic product
GFDRR	Global Facility for Disaster Reduction and Recovery
GoB	Government of Bihar
GoG	Government of Gujarat
GoI	Government of India
GSDMA	Gujarat State Disaster Management Authority
HAP	Humanitarian Accountability Framework
HFA	Hyogo Framework for Action
HFH	Habitat For Humanity
IAP2	International Association for Public Participation
IDNDR	International Decade for Natural Hazard Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
IGNOU	Indira Gandhi National Open University
KSK	Kosi setu kendra
LDC	Low development country
LFA	Logical framework of analysis
NDMA	National Disaster Management Authority
NGO	Non-government organisation
NIDM	National Institute of Disaster Management
NONIE	Network of Networks for Impact Evaluation
OCHA	UN Office of the Coordination of Humanitarian Affairs
ODHR	Owner-driven housing reconstruction

ODR	Owner-driven reconstruction
ODRC	Owner-driven reconstruction collaborative
OECD	Organisation for Economic Co-operation and Development
OFDA	Office of Foreign Disaster Assistance
OHCHR	Office of the High Commissioner for Human Rights
PDR	Post-disaster reconstruction
PhD	Doctor of Philosophy
PM	Project management
PMI	Project Management Institute
PNY	Patanka Navjivan Yogna
PRA	Participatory rural appraisal
PRI	Panchayati Raj Institutions
PwP	PhD-with-publication
RMIT	Royal Melbourne Institute of Technology
RQ	Research question
SDMA	State Disaster Management Authority
SEEDS	Sustainable Environment and Ecological Development Society
SES	Socio-ecological systems
SK	Setu kendra
SPV	Special purpose vehicle
SUPSI	Centre for Development and Cooperation - Water, Sanitation and Hygiene
TRIAMS	Tsunami Recovery Impact Assessment and Monitoring System
UNCRD	United Nations Centre for Regional Development
UNDP	UN Development Programme
UNDRO	UN Disaster Relief Co-ordinator
UN-Habitat	UN Human Settlements Programme
UNISDR	UN International Strategy for Disaster Reduction
UNSW	University of New South Wales
USA	United States of America
V1	Volume 1
V2	Volume 2
WHO	World Health Organisation

Keywords

Disaster resilience

Disaster management

Housing

Project management

Project life-cycle approach

Owner-driven reconstruction

ABSTRACT

A key question facing disaster recovery scholars and practitioners is the mode of reconstruction in post-disaster context so as to trigger adaptability in the construction sector and disaster resilience in residents. Despite significant advancement in theoretical understanding of concepts (disaster, disaster risk, vulnerability and socio-ecological systems (SES) resilience) and approaches to post-disaster recovery (process-driven, multi-stakeholder, cross-disciplinary and an owner-driven housing reconstruction (ODHR)), linking reconstruction to resilience remains problematic. The literature review presented in this PhD with Publication discusses two main hurdles in reconstruction contributing to resilience objectives, as: one, a rather narrow focus on one's field of expertise and two, the lack of research focused on the long-term impacts of ODHR projects. This PhD with publication aims to identify contingent yet generalisable issues and factors, which determine the success or failure of projects in terms of enhancing disaster resilience and long-term developmental needs of the community.

In order to address the identified gap in the ODHR literature, this PhD has deployed a comparative case study research methodology, predominantly using qualitative/interpretative research methods. A mixed methods methodology, including some methods taken from built environment research and others from the social science, has been used. Four ODHR projects were selected from rural parts of India: two are from Gujarat, following the 2001 earthquake, while the other two case studies are from Bihar, after the 2008 Kosi River floods. The case studies in Gujarat allow investigating the long-term outcomes of the ODHR (13 years after the disaster), Bihar allows for the medium-term outcomes (6 years after the disaster). This research has been conducted in two stages and includes 80 in-depth interviews were conducted, including 34 CSO members, professionals and government official, 37 beneficiaries and 9 non-beneficiaries.

The research findings from the four ODHR projects prove that the Indian CSOs have been able to link ODHR projects to long-term disaster resilience impacts in ways that have international significance. The CSO practice – from 2001 to 2008 – had also evolved from being 'facilitators' to 'enablers', seeking to build the capacities of locals from the early stages of reconstruction. These findings suggest that the projects where CSOs ensured: 1) systems based

and strategic envisioning, 2) social mobilisation, 3) proposing minor technical modifications, and 4) sustaining capacity building efforts beyond reconstruction completion or beyond one project life cycle, had the potential to leave a legacy of disaster resilience (self-organising and capable residents). The findings were assimilated in a novel ODHR framework and illustrated in spiral form for use by practitioners, globally. The development of this framework is the most significant outcome of this PhD. However, the author urges practitioners to customise the framework to suit a particular context and to address its systemic challenges, prior to use. The most significant finding of all was a need to enhance people's capabilities – their freedom to choose – to maintain their own disaster resilience.

1. INTRODUCTION

1.1 PERSONAL RESEARCH JOURNEY AND RATIONALE

My interest in the process of design and reconstruction as a catalyst for social change has developed over years of study and practice. My journey in the field of the built environment started with enrolment in a Bachelor of Architecture in 1996 in the Centre for Environmental Planning and Technology, India. During those studies, my home state of Gujarat (from where two of the case studies have been selected) was struck by a massive earthquake in 2001. As an architectural student, I had the opportunity to work as a student assessor, alongside government official and relevant professionals, to categorise houses based on the extent of damage, which in turn decided the funding assistance that each household was eligible for. During these formative years I also had an opportunity to go on an exchange program to Switzerland, where I studied and worked as an intern for six months. The high standard of building and construction there was inspiring. Later, in 2003–04, I worked and lived in one of the most remote tribal communities in northern India as part of a government initiative for enhancing rural sustenance and development. These experiences combined to sow the seed of my passion for participatory design and construction processes for wider social and economic changes.

Since 2004, when I enrolled for a Masters in Sustainable Development at the University of New South Wales (UNSW) in Australia, my interest in the interdependence between human and natural systems has emerged. The concept of eco-literacy (Orr, 2004) informed my master's thesis, *Sustainability principles: Ecology as the basis for the mode of architectural design and practice*. This thesis was a starting point for my personal journey towards evolving a mode of architectural practice which moved away from industrial thinking towards ecological thinking or systems interaction. For about two years between undergraduate and postgraduate studies and for about seven years after completing my Masters, I worked as a university tutor, architectural designer and sustainability consultant, and as a participatory workshop facilitator in India, Switzerland and Australia. Finding ways to use my design skills to inspire others in a collective search for better social outcomes, especially for those living in rural communities within my home country, continues. Along the way I have learnt that housing is not only a fundamental human right, but it can be a focus for imagining and enacting a better future. These experiences have led me to this research project, which now brings together a body of work demonstrating new knowledge in the field of post-disaster reconstruction.

1.2 INTRODUCTION TO RESEARCH

This PhD with publication examines long-term impacts of post-disaster owner-driven housing reconstruction (ODHR) projects in the context of India. The potential for ODHR projects to enhance disaster resilience is examined from a socio-ecological systems (SES) perspective. SES understanding of resilience emphasises the adaptive capacity of a system (housing, communities and other living forms) to cope and to thrive after disaster-related disturbances without losing all pre-existing forms and functions. Primarily, this research focuses on how the process of rebuilding houses and settlements after disasters can become a catalyst for introducing technological adaptations as well as enhancing disaster resilience for long-term developmental needs of the community, in developing countries.

The significance of housing and international efforts for ensuring its safety and access for all human beings is evident in that: housing is part of the Universal Declaration of Human Rights (developed in 1942 after the devastation of World War II); this led to the establishment of a dedicated authority, the UN Human Settlements Programme (UN-Habitat, in 1978) for ensuring sustainable and adequate housing for all; and also the establishment of the UN International Strategy for Disaster Reduction (UNISDR, in 1999) for coordination of disaster reduction efforts in the context of growing numbers of adversities. There has been a recent rise in the complexity, magnitude and frequency of disasters, which threatens the safety of the built environment, housing and its residents. Without durable and robust housing, communities are exposed to weather, to future natural hazards and are impaired from being able restore their livelihood for sustenance or social networking. Thus, reconstruction has a much larger role to play then just rebuilding safer houses, but re-establishing stronger communities. However, the variety of hazard types, specifics of the particular context and diversity of challenges faced by communities imposed by disaster make post-disaster reconstruction complex.

The literature review presented in this volume of the PhD suggests the inter-linked relationship between disaster and development and provides insight into the historical origins of reconstruction, more specifically the ODHR approach since the 1970s. This review suggests the simultaneous advancement in the fields of development and disaster recovery management from: a historic ‘needs approach’ to development or self-help approach in reconstruction; to post World-War II focus on avoiding disruption to on-going development by reducing natural disasters and building safer houses (as a commodity) by top-down approaches (UNISDR,

1994); to 1980s focus on human development (e.g. Sen, 1998) by creating enabling environment and owner-driven approach to housing reconstruction (ODHR) and sustainable development by enhancing socio-ecological resilience (Handmer & Dovers, 1996; Resilience Alliance, 1999). These shifts in the paradigms of reconstruction (from top-down to bottom-up) and in objectives (from a narrow-focus on technical resilience to broader-focus on disaster resilience) were implicit over the last 20 years at the United Nation's International Strategy for Disaster Risk Reduction (UNISDR, 1994, 2005, 2015). Thus, over time, five fields of study have made significant contributions to the practice of reconstruction (specifically to ODHR) for resilience, as follows (see Figure 1.1):

- built environment studies
- development and economic studies
- human geography, sociology and political studies
- socio-ecological studies of resilient systems
- project management studies

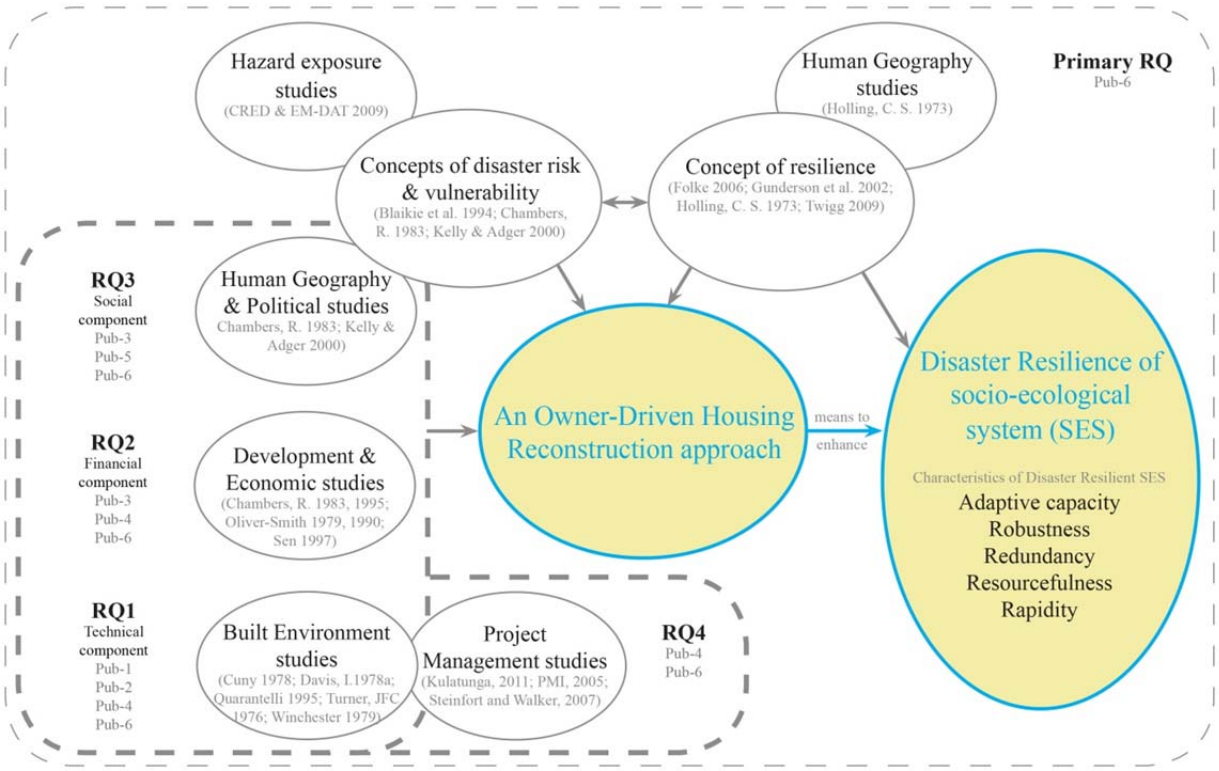


Figure 1.1 Influences on development of ODHR approach as a means of enhancing disaster resilience from a system perspective (source: author)

Figure 1.1 illustrates the influential scholars and the contributions their different fields of study, along with their relationships to the research sub-questions (e.g. RQ1) posed in this PhD

and their respective outcomes or publications (e.g. Pub-1). This review has highlighted two main challenges in reconstruction as:

1. narrow focus on reconstruction based on one's field of expertise
2. lack of research on long-term impacts of reconstruction in terms of resilience

The first hurdle in reconstruction contributing to resilience objectives is a rather narrow focus on one's field of expertise. While this was more the case historically, it continues to pose challenges in current practice and research. For example, the built environment professionals emphasis the need for technical modifications, while the sociologists emphasise community empowerment, and those focussed on development outcomes stress the need to understand linkages of household livelihood to their housing. Over time the built environment professionals have improved their practices after disaster by recommending 'minor' (not major) technical modifications to prevailing construction technologies and techniques (Davis, 1978a; Davis et al., 2015) to ensure that rebuilt houses and settlements are culturally appropriate, not alien to local culture, skills or conditions. These improvement in practice and emergence of ODHR can be credited to some of the pioneers in the built environment profession who emphasised community engagement (self-help approach) and encouraged 'process' over product view (e.g. Cuny, 1978; Davis, 1978a; Turner, 1976). Others have emphasised: the consideration of culturally appropriate technology (Boen & Jigyasu, 2005; Jigyasu, 2010); the role of professionals (e.g. architects and urban designers) in post-disaster reconstruction (Bosher et al., 2007; Haigh & Amaratunga, 2010; Lloyd-Jones et al., 2009); and the relevance of design and ethical responsibility of architects in serving the underserved (Bell, 2003; Bell & Wakeford, 2008; Cuff, 2009; Sinclair & Stohr, 2006). As a subset of built environment studies, researchers from project management (PM) studies have proposed that it can offer tools (such as logical framework analysis), techniques and skills required by civil society organisations (CSOs), to work in a multidisciplinary team and to achieve set goals within specified times and budgets (PMI, 2005). A few scholars and practitioners (e.g. Davidson, 2010; Steinfort, 2017; Steinfort & Walker, 2007) have proposed a modified PM, suitable to deal with the complexities of a disaster context, and breaking down the enormous task of reconstruction projects into achievable sub-tasks through the project's life cycle. On the other hand, human geographers and sociologists have challenged practitioners' shallow understanding of the term 'community' and modes of 'community participation' in a way that has the potential for creating social change and enhancing residents' capacities (Arnstein, 1969; Barenstein, 2012; Ganapati & Ganapati, 2009; Lawther, 2009; Lyons, 2010; Mulligan &

Nadarajah, 2012; Oliver-Smith, 1979; Ophiyandri, 2011; Sliwinski, 2010). Due to the influence of such scholars, not only has community engagement been rethought, but the emphasis in ODHR has also shifted to 'capacity building' within targeted communities. However, this PhD argues that the terms 'community' and 'engagement' are still used loosely in disaster reconstruction and recovery practices. For these reasons, the term 'social mobilisation' is used throughout this PhD as it aligns more with providing community an opportunity to engage actively in (re)building their own lives. At the same time, scholars who have focused on development outcomes have emphasised that disaster and development are inextricably interlinked. Thus, they have emphasised that the surge in the construction sector during reconstruction provides an opportunity for recreating or diversifying livelihood options of the disaster survivors (Chambers, 1983, 1995; Development Alternatives, 2004; Niazi, 2001; Sen, 1997, 2009). While the above three fields of study (built environment, human geography and development) combined have contributed to our understanding of ODHR, the literature review below suggests that reconstruction projects' continue to face the challenge of integrating technical modifications in construction with social mobilisation and empowerment, capacity building and livelihood diversification and good governance, for resilience outcome. Besides, little research on reconstruction has bridged these contributing disciplines.

It was not until the introduction of the concepts such as risk and vulnerability (e.g. Blaikie et al., 1994) and the concept of resilience (e.g. Holling, 1973) that a cross-disciplinary approach began to be highlighted. Cross-disciplinary teams of researchers shattered the myth of disasters being 'natural'; rather, explained it being created by society's interaction with technology and the environment (i.e. disaster risk = hazard x exposure x vulnerability/ capacities). At the same time, the introduction of the influential concept of resilience in disaster management scholarship encouraged an integrated or systems perspective, because people, human environments and natural environments are inevitably interconnected (Holling, 1973). The concept of resilience has largely been informed by the work of ecologists and other natural scientists who followed the lead of the Canadian ecologist Holling (1973) through the international Resilience Alliance (1999) to develop the socio-ecological systems (SES) understanding of resilience. While the concept was borrowed from the field of ecology, its emphasises on interrelationship between humans and ecosystem (socio-ecological system (SES)) and the 'adaptive capacities' of humans for coping with future disasters (Gunderson et al., 2002) has gained traction. However, in the context of post-disaster reconstruction, SES resilience has also been criticised for its all-encompassing nature, which makes

operationalizing a theoretical concept, challenging (Evans & Reid, 2013) or remains open to abuse (Walker & Cooper, 2011). To add to the challenges, scholars predict that in post-disaster context, resilience-related adaptive capacities become evident either during or long after the disaster, which makes it hard to predict with accuracy. Despite such weaknesses, the concept of resilience may have some merits as it succeeds in facilitating cross-disciplinary (technical, economic, social and ecological) research and practice.

This brings us to the second hurdle in post-disaster reconstruction, which is a lack of inter-disciplinary research focused on the long-term impacts of ODHR projects. A recent report by the UN-Habitat (2012, n.p) has concluded that the gaps between emergency relief and development must be addressed, and stated that:

> Piecemeal efforts which are not linked with the long-term development strategy can aggravate the precarious social conditions creating not only dependency on aid, but a critical waste of financial and human resources invested in short-sighted emergency relief plans.

As stated above, the recovery efforts have tendency of tapering off over time, with media and donor attention drifting to other emergency situations. However, since disasters and development are interlinked, it is the poor or low-income group, who could be left in precarious or vulnerable condition than pre-disaster, if recovery efforts are not planned with long-term vision.

There are plenty of documented examples of reconstruction projects where short-sighted investment has been unsuccessful mid- or long-term outcomes. For example, contextually inappropriate transitional shelter provision which lay scattered unused after housing reconstruction (e.g. in Sri Lanka) (Mulligan & Nadarajah, 2012), inappropriate house design (size) without consideration of livelihood activity incorporation or house extension (Barenstein, 2006) or unaffordable resilient technology (Boen & Jigyasu, 2005; Lyons et al., 2010), or introducing radical changes to existing technology or proposing alien technology (Powell, 2011). Re-location without consideration of proximity to livelihood opportunities (Barakat, 2003; Lyons et al., 2010) has meant that households – particularly those of low income – have either abandoned their allocated house and relocated on old/ unsafe sites, or have led to lower quality in construction or reverted back to traditional building practices. Similarly, the premature or poorly planned withdrawal of disaster recovery agencies in Sri

Lanka, post 2004 tsunami has also led to poor social outcomes (Mulligan & Nadarajah, 2012). Furthermore, scholars have also witnessed that the surge in jobs created during reconstruction is typically not sustained, risking the skills in safe construction not getting embedded in the local culture (Niazi, 2001). All of these examples suggest that a short-term focus during reconstruction has retained or even increased people's vulnerabilities to future disasters.

The PhD author acknowledges that there have been some notable examples of research on long-term impacts of post-disaster housing reconstruction projects. These include, the long-term research after the 2004 tsunami in Sri Lanka by O'Brien and Ahmed (2012, p. 316) which indicates that while the agency-built houses had met residents' needs in the short-term (3-4 years), almost 95 percent of them modified their houses in the long-term. Such modifications were possible due to adaptability in house design (form, size, location on site etc.), but were hindered by issues that were beyond residents' control such as poor infrastructure (e.g. sewage, water supply), poor quality of house construction (e.g. low quality timber). Similarly, nine years after tsunami in Tamil Nadu, Barenstein et al. (2014) provide evidence of importance of adaptability in house design because in the longer term residents do need to change to meet their aspirations or changing needs (accommodating extended family or livelihood opportunities). Another recent compendium of research focussed on Asia and Latin America (Schilderman & Parker, 2014) provides evidence that often the dire short-term consequences of reconstruction on relocation sites, were less dramatic in the long term. For example, case studies in Gujarat, 12 years since 2001 earthquake by Barenstein et al. (2014) indicate that such positive long term outcomes were mainly related to provision of large plot size, culturally appropriate and adaptable design (settlement layout and house design). Some proposed disaster-resilient construction technologies did not get replicated in the long term mainly due to lack of government support (legalizing adobe construction for loan purposes) and affordability (e.g. case studies in Guatemala 36 years after 1976 earthquake, by Rhyner, 2014). On the other hand, continued presence of developmentally oriented – rather than humanitarian – civil society organisations (CSOs) is seen as critical for carrying forward the changes put in place during reconstruction (e.g. case studies in El Salvador 12 years since earthquake, by Blanco et al., 2014; and in Indonesia by Meilani et al., 2014). The case studies by Schilderman & Parker (2014) also confirms a need for a common plan for the majority of the affected (rather than bifurcating beneficiaries), while providing tailored housing services to suit individual needs, would be required if the CSOs and governments were to move towards an integrated ODHR. However, these recommendations are based on limited examples of long-term research.

Despite emerging examples of research on long-term impacts of reconstruction, our understanding of holistic (systems based) or integrated approach to reconstruction which can enhance community capacities to maintain their own resilience, remains fairly limited. At the same time, many CSOs have accumulated a wealth of experience and knowledge through practice, but rarely do they have time or money to conduct thorough investigations of the long term outcomes of their interventions. Most of the research on reconstruction is either conducted at, or soon after, the completion of the physical recovery (commonly in the range of two to three years after a disaster), or is based solely on quantitative evaluations or is biased in favour of those who commission the research. This poses the need for an independent research that is not constrained by short time frames or the promotion of particular organisations over others. This PhD demonstrates an urgent need to find more holistic or integrated reconstruction projects to draw lessons from in terms of the right processes that can achieve resilience in the long-term, so as to valuably inform responses to future disasters.

1.3 RESEARCH GAP AND METHOD

The review of literature from the five fields of study (the built environment, development studies, human geography, the SES concept of resilience and project management) and from global and Indian perspectives, suggests there are two key gaps in the research on ODHR practices:

- a lack of long-term research on ODHR projects that identifies the contingent yet generalisable issues and factors which determine the success or failure of projects in enhancing the disaster resilience of at-risk human settlements and communities in India
- disciplinary fragmentation and a lack of cross-disciplinary research on how ODHR projects are conceived, implemented and evaluated

To address the identified research gaps, this PhD has employed a comparative case study research methodology. Multiple ODHR projects in India have been examined long after the disasters and through the lens of disaster resilience. Since India has been at the forefront of ODHR policy and practice internationally, the case studies were selected from there. In selecting case studies, the author has focused on widely acclaimed ODHR projects considered to be best practice in India. Due to the focus of this PhD on the relatively long-term outcomes and impacts of ODHR projects, two of the four cases (projects) were investigated 13 years after

the 2001 Gujarat earthquake and the other two projects 6 years after the 2008 Bihar Kosi River flood. The need to examine the housing reconstruction impact of disaster resilience from an SES perspective has also meant that the assessment needed to incorporate technical, construction codes or design outcomes (hard assets) as well as resident awareness, new construction skills and livelihood options (soft assets). The consideration of both hard and soft assets during housing reconstruction suggests the need for a cross-disciplinary perspective. Such a cross-disciplinary perspective in ODHR practice and research requires stronger inputs from researchers schooled in various academic fields of study. In the past, academic disciplinary boundaries have not served disaster recovery research well and there is a growing need for research that can bridge such disciplinary divides. Hence, this research investigates long-term resilience outcomes in terms of the following:

1. technical impacts: multi-hazard resistant construction technology and robustness of houses
2. social impacts: people's satisfaction and adaptive capacities
3. economic impacts: affordability, equitability, resourcefulness of residents and livelihood diversification
4. project management component: rapidity, strategic thinking and project team

In order to ensure that the PhD would have practical outcomes for practitioners, the author has examined existing concepts and frameworks in disaster resilience and recovery studies. For instance, logical framework analysis (log-frame/LFA) – a tool that is widely used for evaluating development projects – has been used to investigate ODHR projects through all phases of the project life cycle, which includes impacts (unintended outcomes) long after reconstruction completion (CAPAM, 2004; Lizarralde, 2002). By unintended outcomes, the PhD author implies that not every change that occurred in housing or beneficiaries' livelihoods or awareness (capacities) can be attributed directly to reconstruction project, as there may also be external influences. Another framework proposed by IAP2 Australasia (2016), termed the international spectrum of public participation, has also been used to rate the level of participation of residents through the various stages of rebuilding of their own housing.

1.4 RESEARCH QUESTION, AIM AND SUB-QUESTIONS

1.4.1 Primary research question

The primary research question this PhD addresses, based on the identified research gaps, is:

> How can owner-driven housing reconstruction (ODHR) projects enhance disaster resilience of at-risk communities in India?

The relevant publications that address this question are:

- Publication 1: Vahanvati and Beza (2017)
- Publication 2: Vahanvati and Mulligan (2017)
- Publication 3: Vahanvati (2017)
- Publication 4: Vahanvati (2018 under review)

1.4.2 Research aim

Given the researcher's stated interest in making a contribution to post-disaster reconstruction practice, this primary research question gives rise to the following key research aim:

> To propose a strategic framework for ODHR projects which can enhance the disaster resilience of both the reconstructed built environment and at-risk communities in India and beyond

While this PhD focuses on ODHR projects in India, it seeks to offer a practical framework that can inform future projects in India and possibly other settings. This framework intends to be adaptable to varying systemic challenges – different geographical, social, cultural and political contexts and different disaster exposures.

1.4.3 Sub-questions

Due to the breadth of investigation of ODHR and disaster resilience, the ODHR project is divided into more manageable project components. As previously discussed in relation to the various fields of studies, this PhD investigates four components of case study ODHR projects:

1. systems analysis
2. social mobilisation
3. technical modifications
4. capacity building

While each of these components has been discussed separately by a range of scholars (Chambers, 1995; IFRC, 2004; Jha et al., 2010; Kelly & Adger, 2000; UNDRO, 1982, 2010), they have not been discussed in relation to a single framework for ODHR project management. Integration of these four project components reflects the cross-disciplinary focus of this research, combining knowledge from different fields of studies – social sciences, development studies and natural sciences. This is not to deny the importance of built environment practice or research; rather, it argues for a cross-disciplinary dialogue to bring a systems perspective on disaster resilience (Davis, 1978a; IFRC, 2004; Twigg, 2009).

The primary research question is split into four sub-questions in accordance with the abovementioned four project components/discipline areas.

1.4.4 Sub-question 1: Technical component of ODHR projects

This sub-question focuses on the technical components of housing reconstruction and asks:

> What approaches to spatial design or technical support during reconstruction are most likely to enhance the multi-hazard safety of the house over the long term, for ensuring pertinence, quality of construction and effectiveness (cultural adequacy, environmental sustainability, habitability and affordability)?

This sub-question seeks to identify the ways and means by which the project CSOs negotiated technology choices in light of competing demands such as community aspirations (for a 'modern' house) alongside ensuring cultural relevance, sustainability, affordability and multi-hazard resilience. This sub-question seeks to examine whether the proposed technological choices made during reconstruction were sustained long after the CSOs withdrew from the site. The relevant publications that address this sub-question are:

- Publication 2: Vahanvati & Mulligan (2017)
- Publication 4: Vahanvati (2018 under review)

1.4.5 Sub-question 2: Financial component of ODHR projects and capacity building

This sub-question focuses on the financial component of housing reconstruction and asks:

> What mechanisms of housing assistance and capacity building are likely to enhance residents' capacity to access resources (information, finance, materials and skills) to maintain the safety of their houses?

This sub-question seeks to identify the types of financial assistance offered during housing reconstruction, its distribution mechanisms and capacity-building efforts, and how these relate to the future livelihoods or resourcefulness of disaster survivors. The relevant publications that address this sub-question are:

- Publication 1: Vahanvati and Beza (2017)
- Publication 2: Vahanvati and Mulligan (2017)
- Publication 4: Vahanvati (2018 under review)

1.4.6 Sub-question 3: Social component of ODHR projects and mobilisation

This sub-question isolates the social component of housing reconstruction and asks:

> What approaches to community participation during an ODHR project are most likely to enhance residents' engagement, awareness and dignity for maintaining the safety of their houses and settlements in the long term?

This sub-question seeks to understand how the experienced Indian CSOs mobilised community members for effective engagement and how they understood the local meaning of community during PM and the long-term implications in terms of adaptive capacities or enhanced risk awareness. The relevant publications that address this sub-question are:

- Publication 1: Vahanvati and Beza (2017)
- Publication 3: Vahanvati (2017)
- Publication 4: Vahanvati (2018 under review)

1.4.7 Sub-question 4: Project management component of ODHR projects

This sub-question focuses on the PM component of housing reconstruction and asks:

> What project lifecycle management strategy is effective for realising and monitoring ODHR projects in order to enhance long-term disaster resilience?

This sub-question seeks to identify PM strategies which allowed planning, implementing, monitoring and evaluation of projects amid the complexities of a disaster context. Furthermore, the PhD seeks to identify strategies which were successful in going beyond the prevailing one-project life-cycle approach in order to ensure longer term outcomes. The relevant publications that address this sub-question are:

- Publication 2: Vahanvati and Mulligan (2017)
- Publication 4: Vahanvati (2018, under review)

1.5 RESEARCH FINDINGS

The research findings from this PhD demonstrate that a range of CSOs in India have been able to link ODHR projects to long-term disaster resilience impacts in ways that have international significance. The findings confirm that the selected ODHR case studies have improved disaster resilience in housing and settlements, as well as among their residents. The PhD author argues that these best practices are not represented in the prevailing models and frameworks, which either do not consider the life cycle of ODHR projects beyond reconstruction completion or do not have a broader cross-disciplinary focus. Hence, all the findings from the long term investigations are assimilated in a new framework for ODHR projects to enhance the disaster resilience of communities. The development of this framework is the most significant outcome of this PhD. This framework is developed and presented in two publications, Vahanvati and Mulligan (2017) and Vahanvati (2018 under review).

Two of the most significant findings as part of the proposed frameworks are: 1) the need for capacity building beyond reconstruction completion or one project life cycle; and 2) the need for strategic project visioning based on systems analysis to be an integral part of early stages of project planning. The findings suggest that, while technical modifications are an important consideration for enhancing disaster resilience in housing, even more important are social mobilisation, trust building and long-term capacity building. This PhD also argues that, unless the terms and concepts that have emerged from diverse disciplines are used with deeper understanding of their interconnectedness, enhancing disaster resilience may not be feasible. Furthermore, in order to be able to operationalise these concepts, CSOs need to have teams of people from multidisciplinary backgrounds. The proposed framework is original, but it also builds on prevailing frameworks to advance the scholarship on disaster-resilient recovery management. It is argued in the publications as part of this PhD that the proposed framework has practical relevance beyond the rural Indian context where the research has been conducted, however, it needs to be customised to suit a particular context and to address its systemic challenges.

1.6 STRUCTURE OF PHD WITH PUBLICATION

While PhDs with publications have been widely used internationally for a long time, this is still in its emergent stages in Australia, especially in the fields of architecture and social sciences. There is no clearly established format for how the publications should be presented for examination. Moreover, the PhD guidelines are fairly broad in Australia and at RMIT University in particular, as reflected in following excerpts. The University's Thesis Submission Mode policy states that:

> A thesis must be unified and coherent in content and address a significant research question/theme. Theses contain the process, results and analysis of original research and may include publications by candidates based on research undertaken during the course of candidature (RMIT, 2017 17.4).

RMIT University guidelines state that:

> A thesis is essentially an extended proposition that is maintained by argument [and] contributes to knowledge as defined by a specific discipline or disciplines – and in a significant way in the case of a PhD (RMIT, 2016).

While the PhD mode relies on the arguments made in the separate publications, the guidelines state the need to ensure that the thesis is presented in a 'coherent' manner. The format used for presenting this PhD is based on a review of other PhD shown in presentations made by students and staff from other Australian universities. This PhD is divided into two volumes – Volume 1 and Volume 2 – as described below.

Volume 1 (V1) seeks to frame the set of publications and provide a coherent narrative by including the following:

Abstract: briefly discusses the full set of publications

Introduction (Chapter 1): articulates the research gap, research questions, research context and approach, and findings, and an acknowledgement of the research limitations

Literature Review (Chapter 2): establishes understanding of existing research and critiques the subject matter, which this PhD has already integrated in the literature reviews used in the four separate publications

Research Design (Chapter 3): covers the methodology and methods used to address the research question, which is underpinned by the four different publications

Conclusions (Chapter 4): pulls together the key points from the four separate publication conclusions, with a final discussion of the contribution made and suggestions for further research

References: cover the literature reviewed in V1

Appendices: present the list of questions used in semi-structured interviews and the material related to the research ethics approval required by the University submission guidelines

Volume 2 (V2) of the PhD comprises the four most relevant publications that contribute to the findings section in Chapter 4. These publications were written during the PhD candidature, are cited throughout V1 and are here submitted for PhD examination. All the publications in V2 are presented in the format in which they were published (i.e. the page numbering, font size, layout, referencing style etc. are retained), due to copyright restrictions. To provide a link to these publications and for the examiners to easily find relevant papers, a publication declaration form and a summary page precede each publication. The summary page outlines salient features such as the impact factor, why that particular journal/conference was selected, the number of words and the research sub-question that the particular publication addresses. RMIT University and the author request that these publications be treated confidentially and not be made available to the public, except for open-source disclosure. The V2 **Appendix** includes evidence of the peer-review process for each of these publications.

1.7 RESEARCH LIMITATIONS

All research has limitations and it is useful to acknowledge some of these from the outset. The PhD mode of presentation means that, while the key findings have been academically reviewed, these findings are presented in a fragmented way. Each publication has been written with a particular journal audience in mind and the publication guidelines imposed a range of constraints on what or how much could be addressed in each publication. V1 mitigates some of these constraints, but it is also important to allow each publication to stand on its own merits without duplicating the outcomes. Only the papers accepted for publication in reputable journals and books have been selected for inclusion in V2. This means that other research papers, such as the one presented at the International Conference on Building Resilience (held in Newcastle, Australia), have not been included.

While it has become urgent to interrogate the concept of disaster resilience from a cross-

disciplinary perspective, this has imposed limitations on particular aspects of the case study projects. The case studies could have been examined in more detail if the study had been conducted through a particular disciplinary lens e.g. housing typology and adaptation over time. The author's training in architecture has meant that she has had to learn a lot about social science research in the process of the study. However, she was helped in this regard by having one supervisor trained in built environment and another trained in both animal ecology and human geography.

While this project has focused on a time frame that goes beyond the usual construction period allocated for post-disaster recovery research (within three to five years after disaster), it also needs to be acknowledged that the Gujarat case studies worked better with this longer time frame than the Bihar case studies. The benefits of selecting the Bihar case studies are that that government and civil society organisation (CSOs) built on the experiences in Gujarat, but it would be valuable to revisit the Bihar outcomes at some later point.

Last but not the least, the key aim of this PhD is to make valuable contribution to the 'practice' of reconstruction projects (not to policy or governance). Figure 2.11 clearly illustrates the focus of this PhD being at meso- and micro-scale (household and community) at which a project happens (not larger program scale). A focus on such smaller scale and a predominantly qualitative research method with small sample size (of approximately 18-20 people per site) may mean that there might a lot of contextual findings with limited generalizable findings for global use. Having said that, since ODHR policy and practice are interlinked, some background understanding of policy-framework within which each case study projects occurred, have been provided. Moreover, the findings about reconstruction practice may have influence on policy, though that is not the intention of this PhD.

2. LITERATURE REVIEW

This literature review begins by focusing on the significance of housing reconstruction for disaster recovery, tracing the evolution of owner driven housing reconstruction (ODHR) theory and practice since the 1970s to date. The review suggests that ODHR practice remains problematic despite its significant contributions to scholarship due to two main hurdles. One of the major hurdles is a lack of cross-pollination of ideas, concepts and frameworks, which have been introduced by an array of scholars from varied fields of studies and are typically used in ODHR research and practice. For example, an ongoing emphasis on the technical aspects of the built environment has meant that the ideas and concepts emerging from non-built environment scholarship (e.g. resilience, community or development) are potentially adopted by implementing agencies without a deeper understanding. Certainly, the further advancement of ODHR theory and practice requires input from the field of the built environment, as well as other fields of study that the PhD author has identified as:

- development and economic studies
- human geography, sociology and political studies
- socio-ecological studies of resilient systems
- project management studies

A literature review of key concepts and frameworks from the above-mentioned fields of studies is undertaken in order to gain a better understanding of how ODHR projects could provide pathways towards the long term disaster resilience of communities. The concept of resilience is critically examined to understand how a resilience lens during ODHR can potentially carve pathways for better outcomes. Since disaster resilience is typically evident in the long-term after a disruption (i.e. disaster), the need for a long-term research focus is highlighted. Nevertheless, there is limited research that has focused on the long-term impacts of ODHR and this is identified as the second major hurdle in reconstruction practice and research. The critique of existing ODHR subject matter viewed from a resilience perspective, in this chapter, provides a focus (conceptual framework) for research and practical implications of the literature review. This literature review includes references to the author's publications, which are presented in V2 of this PhD.

2.1 HOUSING RECONSTRUCTION

2.1.1 Significance of a house

A house, irrespective of whether it is located in a developing or a developed country, fills a fundamental human need. An adequate house constitutes one of the basic human rights. According to Article 25 of the Universal Declaration of Human Rights:

> Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control (United Nations, 2015, p. 52) .

This definition suggests that a house is intrinsically linked to people's health and wellbeing. A house is thus, "more than four walls and a roof" (OHCHR & UN-Habitat, 2009, p. 3); rather, it is a "a complex asset, with links to livelihoods, health, education, security and social and family stability" (Barakat, 2003, p. 1). By way of example, by providing shelter from the elements, as well as for regular activities such as cleaning and cooking, a house improves its residents' health and wellbeing (Rosowsky, 2011). Empirical evidence in Malawi demonstrated a 44% reduction in diseases among young children living in homes with flooring compared with those living in homes with dirt floors (Wolf et al., 2001 in Habitat For Humanity, 2012b). However, the anthropologist Anthony Oliver-Smith (1990) explains why housing is so complex, stating that, "Human beings sense, interpret, and respond to objective environmental conditions according to their culturally derived perceptions of physical, cultural and social needs and desires" (p. 7). This highlights the fact that the forms houses take – including the use of materials and the spatial organisation of houses in a settlement – reflect their residents' cultural responses to environmental conditions (Barenstein, 2011; Boano & Zettern, 2010; Boen & Jigyasu, 2005). From this perspective, residents turn buildings into cultural expressions – in order to create a sense of space and place for themselves – within their human settlements. Furthermore, in many developing countries such as India and Thailand, residents integrate livelihood activities into their houses, in the form of house-front shops or workshops, storage for livestock or grains, or a home office (Mukherji, 2008; Schilderman & Lyons, 2011). Hence, a home means much more than a shelter for safety, as they reflect its residents' culture, offers their livelihood opportunities and more. To ensure adequate shelter and the development of sustainable human settlement, the UN-Habitat program was established in 1978 and respond

to emerging urban and rural trends. UN-Habitat characterises adequate housing to have: legal security of tenure; availability of services, materials and infrastructure; affordability; habitability; accessibility; location; and cultural adequacy (OHCHR & UN-Habitat, 2009).

2.1.2 Hazards and their disproportionate impacts

It is an internationally accepted fact that hazards are not disasters and disasters are not neutral (see section 2.4.3 for discussion on disasters). Since the 1990s, hazards have steadily increased in frequency, intensity and complexity. Furthermore, hazards have disproportionately affected the people living in developing countries (UNDP, 2013). The low development countries (LDCs) not only face higher hazard exposure but also suffer from higher disaster impacts (deaths, economic loss etc.). For instance, the occurrence of natural and technological disasters has risen from an annual average of 428 to 707 between 1994–1998 and 1999–2003, as shown in Figure 2.1 (red dotted lines) (CRED EM-DAT, 2015). The LDCs had largest rise – a 142% increase (IFRC, 2004, p. 161). With increased hazard exposure, the loss of life of people in LDCs was 300 compared to 44 people in the more developed countries from 1994 to 2003 (IFRC, 2004, p. 164). In addition, as Table 2.1 illustrates (highlighted in red), 95% of all the affected (displaced or evacuated) populations between 1975 and 2011 was concentrated in Asia and Africa (Guha-Sapir et al., 2012). It is expected that by 2100, almost 87% of the world population will be concentrated in the LDCs (UN-DESA Population Division, 2011); such population growth will put the lives of almost 90% of the global population at risk of disasters.

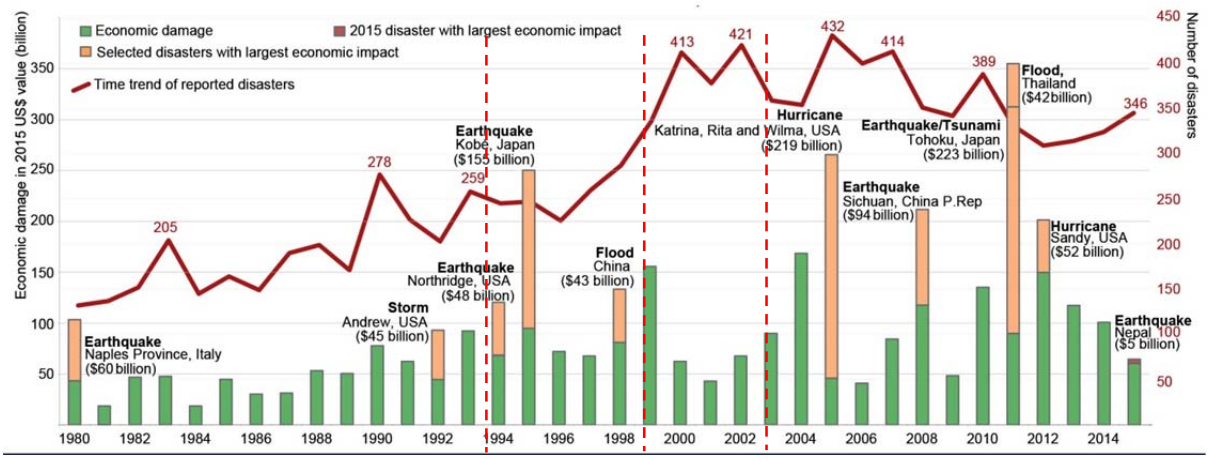


Figure 2.1 Annual reported disaster occurrence and economic damage trend 1980–2015 (source: CRED EM-DAT, 2015)

Table 2.1 Impacts of world natural disasters 1975–2011 (source: EM-DAT: CRED/OFDA International Disaster Database – www.emdat.be – Université Catholique de Louvain, Brussels, Belgium)

Region	*Impact*							
	Occurrence		Killed		Affected		Damage (US$ million)	
	(share in %)		(share in %)		(share in %)		(share in %)	
Africa	2,057	(19.6%)	728,621	(25.5%)	393,800,705	(6.5%)	27,308	(1.2%)
Americas	2,496	(23.8%)	418,484	(14.6%)	210,406,943	(3.5%)	757,763	(33.9%)
Asia	4,041	(38.6%)	1,521,599	(53.3%)	5,402,771,764	(89.0%)	1,086,756	(48.7%)
Europe	1,390	(13.3%)	182,721	(6.4%)	42,065,797	(0.7%)	306,022	(13.7%)
Oceania	489	(4.7%)	5,999	(0.2%)	20,552,254	(0.3%)	55,801	(2.5%)
Total	10,473	(100.0%)	2,857,424	(100.0%)	6,069,597,463	(100.0%)	2,233,649	(100.0%)

2.1.3 Housing vulnerability to hazards

It is widely accepted that hazards alone do not kill people, the collapse of unsafe buildings and infrastructure has a major role to play (Unnati et al., 2012). By way of example, hazards that occur in deserted regions cannot have disastrous effects on people since there are no human settlements for the hazards to interact with. Thus, unsafe housing is identified as the main reason for housing collapse or damage associated fatalities in the event of a disaster, as highlighted by Vahanvati and Beza (2016). Housing damage has increased since 1980s despite reconstruction efforts (see Figure 2.2).

Figure 2.2 Numbers of houses damaged per loss report 1980–2006 in 12 countries most at risk of disaster (source: UNISDR et al., 2009)

Apart from loss of life, housing damage also contributes a major share to the overall economic losses caused by disasters, at both household and national scales (UNISDR et al., 2009). According to World Bank estimates, damage to housing was almost 20 times greater in LDCs than in developed settings (Barakat, 2003, p. 1). This explains why the economic loss due to disasters was almost 11 times greater in the LDCs (IFRC, 2004, p. 164), with Asia and Africa bearing almost 50% of the world economic loss from 1975 to 2011 (see Table 2.1) (Guha-Sapir

et al., 2012). Consequently, disaster-related housing damage threatens to undermine economic development in developing nations by forcing all other development projects to be put on hold until housing and infrastructure is recovered (IRP et al., 2010; UNDP, 2013). Moreover, for low-income groups who have limited savings, house insurance or livelihood alternatives, rebuilding of houses without external support is almost impossible. Consequently, housing vulnerability to disasters threatens to destroy the physical, social, emotional and economic fabric of these residents (ADPC, 2015).

While reducing vulnerabilities in housing – hard/ physical asset – is essential, the diversity of residents' needs, aspirations and the complexity of hazards demonstrate why reconstruction raises many questions about the capacity of households and communities to rebuild after a disaster. This is especially the case if houses are to be rebuilt in a manner that can withstand future hazards and at the same time allow its residents (particularly low-income groups) to maintain them and carve pathways for poverty alleviation of (ASTRA, 2008; Chambers, 1983).

2.1.4 Challenges in post-disaster housing reconstruction

Reconstruction is essentially classified as a development process due to its linkages to economics. The term 'development' became prevalent in 1950s, it was used then to define relationships between different countries (mainly in the context of a country's income level), such as being less developed than the USA. The term is multi-layered; however, it has been used imprecisely in varied contexts, with a general meaning of growth or favourable change (see section 2.4.2 for more on the field of development). However, the term's connotation of positive change lends itself to moving from unsafe to safer conditions through post-disaster reconstruction (PDR).

PDR of houses, however, is a highly complex intervention as it involves a great deal of uncertainty. PDR interventions present a double-edged sword to implementer or civil society organisations (CSOs) (Suarez et al., 2008). As highlighted by Vahanvati and Mulligan (2017), on one hand CSOs need to address survivors' aspirations (for speedy housing recovery and safe houses). On the other hand there is a growing expectation that CSOs will use the reconstruction to address broader issues such as climate change impacts and environmental sustainability (Suarez et al., 2008). Such competing interests, the need for speed as well as sustainability, pose further challenges for CSOs (Lizarralde et al., 2010a; UNCRD, 2003). Moreover external pressures, such as political agendas (which set the tone and sometimes the timeframe for

reconstruction), donor mandates (e.g. quick and efficient use of funding) and the need for multi-stakeholder collaborations, puts added pressure on CSOs (Berke et al., 1993; Davis, 1978a; Lyons et al., 2010; Mulligan & Nadarajah, 2012; Suarez et al., 2008; UN-Habitat, 2012). To add to these challenges, CSOs have only entered the field of development since the 1950s. Moreover, there is a rapid turn-around of staff within CSOs, which hinders any possibility of building on internal knowledge based on past experiences. Consequently, CSOs are challenged by limited experience and internal capacity in the field of development (Sinclair & Stohr, 2006). In recent times, the responsibility for disaster recovery has steadily shifted from – household self-help to CSO-aided to the state-aided – recovery. While the state is considered to be the prime authority responsible for disaster recovery management, it also faces the same double-edged sword as CSOs due to lack of experience and/or capacity. Irrespective of who is responsible for managing post-disaster housing reconstruction, it poses many challenges due to competing interests (speed versus sustainability), multiple pressures (external as well as internal), dwindling resources and increasing disaster risks. While no one has control over the rising number and complexity of hazards, one can ensure that PDR leads to safer housing outcomes, quality in construction skills and enhances people's understanding of disaster risk.

2.2 APPROACHES TO HOUSING RECONSTRUCTION

Reconstruction approaches have evolved over time based on the specifics of a disaster affected area, such as, its social, political and economic context, among others. An understanding of distinction between these approaches is important for the advancement of theory and practice in ODHR, which is complex and rooted in many sub-fields. Scholars (e.g. Jha et al., 2010) have identified and distinguished five reconstruction approaches adopted by state or civil society organisations (CSOs) as:

1. cash approach: financial support given (unconditionally) without technical or social support
2. Owner-driven reconstruction: conditional financial, technical, social and material support provided
3. Community-driven reconstruction: all support similar to ODR is provided but channelled through community organisation
4. Agency-driven reconstruction in-situ: reconstruction done by contractors hired by government, donor or nongovernment agencies, on pre disaster site

5. Agency-driven reconstruction in relocated site: similar to above but reconstruction on a new site

Broadly, the above-mentioned approaches can be categorised into two dominant paradigms, depending on the role of the residents, as described by Vahanvati and Beza (2017) and identified by few researchers (Barakat, 2003; Hunnarshala, 2007; IFRC, 2010; Jha et al., 2010) as:

- **Providing:** donor-driven reconstruction (DDR) or agency-driven; and
- **Enabling:** owner-driven reconstruction (ODR) or bottom-up or aided self-help approach

Since this research is focused on the ODR approach, DDR is only briefly discussed. As discussed by Vahanvati and Beza (2015), in a DDR approach the tasks of planning, designing and constructing houses are handled by professionals or consultants with technical expertise and knowledge, but who may have limited or no community participation experience (Barakat, 2003; Schilderman & Lyons, 2011). The weaknesses evident in the DDR approach outweigh this approach's benefits. The potential weaknesses of a DDR approach include: aid dependence among disaster survivors since houses are gifted as charity (Davis, 1978a); production of alien and culturally inappropriate houses for the specific setting, leading to a loss of ownership and dignity (Ahmed, 2011; Aquilino, 2011; Barenstein, 2006, 2010; Schilderman & Lyons, 2011; Suarez et al., 2008); and, in worst-case situations, undermining of the prospects for social recovery (Mulligan & Nadarajah, 2012). A DDR approach also often involves relocation of disaster survivors to less hazardous locations, but this can make it harder for residents to resume or re-create livelihood options (Barenstein, 2006, 2010; Schilderman & Lyons, 2011, p. 222). In some cases, residents have abandoned their rebuilt houses on relocated sites and returned to old, disaster-prone locations and unsafe construction practices, in order to be close to livelihood opportunities (Ahmed, 2011; Mulligan & Nadarajah, 2012). Consequently, scholars and practitioners (e.g. Jha et al., 2010; Lyons et al., 2010) have concluded that a DDR approach should only be deployed when a disaster-affected community lacks all the required skills or resources (e.g. construction skills, decision-making ability) to participate actively in the reconstruction effort.

2.3 ORIGINS OF OWNER-DRIVEN HOUSING RECONSTRUCTION

Since there is no clear and accepted definition of an owner driven housing reconstruction (ODHR) approach, the author of this PhD defines it informed by various scholars (e.g. Barakat, 2003; Barenstein, 2006, 2015; Jha et al., 2010) as:

> An ODHR is a process in which the residents (including house owners, renters or squatters) who lost their shelter due to hazard or disruption are mobilised (or enabled with informed decision-making power) to act for themselves for rebuilding their houses, through financial, technical, material and social support and enabling policy framework.

An ODHR approach is not new, as its origins can be traced back to the self-help approach to housing known as the "Ayni" (Negron, 2010, p. 314) practiced by communities living in the Andean region of Latin America (Barakat, 2003). Pioneers such as John Turner (1976) – the British architect and development practitioner – had proposed 'self-help housing', which considers housing a verb/process, not a mere product, based on his practice in the squatter settlements of Peru from 1957 to 1965. This approach was promoted especially for low-income households. In self-help housing, Turner was suggesting that residents' coping abilities can be enhanced by driving, if not enacting, the reconstruction of their housing themselves. Turner's emphasis on housing as a verb echoes the incremental nature of the housing of low-income people, who build in phases as their resources allow or circumstances change. It must be noted that Turner (1972, 1976) proposed self-help housing because he had become personally disillusioned with aspects of modern architecture, which, for him, commonly delivered socially oppressive and environmentally insensitive buildings that had lost sight of the values in traditional practices. At the time, he was ridiculed for reducing the role of built environment professionals to that of mere facilitators; however, his enabling approach to housing design and construction later gained wider support. For instance, Davis (1978a) identified self-help housing as the only approach available to low-income groups after a disaster, in the absence of external assistance and Chambers (1983) proposed putting the poor first with an emphasis on self-help. The first comprehensive guidelines on *Shelter after disaster* (UNDRO, 1982, 2010) emphasised citizens as the primary resource during reconstruction.

From its rather shaky beginning as self-help housing for the poor, 20 years later, an owner-driven housing reconstruction (ODHR) approach has become mainstreamed. India (in 2001)

and Bolivia were among the first two countries to adopt ODHR at-scale, as a national policy framework (Barenstein, 2006). ODHR has now become the preferred option as noted by Vahanvati and Beza (2015), evident in its active promotion by a host of international organisations. For example, UN-Habitat and the World Bank promoted ODHR approaches after the 2004 Indian Ocean tsunami and the 2005 Pakistan and 2010 Haiti earthquakes (Davis et al., 2015). In recent history, the development of guidelines for ODHR by the International Federation of Red Cross and Red Crescent Societies (IFRC, 2010) indicates a wide consensus on the merits of the approach.

Despite the embrace of ODHR in international disaster management policies and practices, the approach has its own limitations and advantages (see Jha et al. 2010, p.96). A number of myths surround ODHR's interpretation for on-the-ground practices, such as:

- **misinterpretation of the term 'owner' in ODHR:** ODHR is often associated with ownership of land, implying that only the portion of the population who have legal land tenure are supported by CSOs, leaving some of the poorest people without assistance (Mukherji, 2008; Taheri, 2008)
- **misunderstand 'owner-driven' equal to a 'do-it-yourself' approach:** often owners are used as mere labourers in their own housing reconstruction, without being given much decision-making power (Lizarralde et al., 2010b)
- **perceive to be time consuming:** the implementing organisations often assume that engaging with disaster survivors and asking them what their needs or coping mechanisms are will be time consuming (Jha et al., 2010)
- **perceive as demeaning the role of nation-states and CSOs:** government authorities as well as CSOs tend to think that collaborative decision-making demeans their role and their ability to manage post-disaster recovery work; collaborative practice requires a change in traditional top-down thinking and governance

Due to such misinterpretations, a lot of variations are evident in on-the-ground practice of ODHR. For example, Barenstein (2006) and Barenstein and Iyengar (2010) identified three variations within the ODHR approach, based on their research in the Indian state of Gujarat after the 2001 earthquake as: 1) owner-driven without NGO; 2) owner-driven with NGO top-up; and 3) participatory. Barenstein (2006) verified that resident satisfaction and the ability to maintain disaster resilience in relation to housing are highest in the two latter approaches.

Contrary to such misinterpretations, a number of scholars suggest the following is true for an ODHR approach:

- **the term 'owner'** in the ODHR approach represents the authority or decision-making power of the resident through the entire process of housing reconstruction, irrespective of whether those involved are land owners or not (Barakat, 2003; Barenstein, 2006; Jha et al., 2010).
- **it is among the fastest and most economical approaches**, and also results in robust and culturally appropriate housing, providing relatively high community satisfaction (Barenstein, 2006; Hunnarshala, 2007).
- **the approach demands more from government authorities and CSOs** to be effective enablers (rather than mere aid providers or facilitators) for mobilising communities to regain confident and make informed decisions for themselves (Jha et al., 2010). In this regard, an ODHR approach challenges the top-down or heteronomical relationship between the government or CSOs and the communities and proposes a radical shift towards a more collaborative approach.

Thus, the benefits of ODHR can be summarised as it being faster, cheaper, potentially the most dignified and empowering approach towards reconstruction (Barenstein, 2010; Hunnarshala, 2007; Schilderman & Lyons, 2011), with the potential for the safe technology to get embedded in the local culture, strengthen the social capital and livelihoods of the residents (Hamdi, 2010; Jha et al., 2010). However, the experience of practitioners has prompted questions such as: "How can outside aid be balanced with local self-help?" and "How can the active participation of the affected community be mobilised along with the post-disaster pressure for swift action?" (UNDRO, 1982, 2010, p. 1). Such questions bring us back to the fundamental question posed by Turner at the very outset when he said that it is critically important to investigate the question of "whose participation in whose decisions and whose actions" (Turner, 1976, p. 139–152). Practitioners or researchers who have no background in fields such as sociology, psychology or political studies may think that participation is straightforward. However, on-ground uncritical approaches to community participation can divide and even weaken communities (Mulligan, 2015). Hence, taking an ODHR approach is easier said than done, and it is necessary to understand that ODHR **"by itself does not necessarily lead to a sustainable built environment or to resilient communities"** (Barenstein & Iyengar, 2010, p. 173).

ODHR thus provides a means for recovering housing (safer than pre-disaster) and communities (resilient than pre-disaster), however, to achieve that, the practice needs contributions from various disciplines. The discussion below will demonstrate that ODHR has already absorbed ideas from a range of disciplines and study areas, which may be deployed by CSOs or the state without much appreciation of their strengths and weaknesses.

2.4 THE CONTRIBUTION FROM DIVERSE FIELDS OF STUDY

Table 2.2 presents an illustrative list of key thinkers who have had a direct or indirect influence on articulation of an 'enabling' or ODHR approach. Ideas proposed by these key thinkers were not necessarily absorbed into ODHR practice in the order in which they were first disseminated. However, the table shows that while the practice of reconstruction was rather narrowly framed (i.e. technical aspects, sudden shocks) in its early years, a range of disciplinary backgrounds have contributed to the practices' further development.

Table 2.2 An illustrative list of key events or disciplinary thinkers who have influenced or developed ODHR (source: author)

Author	Year	Key idea and its direct/indirect influence on ODHR
UNESCO	1964 1976	- First and second major inter-governmental conference on "The assessment and mitigation of earthquake risk" - first time, the human, social and economic aspects of earthquake (rapid onset disasters) were considered; not just resistant construction of buildings or seismic zoning; however, there wasn't much cross-disciplinary perspective
C.S. Holling (Ecologist)	1973	- concept of resilience from a socio-ecological system (SES) - human adaptive capacity – a component of resilience
Disaster Emergency Committee (DEC) & the Disaster Unit	1976	- seminar on "Emergency Housing and Shelter" in London - technical focus: on solving emergency shelter needs and advocating for avoiding intermediate housing between temporary and permanent shelter - emerging social focus: on participation of communities was emphasised
John Turner (Architect, development practitioner)	1976	- pioneer of self-help housing (laid roots of ODR), emphasised: o social: people's coping capacities and willingness to act for themselves o technical: housing as process, not product o natural: disasters confined to space and time o economic: livelihood prioritised over housing by low-income people
-	1977	- first International Conference on Disaster Area Housing in Istanbul, Turkey - those from technical field emphasised material and technology selection - those from social science field implied housing as a process, not an end product and need to give *voice* to the survivors
ARTIC	1978	first seminar on sharing agency experiences about disasters and housing provision organised by Appropriate Reconstruction Training and Information Centre (ARTIC) after 1977 cyclone in Andhra Pradesh, India

Ian Davis & Frederick Cuny (Architect, Disaster Risk & recovery management)	1978	Shelter after disaster – first comprehensive guidelines on post-disaster shelter recovery through entire disaster spectrum, which: - linked disaster to vulnerability - emphasised importance of disaster management - recommended participatory process for reconstruction of low-income housing - linked housing – livelihood – development - specified roles for government, agencies and community
Robert Chambers (Development practitioner)	1983	first practitioner to formally introduce 'vulnerability' and 'resilience' (p. 103–113) - put first the priorities of the poor and understanding of poverty - sustainable livelihood approach – layers of resilience - participatory rural appraisal
OCHA	1991	UN Office of the Coordination of Humanitarian Affairs (OCHA) expanded to include response, policy and advocacy
UNISDR, NSET	1994	first world conference on natural disasters in Yokohama, Japan led to International Decade for Natural Hazard Reduction (IDNDR) (1994–2004) - comprehensive approach to disaster management as a continuum from relief through reconstruction and development to prevention - focus on 'natural' disaster reduction
Piers Blaikie, Terry Cannon, Ian Davis & Ben Wisner	1994	- a highly influential multi-disciplinary concept of Risk was proposed through pressure and release model - Risk = hazard x vulnerability; because disasters not 'natural', but created by society's interaction with technology and environment
Anthony Oliver-Smith (Hazard anthropologist)	1996	- vulnerability theory - PDR an opportunity for social change
Resilience Alliance	1999	- advanced the trans-disciplinary understanding and practical application of: o resilience of coupled socio-ecological system (SES) and o adaptive capacity - for transformation of societies and ecosystems in order to cope with change and support human well-being
Amartya Sen (Development)	1981, 1997	- theory of human capabilities and human capital
Sultan Barakat (Architect)	2002	- complex linkages of housing (environmental, technical, financial, social etc.) - different modes of housing reconstruction after disaster/conflict - process of recovery, from plan, implementation to handover
UNISDR	2005	second world conference on disaster reduction, in Kobe, Japan led to formation of Hyogo Framework for Action (2005–2015): - focus on "building a culture for safety and resilience" (priority 3)
Office of the UN Secretary-General's Special Envoy for Tsunami Recovery	2006	- building back better (BBB) - a new kind of recovery - BBB = enhanced resilience = risk reduction - good recovery, which goes beyond mere restoration, setting communities on a better and safer development path and enhanced resilience
Abhas Jha, Jennifer Barenstein, Priscilla Phelps, Daniel Pittet & Stephen Sena	2010	- first comprehensive handbook on safer houses and stronger communities - 5 reconstruction approaches – variations between ODR and DDR - ODR as the most empowering, dignified, sustainable and cost-effective reconstruction approach applicable to house, apartment owners, informal settlers
IFRC	2010	first guidelines on ODHR, emphasising - turning disaster vulnerabilities of settlements into disaster resilience - various scales – household, community and livelihood - institutionalising, contextually tailored program; appropriate technical assistance; mechanisms for financial assistance; participatory process
IFRC, OCHA	2015	- user-built approach became default policy of international agencies for reconstruction for risk reduction (high human resources required)
UNISDR	2015	- third UN conference on DRR in Sendai, Japan led to Sendai Framework for Disaster Risk Reduction (2015–2030) - focus on BBB and disaster risk reduction (DRR)

In Table 2.2, many academic disciplines are clearly defined and delineated; however, there are other ideas that draw on a range of disciplines. In reviewing the origins of ideas that have shaped the field of housing reconstruction and in particular ODHR, the author has identified the following five fields of influences. These are not named as traditional academic disciplines but, rather, as fields of study which draw on diverse disciplines:

1. **technological and built-environment studies** – proposed avoiding transitional shelters, understanding appropriate technology (indigenous materials, skills, labour), spatial understanding of housing and settlements and importance of amenities and social infrastructure
2. **economic and development studies** – proposed that disasters are not neutral and affect low-income people more; human development (capabilities development); addressing residents' livelihood and affordability issues during reconstruction as the process of reconstruction is essentially an economic activity, which can revive local economy (businesses, masons, contractors, builders and transport companies, among others)
3. **human geography, sociology and political studies** – proposed community participation as a house is a reflection of a person's way of living at a household scale and of the political context at a nation-state scale through relationships for safe construction
4. **socio-ecological systems (SES) studies** – proposed the concept to of resilience of SES, appreciation and acceptance of the fact that the very survival of humans and human-built environments or settlements is inextricably linked with that of the ecosystem due to an interconnected relationship
5. **project management studies** – may offer the tools and techniques required to manoeuvre through the complexities of post-disaster housing reconstruction projects

The PhD author acknowledges that it is not possible for any one researcher or practitioner to have a thorough grasp of all the concepts and terms introduced by so many areas of study. However, it is important to acknowledge the sources of key ideas and also to respect the expertise that lies behind the development of such ideas. While there is an urgent need for cross-disciplinary research to integrate ideas from diverse disciplines (which this PhD attempts), it is sometimes necessary to turn to relevant experts for what can be called multidisciplinary research.

2.4.1 Technological and built-environment studies

For some time, post-disaster responses were essentially seen as relief work or charity (Barenstein & Iyengar, 2010; Davis, 1978a) and the suggestion that people should be helped to repair or replace damaged or destroyed housing only entered public discourse after World War II. As a consequence of the massive destruction and losses from World War II, the world saw an increase in condemnation of the crimes of war and hopes for change – to build a new and a better society. Subsequently, the United Nations was formed to ensure the world never again witnessed such war crimes. Immense efforts went into post-war reconstruction to provide housing to soldiers returning from war and survivors in cities that were almost completely ruined.

While post-war reconstruction of houses and infrastructure mostly saw mass production of one single design, the reconstruction programs that followed in the 1970s have informed our current understanding of what constitutes an effective post-disaster housing reconstruction approach. For example, Oliver-Smith (1979) examined reconstruction programs that received external support and attention after the 1970 avalanche and earthquake in Yungay, Peru, while others studied reconstruction efforts following the 1970 earthquake in Turkey (Ganapati & Ganapati, 2009; Schilderman & Lyons, 2011), the 1976 earthquake in Guatemala and Mexico (Davis, 1978a) and the 1977 cyclone in Andhra Pradesh, India (Winchester, 1979). All these studies highlighted the importance of understanding pre-disaster vulnerabilities – in terms of physical/ technical (hard assets) as well as social vulnerabilities (soft assets).

Addressing physical or technical weakness in houses were the main focus of housing reconstruction in earlier days (Davis, 1978a, 1978b; Unnati et al., 2012). Physical vulnerabilities in houses include, “choice of location, construction practices and the use of technology” (McEntire, 2012, p. 210). In order to address these physical vulnerabilities, some agencies were donating fully built houses (agency-driven or donor-driven) or equivalent financial aid (cash approach) in a continuation of the charity approach (Davis, 1978b). ‘Major technical modifications’ were emphasised due to a technical focus, which included relocation to a safer location, replacing traditional technology with more modern/industrial technologies and designing robust houses without cultural, environmental or affordability considerations (Aquilino, 2011; Boano & Zettern, 2010; Boen & Jigyasu, 2005; Robinson, 2011; UNDP & Hunnarshala, 2006).

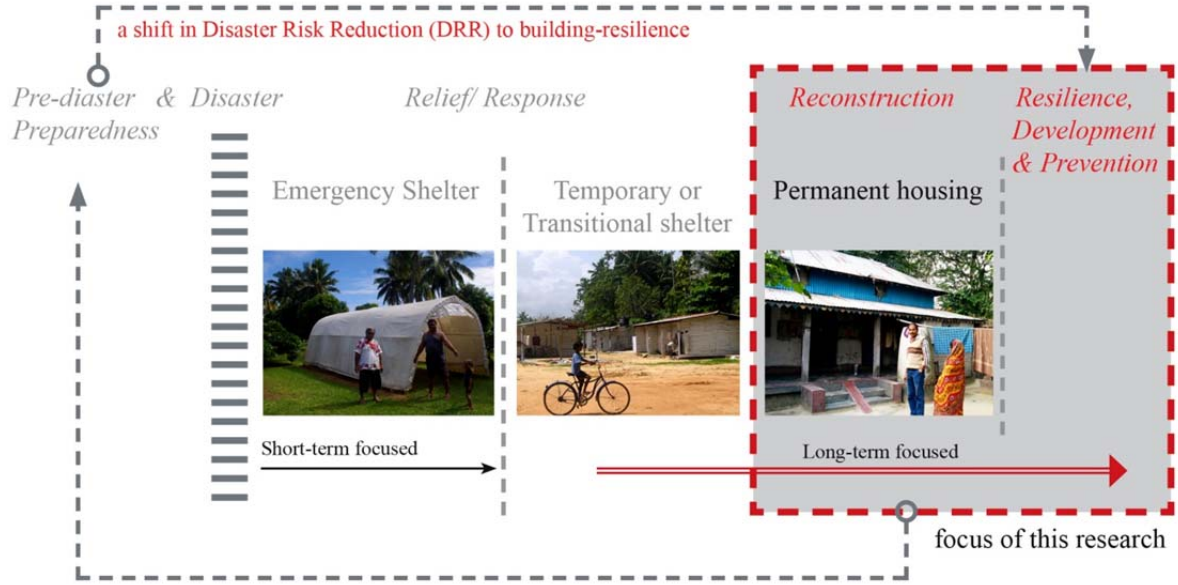


Figure 2.3 Three housing types after a disaster: left – family tent in the Cook Islands (photo Ifte Ahmed); middle – transitional shelter in Sri Lanka (source: Ifte Ahmed); right – permanent house in Bihar (source: author)

Often two types of shelters were provided prior to reconstruction of permanent houses. As illustrated in Figure 2.3, these three shelter types were often provided sequentially. The emergency shelter included tents or tarpaulins, which were distributed to the survivors within weeks after a disaster, followed by temporary shelters, since tents do not last longer than a year (Davis, 1978a). Due to the presumed short-term purpose of the temporary shelters, they were not designed for climate, culture or hazard safety. However, typically people end up staying in them for much longer than expected (e.g.over 2 years of stay in temporary shelter- trailers after the 1992 Hurrican Andrew in Florida, by Patel & Hastak, 2013). Scholars (such as Davis, 1978a; Quarantelli, 1995) quickly recognised the drawbacks of providing three different shelter types, which include waste of scarce resources (financial and human) and consequent socio-psychological trauma for the survivors. For example, as shown in Figure 2.3, the waste of resources is evident in the vacant and unused temporary shelters that are scattered across Sri Lanka since the 2004 tsunami (Ahmed, 2011; Aquilino, 2011). Moreover, multiple relocations prior to the beginning of permanent housing reconstruction caused increased grief, lack of confidence and increased vulnerability among the survivors (Barenstein, 2006, 2010; Collins, 2005; Mulligan & Nadarajah, 2012; UNDP, 2009) (see section 2.4.2 for further discussion on relocation). Consequently, the German architect Otto Koenigsberg, based on his experience in Asia, Africa and Latin America, urged that, “relief is the enemy of recovery” (Davis, 2011, p. 194). This is especially true for low-income communities living in developing countries, as their normal housing standard may be deemed temporary from a Western society’s perspective.

Thus, a broad consensus has emerged internationally, among scholars and practitioners on avoiding the provision of temporary shelters in favour of early permanent housing reconstruction (Berkes et al., 1998; Davis, 1978a; Quarantelli, 1995; UNDRO, 1982, 2010).

While it may be desirable to avoid temporary shelters, it is not always possible to do so. In rare exceptions – such as a lack of time before the approach of harsh weather or when the government require extended periods of time for sorting out town-planning and land-use issues – temporary housing may be necessary (Schilderman & Lyons, 2011). At times, not providing temporary shelter could also encourage haste in the reconstruction of permanent housing (Mulligan & Nadarajah, 2012). Research suggests that at times, even now, permanent housing reconstruction does not begin until nine months to two years after the disaster (Davis, 1978a; Jha et al., 2010). Unfortunately there is no simple recipe for housing provision after disasters.

It is necessary to draw a distinction between the terms 'shelter' and 'house', which in the context of disasters are often used interchangeably or in a variety of unclear ways. For the purpose of clarity in this PhD, since the focus is on permanent housing, shelter is primarily associated with temporary accommodation and house with a permanent habitable space for people to live in (Quarantelli, 1995).

To address the challenges associated with diverse house designs and three shelter types, one innovative solution – a core shelter or transitional shelter – was proposed and implemented by the UNHCR in Aceh and Sri Lanka after the 2004 Indian Ocean tsunami (Collins, 2005; Kennedy et al., 2007). A 'core shelter' is a partial permanent house. Its design includes one or two rooms and all basic services (kitchen, bathroom and toilet) and allows its residents to extend over time. Transitional shelters were later implemented in Pakistani Kashmir after the 2005 earthquake by Habitat For Humanity (Habitat For Humanity, 2012a). While the core shelter was already in use by a few CSOs, it has only been used by international agencies since 2004. For example, core housing was implemented in Orissa by CARE India after the 1999 supercyclone (Development Alternatives & Luethi, 2001a; Development Alternatives & Niazi, 2001b) and in Marmara, Turkey after the 1999 earthquake. The core housing method for building a house which can be incrementally extended echoes Turner's contention of housing as a verb (Boano & Zettern, 2010; Davis, 1978a, 2011). Moreover, in a disaster context financial limitations and time restrictions often hinder the (re)building of an entire house. Subsequently, a core house allows agencies to reach maximum number of survivors within

limited resources. However, some CSOs have used the concept of the core shelter to design a single unit of optimum size and to build multiples of these same units for affected families, on the grounds of equity, ease of design approval, ease of construction management and ease of delivering skills training for livelihood development (Lizarralde et al., 2010b). Thus, while core shelter may resolve the challenge of the three housing types, it is neither a panacea for solving the housing problem nor a licence to rebuild inappropriate, unsafe or pre-disaster standard of housing in haste.

In regard to construction technology, housing typology and settlement layout, the literature is replete with examples of inappropriate interventions which focused on 'major technical modifications'. For example, after the 1993 earthquake in the Indian state of Latur, a climatically inappropriate concrete pre-fabricated house was proposed, replacing the traditional stone construction in a hot and arid rural region (Desai & Desai, 2011). This alien and culturally insensitive house design, without an internal courtyard, left women feeling exposed and "at risk, in a society that demanded discretion" (Desai & Desai, 2011, p. 85). In addition, these houses were organised in a city-like grid pattern with wide streets which replaced the narrow streets and cluster-organised houses of traditional settlements, leaving little or no community space (Boen & Jigyasu, 2005). Essentially, architects and built-environment professionals have long experimented on disaster survivors with their innovative ideas (Sinclair & Stohr, 2006). The problems created by such innovations appear to go unnoticed and at worst are repeated. Similar experiments were observed in housing reconstruction in Sri Lanka after the 2004 tsunami. Once again, there was complete disregard for the traditional housing typology (modified from single-storey to multi-storey housing), settlement layout (new housing blocks were compactly organised along a grid pattern unlike the traditional layout) and housing design (with culturally inappropriate location of the kitchen inside the house, rather than outside) (Aquilino, 2011; Mulligan & Nadarajah, 2012). Moreover, on the Indian side of the post 2004 tsunami reconstruction, the lack of communal space for collective weaving of fishing nets and the removal of existing trees to make space for development have had serious mental and psychological health implications for the fishermen, the women and even the children, who are housebound due to lack of space to play outside (Barenstein, 2011).

While desperate and traumatised survivors were initially (3-5 years since disaster) impressed by the high standard of construction technologies (Jigyasu, 2010) and alien housing designs (Boano & Zettern, 2010), their new houses have made their life more difficult in the mid-term

(Mulligan & Nadarajah 2012). Researchers suggest that many people have abandoned their culturally insensitive rebuilt houses and returned to hazardous locations or reverted to unsafe building practices or technologies (Ahmed, 2011; Aquilino, 2011; Barenstein, 2006, 2010; Schilderman & Lyons, 2011; Suarez et al., 2008). Furthermore, scholars have suggested that such culturally insensitive houses and settlements can lead to an erosion of people's sense of community and leave them worse off in regards to their physical, social and emotional needs (Boano & Zettern, 2010; Mulligan & Nadarajah, 2012). Such 'major technical modifications' are the opposite to aims of building adaptive capacity and community resilience.

Consequently, Davis et al. (2015) have concluded that 'major' technical modifications and replacement strategies have proven insufficient to reduce the disaster risk of survivors. Addressing the physical vulnerabilities alone has also proven insufficient to enhance the disaster resilience of housing and its residents. There is an emerging understanding that people's access to livelihoods (or limits to it) is an underlying cause of their housing vulnerability (Chambers, 1983; Development Alternatives, 2004; Sen, 1981). Focusing on ensuring access to livelihoods by disaster survivors is not a normal approach to economic development but, rather, a development studies approach.

2.4.2 Development and economic studies

A number of scholars have established that housing and their resident's livelihoods are interlinked (Chambers, 1995; Development Alternatives, 2004; Niazi, 2001). While a house is potentially the most expensive assets possessed by residents globally; disaster-related damage or destruction of a house and associated livelihood (e.g. stored grains, workshop space, fodder and/or tools) implies economic loss for its residents. Chambers and Conway (1992), based on their research among the rural poor in Kenya, affirmed that people with low incomes are more vulnerable to disasters due to multiple inter-related deprivations, such as: economic poverty, physical weakness, spatial isolation and political powerlessness. Such deprivations cause a 'ratchet effect' making the poor even poorer. Such deprivations were arguably linked to people's livelihoods. It is now broadly accepted that economic vulnerabilities may be the cause of why the houses have been damaged or destroyed from hazard. Thus, disasters can disrupt economic development at scales ranging from the household to the national, and at the same time, post-disaster reconstruction (PDR) and recovery processes can potentially induce forms of development, as noted by the UNDP (2001, p. 1):

> the period when relief is provided but recovery is yet to begin … not only determines

> whether people attain recovery or rebuild risk, but also determines whether the process of recovery leads to sustainable development or hastens a downward spiral of development and livelihoods.

As highlighted in the statement by the UNDP, post-disaster period is linked with people's recovery (housing and livelihood) as well as their on-going development. However, it is not clear how reconstruction can provide means to achieving these objectives. This requires unpacking of the term development in the context of disasters.

The field of development studies has evolved significantly from a historic 'basic needs approach' or a self-help approach to post World-War II (1940-80s) 'development theory', imposed upon the world by the Western society (e.g. the United States), who wanted to claim supremacy over the world and hence identified the Southern hemisphere as 'underdeveloped'. The practice and concept of development, focused on economic and political gains, was essentially "an outcome of the post-war era of fossil-fuel-based triumphalism, undergirded by colonial perceptions and the legacy of Western rationalism" (Sachs, 2010, p. xii). Mahatma Gandhi had sensed the dead-end of development, evident in his text written in 1926 (Sachs, 2010, p. xiv):

> God forbid that India should ever take to industrialisation after the manner of the West. The economic imperialism of a single tiny island kingdom (England) is today keeping the world in chains. If an entire nation of 300 million took to similar economic exploitation, it would strip the world bare like locusts.

This statement has not lost its relevance to date, as, India, like many other colonial countries from the southern hemisphere, have surely taken inspiration from the West.

The late 1990s saw an emergence of a 'post-development age', in order to counter the existing theory of development and a desire for human well-being based on community and culture, rather than economic growth. The post-development age saw two major streams – one, green transition – from economies based on fossil-fuels to those based on biodiversity or limits of growth (e.g. sustainable development – Brundtland Report, 1987) and – two, revival of a bottom-up or people-centred development – based on the conviction that human well-being can be attained by many sources beyond monetary means (e.g. Schumacher, 1993). This second stream of thought has given birth to the 'human development' approach, by economists Nobel

Laureate Amartya Sen (1981) and Mahboub Ul Haq (Schumacher, 1993). Prioritizing human development in contrast to traditional economic development has become a guiding principle in international development (UNDP, 2010), in an effort to enable humans to imagine a better future and carve their own pathway for achieving it. The human development concept, was introduced in 1990s and is defined by the United Nations Development Program (UNDP, 2010) as:

> Human Development aims to expand people's freedoms – the worthwhile capabilities people value – and to empower people to engage actively in development processes, on a shared planet. People are both the beneficiaries and the agents of long term, equitable human development, both as individuals and as groups. Hence Human Development is development *by* the people *of* the people and *for* the people. (p.40)

As the definition suggests, people (engaged and empowered) and their capabilities (freedom to choose) are important considerations for human development. Human development was anchored in the concept of capabilities proposed by Sen (1985).

Through the concept of capabilities (freedom to choose), Sen (1985) argued that the freedoms enjoyed by people are a greater determinant of human development than capital possession (physical commodities, social, financial or human capital such as skills and knowledge). Such freedoms were classified by Sen (2006) into five categories: economic empowerment; political freedom; social opportunities; protective security; and transparency.

As shown in Figure 2.4, Sen uses the term 'capability' to identify people's valued activities and their ability to choose to perform those activities and to live the life they value. Thus, the totality of all alternative functioning the person can 'choose' from, given by contingent circumstances, reflects the person's capabilities (Sen, 1985). In this regards,

> Commodity command is a *means* to the end of well-being, but can scarcely be the end itself (p.28).

Sen considered house and livelihood, among others, as the subsets of capability, which refers to proactive and dynamic adaptation of livelihood opportunities to respond to adverse changes.

By way of example, rebuilding of a house or its possession (as a commodity) may give its residents access to its characteristics (such as shelter, protection of family, social meeting,

social status, means of livelihood and so on). However, these characteristics neither necessarily increase the resident's resilience, nor say what the household will be able to do with those properties (i.e. functioning). This is because functioning depends on resident's personal, social and contextual needs. For example, if a person is disabled, he or she may need a specific type of house, and the nature of social or cultural conventions may demand house design suitable to a particular context, and livelihood means may determine people's house location requirements. Thus, mere provision or rebuilding of a house may not cater to household's well-being, but capabilities (freedom to choose) can.

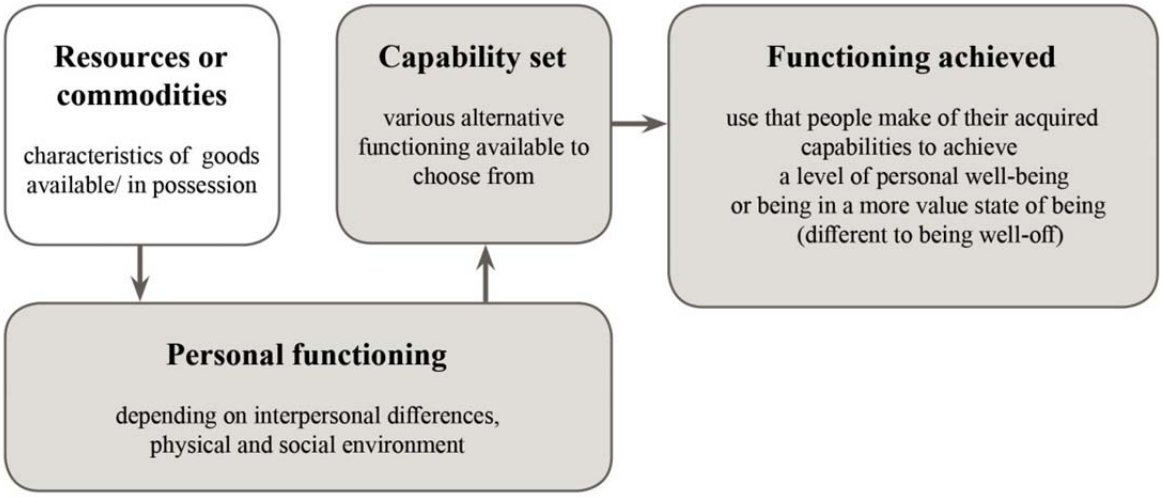


Figure 2.4: Outline of core relationships in the Capabilities Approach (source: author, adapted from Wells, u.d.)

While an owner-driven housing reconstruction (ODHR) after disaster emphasises household empowerment, their capabilities are not that widely discussed. For example, during post-disaster reconstruction (PDR), survivors may have to choose between the binaries – to relocate for disaster resilience or to stay in-situ for proximity to livelihood; to choose between affordable construction technology or alien technology and so on. On one hand, there is danger in residents' (especially low-income group) with freedom to choose making short-sighted decisions (e.g. living in unsafe sites) based on their needs for daily sustenance and proximity to livelihood opportunities, rather than the safety from future disaster. On the other hand, the consequences of not giving residents a choice (such as in donor-driven approach) has proven to be dire. For example, in the Indian state of Gujarat after the 2001 earthquake, the residents of the settlements of Adhoi and Vondh were relocated to about three kilometres inland from their previous settlement. The residents never accepted the relocated settlement because of its lack of proximity to livelihood means. More than a decade later, the relocated settlements remain uninhabited and its residents have relocated to old unsafe sites and construction practices

(Sanderson et al., 2012). Similarly, after the 2004 tsunami in Sri Lanka, the government's initial decision to impose a blanket ban on housing reconstruction along the coastline, without resident inputs, created widespread anxiety. Such lack of choice and a top-down approach made life very hard for the fishing communities, whose livelihoods relied on the fishing industry, until the government realised the error (Mulligan & Nadarajah, 2012; Schilderman & Lyons, 2011). Other studies (e.g. Mulligan & Nadarajah, 2012; Schilderman & Lyons, 2011) have confirmed that relocation (when imposed) makes it hard for low-income people to sustain their livelihoods, especially for subsistence-based livelihoods such as fishing and agriculture. Joel Audefroy (2010, p. 666) argues that such relocations have led to social upheavals and burdens faced by communities: "overcrowding" related to shortage of safe land; "uprooting" from land of symbolic value (or collective memory of the community); and "uncertainty" in terms of livelihoods. Relocation is obviously a form of major modification to pre-disaster settlement location, but it is also associated with land value; which are sadly prioritised by the state over people's wishes or consideration of alternative livelihood skills. Thus, ensuring some freedom of choice of residents, amid the complexity of a post-disaster context, could have potential to support physical comfort, social cohesion and economic sustenance.

Reconstruction processes which enhanced (intentionally or unintentionally) the choices available to the local residents, have shown positive outcomes. For example, following the 1970 avalanche in Yungay, Peru, the anthropologist Anthony Oliver-Smith (1979, 1996) noted that housing reconstruction activities (e.g. training in new skills) and surge in employment opportunities provided the local Indians and *mestizos* (those of low status) with a choice between working for low-paying labour jobs offered by rich townspeople or high-paying reconstruction work. This ability to choose provided by post-disaster reconstruction (PDR) activities consequently disrupted the social power structure, although it was short-lived. While skills-training has typically been promoted during reconstruction for diversifying disaster survivors' livelihood choices, the challenge lies in linking those newly acquired skills with sustained employment opportunities. Thus, PDR can instigate its resident's capabilities (freedom to choose), however, sustaining capabilities, has proven to be challenging.

To reiterate, the development sector has evolved beyond a narrow focus on economic growth to human well-being or human development. Sen's work on capabilities provides a rich understanding of human development. However, in a post-disaster reconstruction context, providing such freedom of choices for house design, material selection, construction

technology selection, labour selection, house location and so on is filled with challenges for disaster survivors as well as CSOs. Furthermore, sustaining such freedoms (e.g. social or economic changes) instigated during reconstruction has been challenging. While the concept of capabilities has emphasised the socio-cultural and livelihood resources, it has underemphasised geography and ecology (see section 2.4.4 for discussion on the socio-ecological systems (SES) approach to disaster resilience, which integrates these concepts). The PhD author argues that resident's freedom of choice without enabling mechanisms can hardly lead to disaster resilience outcomes for broader human development because the deep-rooted social vulnerabilities are often the very reason behind the disaster risk of housing and its residents. In order to develop a deeper understanding of social and cultural vulnerabilities, which are less visible than physical or livelihood options, we need to turn attention to the field of study which can be broadly be labelled as human geography.

2.4.3 Human geography, sociology and political studies

Our current understanding of disaster risk as a product of interaction between natural hazards and social vulnerabilities (soft assets) has emerged from the synthesis of what can be called as natural science and human geography studies (see Figure 1.1).

Our understanding of disasters have evolved from reactive focus (understanding effects of disasters, being perceived as 'acts of God') to proactive focus (understanding cause and effect, because disasters are not neutral and affects some people and communities more than others) (Davis, 1978a). Traditional fatalistic thinking was evident in early research on disasters published in medical and philosophical journals (Blasius, 1877; Caldwell, 1896; Milne, 1899; Watson, 1883). While the medical articles were concerned with ways of dealing with the medical issues in the aftermath of a disaster, the philosophical articles considered storms as "erroneous meteorological" or "terrible" events and were interested in understanding the true nature of a hazard (Blasius, 1877, p. 215). Since the 1970s, the focus has shifted to understanding the causes and effects of disasters. On one hand there is an emphasis on collecting hard scientific data for understanding the causes of disaster; and on the other hand bringing up deep-rooted vulnerabilities (hard/physical and soft/social assets).

In 1988, the Emergency Events Database (EM-DAT) was created by the Centre for Research on the Epidemiology of Disasters (CRED EM-DAT, 2009a) in an effort to create an accurate database of disasters globally. By the 1990s, the criteria for entering a disaster in this database

were developed as, “10 or more people reported killed; and/or 100 or more people reported affected; and/or declaration of a state of emergency; and/or call for international assistance” (Guha-Sapir et al., 2012, p. 7). This database collects data about the type of disaster, the speed of onset, magnitude, duration and frequency (CRED EM-DAT, 2009a). Moreover, it groups disasters into three categories: natural, technological (industrial and transport accidents) and social (war). The natural disasters are further categorised into five sub-groups (CRED EM-DAT, 2009c):

- geophysical (originating from solid earth, like earthquakes, volcanoes)
- meteorological (caused by short-term/meso-scale atmospheric processes, like storms)
- hydrological (caused by water, like floods)
- climatological (caused by long-term/macro-scale processes, like climate variability)
- biological (caused by exposure to germs and toxic substances, like epidemics)

While such categorisation and database is useful; it is mainly hard science, which tells only half of the story. Such an initial focus on hard science alone, which considered disasters ‘natural’ and people as victims rather than one of the contributing factors to disaster causation, was evident in the first UN international conference on natural hazard reduction (UNISDR, 1994). While a disaster was not defined then, its current definition as per UNISDR (2009, p. 9) is:

> a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

The concept of vulnerability (of soft and hard assets) is implied in this definition and understood as the limits or thresholds within which individuals, groups or communities can cope with disaster impacts (Lizarralde et al., 2010b). The introduction of the concept of vulnerability has enabled researchers to point out that vulnerability is a greater determinant of disaster than the hazard event in itself (Brown et al., 2006; McEntire, 2012; Wisner et al., 2003). Vulnerability is defined by Blaikie et al. (1994, p. 4) as:

> the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.

This definition highlights the deep-rooted social vulnerabilities (soft assets) may influence people's abilities to cope with or recover after a disaster.

Social vulnerabilities include social status, cultural beliefs that favour some people over others, largely hidden tensions or divisions within communities, aspirations to display wealth by means of housing, lack of awareness about safe technologies and risk exposure (McEntire et al., 2010; Schilderman & Lyons, 2011). Accordingly, those who have financial means or resources necessary for building safe houses may not necessarily do so due to their social limitations (e.g. cultural beliefs). To this, Oliver-Smith (1996, p. 314) had added that vulnerabilities are often deep-rooted in communities which have experienced "colonialism and underdevelopment". Many scholars have argued that post disaster reconstruction (PDR) is inevitably entangled with considerations for reducing social vulnerabilities, creating social change and enhancing residents' capabilities (Arnstein, 1969; Barenstein, 2012; Ganapati & Ganapati, 2009; Lyons, 2010). Hence, as the definition of disaster broadened from being natural to being socially and economically rooted, the task of addressing it became more complex, and it cannot be solved merely by technology transfer. For these reasons, participatory forms of ODHR have been promoted, as such processes may bring many hidden vulnerabilities to the surface.

The introduction of the concept of risk, which amalgamated views emanating from different sources on natural, economic, social and political causation of disaster, has progressed our understanding of disaster. Piers Blaikie et al. (1994) proposed a pressure and release model (PAR) in which risk is created due to the interaction between the hazard and the vulnerability of the exposed unit; that is, *Risk = Hazard x Vulnerability (R = H * V)* (see Figure 2.5).

As shown in Figure 2.5, the PAR model has managed to generate a broad consensus about disasters not being natural but constructed through interaction between the human system and the natural system (Oliver-Smith, 1990, 1996). Disaster risk is thus defined by UNISDR (2009, p. 9-10) as:

> The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.

This definition highlights that unlike disaster, risk is continuously prevalent. Nevertheless,

disaster risk can be assessed, in broad terms, by the knowledge of the prevailing hazards, the population and socio-economic patterns of development.

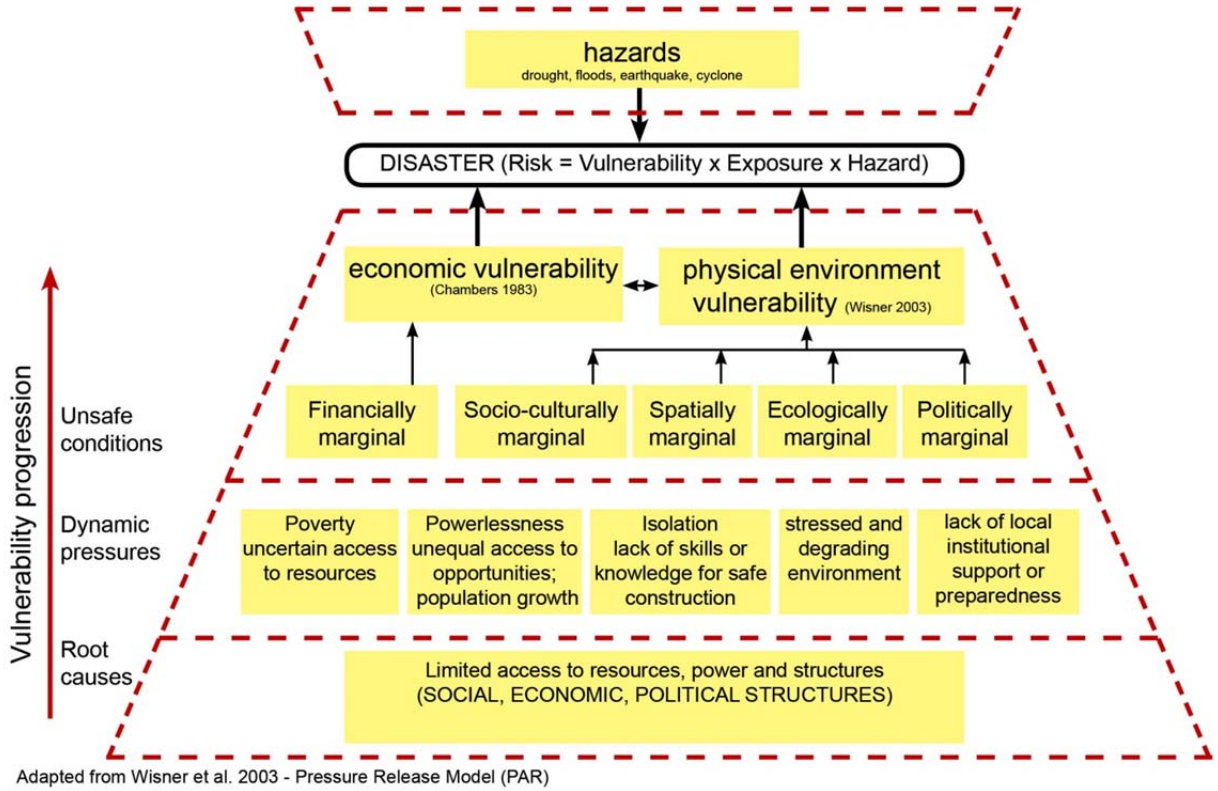


Figure 2.5 Pressure and release model: disaster risk = vulnerability progression coupled with hazard (adapted from Blaikie et al., 1994)

Subsequently, “disaster risk reduction and enhancing resilience” was noted as the goal in the Sendai Framework for Disaster Risk Reduction (SFDRR). This was a shift in goal from “disaster reduction” by its predecessor instrument – the Hyogo Framework for action (HFA), adopted in 2005. The HFA (2005–2015) also identifies housing reconstruction as a crucial “first step toward reactivating the productive economy” and avoiding “the reconstruction of risk” under its priority 4 of “building a culture of safety and resilience” (UNISDR, 2005, p. 116-117). While there are similarities in HFA and SFDRR in terms of reconstruction as a means to enhancing resilience, there is a shift in goal from disaster reduction to DRR, due to an improved understanding of risk being continuously prevalent and disaster being an outcome of risk.

In SFDRR, a new term, “Build Back Better” (BBB), was identified as one of the dimensions of disaster risk and thus considered important for disaster risk reduction. It was evident as priority 4: “Enhancing disaster preparedness for effective response and to ‘Build Back Better’ in

recovery, rehabilitation and reconstruction" (UNISDR, 2015, p. 14). BBB strategy was proposed by Clinton (2006, p. ii), after the 2004 Indian Ocean tsunami and can be summarised as:

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

The 10 key propositions presented in the BBB strategy are: communities to drive their own recovery, fairness and equity, local government to be empowered to manage recovery, effective coordination, agency partnerships, and emphasis on rebuilding safe communities' not just reconstructing houses for holistic livelihood recovery, disaster preparedness, risk reduction and resilience. The slogan – BBB – caught global attention despite its several severe limitations. As discussed by Maly (2017), BBB lacks a shared or precise definition, can be narrowly interpreted in the sense of risk reduction through technical features in building structures (e.g. "better than pre-disaster situation") and it proposes ideas that were not new to recovery goals and knowledge of good practice. The vagueness of the term BBB means that it can misused to promote top-down reconstruction interventions in order to reduce risk from technical perspective, which do little or nothing to engage or mobilise disaster survivors. Thus, the introduction of new terms and concepts can be confusing and may lead them to being used in a rather shallow way. Hence, the necessity of the term BBB is questioned by Vahanvati and Beza (2017), especially when ODHR conveys the same meaning and much more.

Disaster risk reduction, as discussed earlier, demands that government or civil society organisations (CSOs) involved in recovery efforts, have thorough understanding of the population, local political, technical and socio-economic patterns of development (Barenstein, 2011; UNDP & Hunnarshala, 2006). Hence community participation or engagement is promoted in SFDRR, as local people know their own needs, aspirations and social-political contexts best (UNISDR, 2015).

An ODHR approach, as discussed earlier, clearly emphasises community participation and advises technical modifications to be kept to a bare minimum (as opposed to BBB). Such an approach with minor technical modifications has also enjoyed relative success to the major technical modifications approach (Davis, 1978b). Such successes were reported by various

agencies such as Interact and Oxfam working after the 1976 earthquake in Guatemala (Cuny, 1978) and the 1977 cyclone in Andhra Pradesh in India (Winchester, 1979). The main reason for the success of the minor modifications approach (now termed ODHR) is its combination of social, technical (skills training) and financial (on-condition or in-kind) support to residents for them to attain through their own efforts, hazard safe and socially acceptable living standards (Jha et al., 2010, p. 95).

Other terms used in ODHR such as, 'community', 'participation', 'engagement' and 'mobilisation', can also tend to be used uncritically, for their political appeal. Sociologists, anthropologists and political studies scholars have, for decades, fiercely debated the term community and its meaning (Mulligan 2015). The term 'community' has multiple, culturally specific or even conflicting meanings. Typically, people working in disaster recovery who have not had the need or opportunity to think carefully or deeply about the meaning of community assume that it applies only to people living in a particular spatial location or settlement. Moreover, they are likely to think of a community as a single identity which existed before a disaster and which can be rebuilt afterwards; that is, as a pre-existing and coherent formation. However, a range of scholars (e.g. Delanty 2003, 2010; Mulligan 2015) have demonstrated that the single word 'community' masks a host of interacting formations and tendencies, with growing forms of community in a world of advanced communication technologies. The British sociologist Gerard Delanty (2003, p. 130) has noted that in the contemporary world, communities only exist if they are "wilfully constructed" and Dan Bulley (2013, p. 276) has extended this understanding by arguing that communities need to be "produced" before they can be mobilised. Mulligan et al. (2016) have suggested that communities now come in three main forms: place-based; virtual (connected by communication technologies); and imagined (no actual contact, but merely existing in the imagination). Delanty (2003) and others have noted that increased levels of mobility and migration mean that local communities have become more fluid and transitory than in earlier times. Individuals can belong to an increasing array of community formations, often a mix of real and virtual, local and translocal, national and transnational, with an increasing number of multi-ethnic and multicultural community formations. For example, while rural people in India continue to identify their communities as caste-based (Mukherji, 2008), caste identities may be dissolving or have less relevance to community formations based on interests, professional networks or social aspirations. Even remote rural communities in India are being destabilised by new forms of mobility and migration, and caste identities do not have the influence they once had. While a community

may be an ageless human concept (Delanty, 2003), all communities have become more fluid as a result of globalisation and associated mobilities. This makes it clear that geographically bound or place-based communities are just one of the many ways in which communities are now formed. Moreover, the sense of community may be weak or fragmented in any particular place-based community and these fault lines can open up in the aftermath of a devastating disaster (Mulligan, 2013). Human geographers have warned against the uncritical, narrow or inappropriate use of the term 'community' as it can exacerbate social division and conflict as much as it can enhance social cohesion (e.g. Jha et al., 2010; Mulligan & Nadarajah, 2012).

Like community, the term 'participation' also covers a raft of possibilities in terms of how it is exercised and facilitated, which can be shallow or insincere. Participation, in its broadest sense, is perceived as a 'tool or instrument' for community empowerment. In other words, participation is a means to transferring responsibility of reconstruction and strategic risk reduction initiatives to the local residents. In this regard, there are two main objectives of a civil society organisation (CSO) or government involved in reconstruction: one is to build or retrofit physical and social assets by mutual help, and the other is to claim resident's rights in the political arena (Choguill, 1996). Only if both of these objectives are met, the residents would be empowered to eventually alter the *status quo*, permanently.

Perhaps the ladder of citizen participation proposed by Sherry Arnstein (1969) is the best known attempt to determine varying shades or scales of participation in public works. She proposed this ladder based on her work in various public works programmes, such as urban renewal, anti-poverty cities, in Washington DC. As shown in Figure 2.6 (left), the ladder has eight rungs: the bottom rungs of the ladder, 7–8, are non-participation (manipulation and therapy); 4–6 are tokenism (informing, consultation and placation); and 1–3 citizen power (partnership, delegated power and citizen control). The criterions by which these rungs are defined are "the extent of citizens' power in determining the end project (of public policy)" (Arnstein, 1969, p. 217). Marisa Choguill (1996) argues that while such "citizen control" can be equated to success of projects in developed countries, within underdeveloped countries, low-income communities want more than power alone. "They need empowerment to influence decisions which affect them. In addition, they want urban services and housing from a government" (Choguill, 1996, p. 433). This influential ladder of community participation was later adopted for use in post-disaster housing reconstruction work by Davidson (2007), where Choguill's eight rungs were simplified into five rungs (see Figure 2.6).

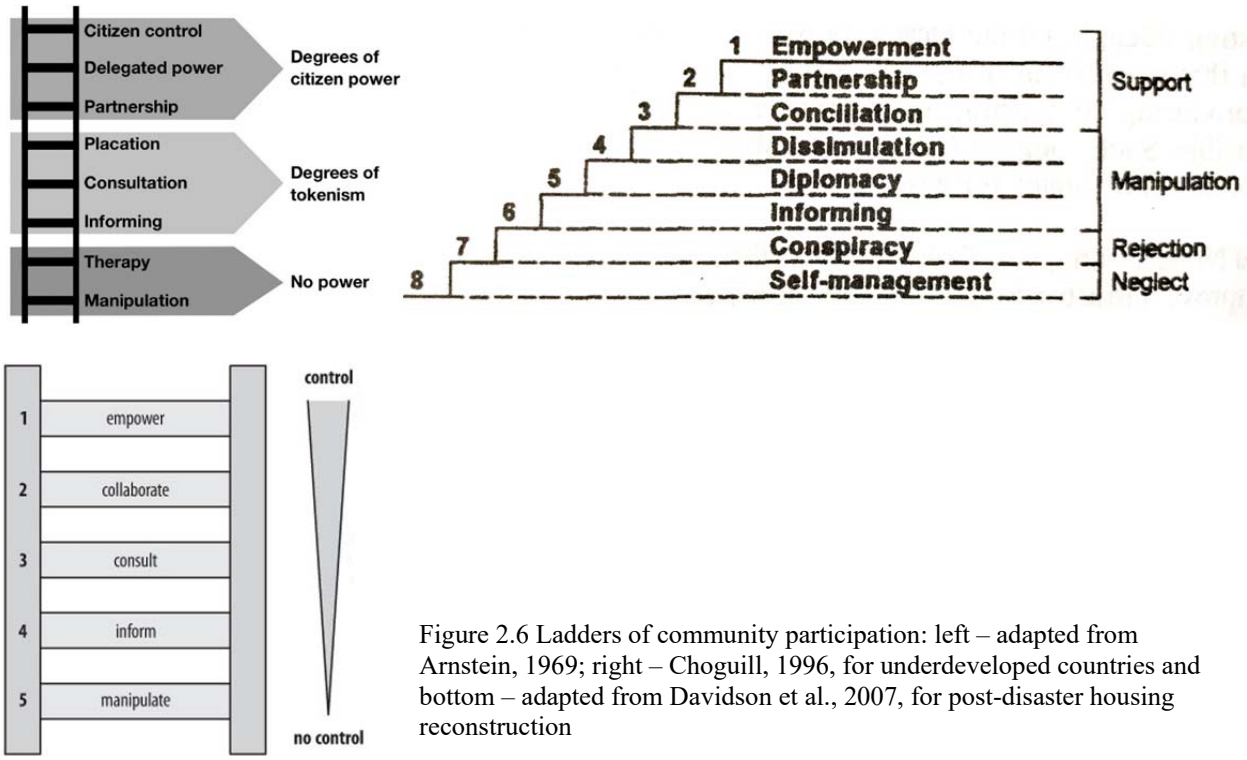


Figure 2.6 Ladders of community participation: left – adapted from Arnstein, 1969; right – Choguill, 1996, for underdeveloped countries and bottom – adapted from Davidson et al., 2007, for post-disaster housing reconstruction

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek your feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 2.7 Spectrum of participation for Australasia (source: IAP2 Australasia, 2016)

Later, in 2013 the International Association for Public Participation (IAP2 Australasia, 2016) developed the 'spectrum of participation' for Australasia (see Figure 2.7). This IAP2 model follows very similar structure of five rungs as proposed by Davidson et al. (2007). As shown in Figure 2.7, this internationally recognised IAP2 model goes way beyond the classification of

types of participation as it includes goals (for participation as well as implementation support), time frames and resources required during the decision-making process. While this model is not specifically designed for post-disaster recovery work, it is a very comprehensive community participation model.

While full community control of housing reconstruction may logically appear to be the best way, a number of researchers have noted that, without providing social, technical and financial support during interventions, this may not necessarily lead to building disaster resilience (ACHR, 2010; Barenstein & Iyengar, 2010). Without a multi-pronged approach to interventions, these researchers noted, residents may make short-sighted decisions motivated by feelings of insecurity or unrealistic aspirations. Hence, community control – without enabling mechanisms – can undermine community cohesion and longer term strategies for disaster resilience (Lizarralde et al., 2010a).

Colin Davidson et al. (2007, p. 102) has added that

> A "ladder of community participation" defines a continuum of approaches for how organisations seek community involvement in housing projects.

This statement highlights that if post-disaster reconstruction projects were to lead communities towards disaster risk reduction (enhanced resilience and development), civil society organisation (CSOs) ought to ensure deployment of community capabilities to make meaningful choices (as suggested by Amartya Sen) and provide "continuum" of possibilities for participation, beyond a single project. This suggests that while the concepts of community and mobilisation need more careful consideration than has often been the case in disaster recovery work, more work also needs to be done in understanding the wider ecological system.

2.4.4 Socio-ecological resilience studies

The concept of resilience has gained traction within the disaster management scholarship (prevention and reconstruction), since its introduction in 1970s. The term has its etymology in the Latin verb *resilire* meaning 'to rebound or recoil'. In a hazards context, the concept broadly refers to the society, system or area's ability to cope with, adapt to and prepare for future hazards (IFRC, 2004). Disaster resilience is widely touted as the ultimate aim of reconstruction policies and practices (UNISDR, 2005, 2015), and during the second international conference on disaster reduction in Kobe, Japan "building a culture of safety and resilience" was identified

as one of the five key priority areas for PDR interventions (UNISDR, 2005, p. 57-75). Over the decades, a resilience discourse has been adopted in many fields of studies, such as, human psychology, finance and business, with varying meanings. Such proliferation of use of the term 'resilience' has also made it highly contentious, with some arguing resilience thinking lacks a 'normative dimension' (e.g. Bahadur and Tanner 2014, p.202) and others pointing the dark side of the concept – promoting a "negative anti-community individualism" (Davoudi et al., 2012; Mulligan et al., 2016, p. 1). Despite such criticisms, the long-standing use and increasing recognition of the term means that use of resilience concept will most likely continue in disaster management work. Hence, a number of scholars (e.g. Cascio, 2009; Seville, 2008; Smit & Wandel, 2006) have proposed giving answers to questions regarding, resilience – of what, to what, why, when and for whom, if the SES resilience concept were to have any practical significance? This section is divided into three parts: one, narrowing down SES resilience concept by answering above mentioned questions; two, examining critically prevailing theoretical understanding or definitions, its characteristics and components (what constitutes resilience) and three, identifying ways of operationalizing the concept during practical, post disaster response for disaster risk reduction (DRR).

Linking resilience to disaster risk reduction answers the question of resilience – to what – disaster. An answer to the question of resilience – of what – can be found in the definition of disaster resilience according to the UNISDR (2009, p. 24):

> The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

This definition answers to resilience – of what – a system or community or society. As Walker and Salt (2006, p. 1) explains, "system might be a home, a company, or a nation" or a farm, or a region. This PhD focuses on the resilience of system at societal scale (people, communities, houses and human settlements). This is because a house relates primarily to human needs (as discussed earlier in section 2.1.1) and its ability to provide the first layer of buffer for its residents to cope with disturbances without losing all pre-existing forms and functions. Of course, it is important to also consider the ecological impacts of people and human settlements, and this certainly comes into play in considering the local relevance and sustainability of particular housing forms and modes of construction. Furthermore, an understanding of inter-

relationship between ecosystem and human/ societal system can determine the long term sustainable development of the communities concerned. While a societal system is comprised of many systems within – including the built environment, communities, institutional arrangements and ecosystems – Gunderson et al. (2002) argues that the complex interaction within and between multiple components of a system of system (which can produce unpredictable or unintended impacts) are nearly impossible to study. It must be noted that these systems within systems (interrelated but independent) are different from system of subsystems (based on dependency) as distinguished by Gunderson et al. (2002). Thus, a study of the ecological impacts of post-disaster housing and settlements reconstruction is beyond the scope of this PhD. Having said that, the author acknowledges that enhancing the resilience of people and housing during reconstruction is reliant on relationships between building practices, traditional knowledge and how people respond to their geographical settings.

The question of resilience – for whom – is probably the most fundamental for all involved in disaster recovery work. As noted in The Sphere Project (2011), the CSOs undertaking disaster recovery work must be accountable to the primary stakeholder – the beneficiaries – and must have humanitarian, rather than opportunistic, objectives. To add to the complexity, as discussed in earlier sections, the changing nature of community formation amid the complexities of a post-disaster context poses tremendous challenges to even the most well-meaning CSOs.

There are disagreements in relation to the timing or – when – resilience is evident to be assessed. While some (e.g. Kapucu et al., 2013; Mulligan et al., 2016) argue that resilience is present continuously and is an on-going activity rather than an end result; others (e.g. Allen et al. 2005) argue that resilience is not revealed before a stress or shock has occurred because there is no system response without a disturbance. However, there seems to be some agreement, according to Kapucu et al. (2013, p. xiv), about three time frames within the disaster management cycle, when resilience is most evident, as:

- prior to a disaster – anticipatory resilience
- during a disaster – responsive resilience
- a long time after a disaster – adaptive resilience

Lee Bosher (2010) claims that pre-, during- and post-disaster resilience are closely interrelated. For example, people with pre-existing community networks prior to a disaster have shown to

recover faster (i.e. post-disaster resilience) (Mukherji, 2008). However, Folke (2006) stresses that in post-disaster context enhancing resilience can become a more conscious task as people are likely to be open to changes or new ways of thinking. This fits in exactly with the proposal by Gunderson (2010) of post-disaster housing reconstruction and response as window of opportunity for alternative system configuration and to Holling's call (2004) for human systems to take a leap from vulnerability to enhanced resilience, which is most evident long after a disaster.

This second section critically examines multiplicity of theoretical understanding of disaster resilience – its meanings, corresponding scales, states and components that constitute it (Twigg, 2009). Three predominant meanings of disaster resilience have been evident in disaster response and management literature, dependent on its roots in the fields of study – engineering, ecology and social sciences.

From an engineering perspective, resilience is used to explain variations in the ability of a material (e.g. timber) to withstand sudden severe loads (Mc Aslan 2010 p.2 in IFRC, 2008a). In other words, engineering resilience was about resistance to change and reaching an equilibrium state in order to maintain functionality, after the material has experienced sudden shock (see Table 2.3). It was a fairly linear view of resilience.

The concept was then introduced in the field of ecology by the Canadian ecologist Holling (1973) and other natural scientists. Ecosystem resilience is characterised by "the ability of the system to re-organize while maintaining its functionality, following disturbance-driven change" (Holling, 1973, p. 17). From an ecological perspective, as observed by Holling and Walker (2003), resilience was about adaptive capacity of the system or to be able to adapt to all kinds of disturbances (both anticipated and unexpected). Ecology resilience emphasised adaptive capacity, multiple equilibrium states and a non-linear view of achieving it. The intention of ecologists was to challenge the dominant stable-equilibrium view of ecosystems, by proposing that resilience is continual.

Table 2.3: Various meanings of resilience concept (from the narrow to the integrated socio-ecological system interpretation) (source: author)

Various concepts	Focus on	States and scales	Natural hazards as	Timing	Related literature
Engineering resilience	- Coping/ Resisting change - Recovery (to pre-disaster state) - Stability/ Constancy/ Control regime - Eliminates redundancy - Economic development	- One stable-state - Linear (cause and effect)	External shock	Post-disaster	Bosher, 2008; Haigh & Amaratunga, 2011; IFRC, 2008a; Mc Aslan, 2010; Malalgoda et al., 2013; Tobin, 1999
Ecological or Social resilience	- Adaptive capacity (improved state) - People-place connection; agency and self-organisation - Persistence - Robustness - Redundancy - Rapidity	- Multiple stable states - Non-linearity	On-going disturbance	Pre-& post-disaster	Holling, 1973; Jha et al., 2010; Mulligan at el., 2016; IFRC, 2012
Coupled Socio-ecological systems (SES) resilience	- Alternative system configuration - Renewal cycles - Unpredictability - Transformation - System memory/ learning - Building change - Process-focused - Long-term	- Nested scale - Multiple states - Dynamic system interaction - Feedback loops - Context specific - Non-linearity	On-going process	Pre- & post-disaster	Berkes et al., 1998; Berkes & Ross, 2013; Folke, 2006; Gunderson, 2010; Lizarralde et al., 2015; Turner et al., 2003; Walker & Salt, 2006

From social sciences perspective, community resilience has been emphasised (IFRC, 2012; Imperiale & Vanclay, 2016; Tobin, 1999). This strand of thinking "emphasizes identifying and developing community strengths, and building resilience through agency and self-organization, with attention to people–place connections, values and beliefs, knowledge and learning, social networks, collaborative governance, economic diversification, infrastructure, leadership, and outlook" (Berkes & Ross, 2013, p. 5).

Since the concept's adoption in the field of disasters and hazard studies in 1970s, it has promoted an integrated socio-ecological systems' (SES) perspective. However, as highlighted in Table 2.3, there are considerable disagreement in definition of resilience concept and consequently, its relevance for disaster risk reduction (DRR) (for multiple definitions of resilience applied to disaster risk management field, see Aldunce et al., 2014). The Resilience Alliance (1999) proposed a coupled socio-ecological systems (SES) resilience because any one of the perspectives – ecological or social or an engineering one, alone, leads to a narrow view in the face of uncertainties. As Neil Adger (2006, p. 268) notes, "human action and social

structures are integral to nature and hence any distinction between social and natural systems is arbitrary". SES resilience challenges the traditional (e.g. engineering resilience) equilibrium view as well as adaptation view (e.g. ecological resilience) exemplified in resistance or recovery line of thinking for disaster risk reduction. SES scholars have long argued (e.g. Walker & Salt, 2006) that human systems have much to learn from ecological systems about what systemic resilience looks like. SES scholars argue that humans appear to have a greater ability to learn from past experiences than other forms of life, in order to build capacities now for future contingencies (Holling & Walker, 2003). On one hand, humans have capacity for strategic foresight, which is reliant on embedded "social memory" (Folke, 2006, p. 253). Furthermore, human communication systems can transcend spatial and temporal boundaries, increasing the possibility of multi-scale networks and connectivity (Mulligan et al., 2016). On the other hand, some forms of social change can also result in a permanent loss of capacity – such as the loss of indigenous cultures, languages or traditional skills. While human foresight can multiply the opportunities to build and foster ongoing system evolution while maintain functioning (beyond adaptive capacity), this has not been a strong feature of post disaster recovery work.

Apart from evolution in interpretation of the resilience concept, there are also varying views on system elements that constitute resilience. Table 2.4 summarises the contributions of a range of thinkers who have identified key characteristics and dimensions of resilience from an SES perspective for DRR. While the characteristics – robustness, redundancy, resourcefulness and rapidity – fit squarely within a traditional (engineering resilience or linear) approach to societal system recovery; if they were to be combined with other characteristics – such as uncertainty, diversity, feedback loops, cross-scale linkages and adaptive/ transformative capacity (self-organising in change) – they would contribute to an integrated SES disaster resilience approach to DRR. A conceptual framework has been developed for this PhD in Section 2.5, to integrate these varying components and their characteristics. This summary of the SES research suggests that the key characteristics of societal (housing and community) resilience for DRR and from SES perspective are – robust yet diverse, redundancy, resourceful yet equitable, rapid yet time-flexible, contextual and strategic and adaptive capacity.

Table 2.4 Characteristics and dimensions of disaster resilience from a socio-ecological systems perspective (source: author)

Authors	Resilience of what	Characteristics	Dimensions of resilience (system of systems)
Gunderson & Holling (2002)	Socio-ecological system (SES)	Renewal Reorganisation Development	
C.S. Hollings (2003) ecologist	SES	Maintenance of function Self-organisation/change Buffer capacity Adaptive capacity	Structures & processes Human, social, ecological, economic
Carl Folke (2006) ecological economist	SES	Adaptive capacity Transformability Learning/embedded memory Innovation (contains non-linear dynamics, thresholds, reciprocal feedbacks, cross-scale interactions across temporal & spatial scales)	Ecological, social and economic domains
Barry Smit & Johanna Wandel (2006)	SES	Contextual derivation Pertinent conditions or exposures Community sensitivities Adaptive strategies	Local (e.g. kinship networks) General social, cultural, political, institutional Economic system Technological Management
John Twigg (2009)	SES	Adaptation or resistance Maintenance of basic functions Recovery or 'bouncing back'	Institutional, environmental (risk assessment) Culture (knowledge) Social (health, wellbeing) Financial (livelihood) Physical, technical
IFRC (2012)	SES; community	Robustness Diversity Equity Redundancy (loss) Being well-located (consists of capacity to learn, adapt and be resourceful)	Human (knowledge, health) Social (organised) Political Physical (housing etc) Economic opportunity Environmental assets
C. Bevc in Kapucu et al. (2013)	SES	Robustness Redundancy Resourcefulness Rapidity of recovery (contains loss, feedback loops, interactions)	Technical, organisational, societal Economic Multiple scales

The five characteristics that have been used in this PhD have been fleshed out in more detail by Bevc (2013, p. 17) and others as follows:

1. **robust yet diverse:** to withstand a given level of stress or demand without suffering degradation or loss of function i.e. buffering capacity (Folke, 2006); while robustness relates to the quality of physical/technical components such as "strong housing, transport, power, water and sanitation systems" (IFRC, 2012, p. 7) and for agencies to BBB

diversity relates to residents' ability to personalise, maintain or renovate

2. **redundancy:** loss "of functional requirements in the event of disruption, degradation"; this concept of redundancy, which has been adopted from the disciplines of ecology and information technology (IT), relates to having a backup or failsafe options for system functioning in the event of disruption
3. **resourceful yet equitable:** "resourcefulness to supply material and human resources to meet established priorities and goals"; this concept relates to social as well as financial resources provided to disaster survivors from external agencies for PDR – it highlights the need for equitability in resource distribution
4. **rapid yet time-flexible, contextual and strategic:** "Rapidity to contain losses and avoid future disruption" i.e. efficiency, which, "measures how economically inputs (usually financial, human, technical and material resources) were converted to outputs" or results (ALNAP, 2006, p. 44)
5. **adaptive and transforming capacity:** "the ability (adaptive capacity) of humans to imagine the future, the capacity for forward planning" (Holling & Walker, 2003, p. 2); "the capacity for renewal, re-organization and development" of system has rarely been part of resilience discussion within the DRR (Folke, 2006, p. 253) – this characteristic often implies a need for social change or self-organise during disturbance.

In post-disaster discourses capacity building is associated with skills training, as explained by (Jha et al., 2010, p. 239) :

> Training is the intervention that most determines whether the housing reconstructed after a disaster is an improvement over what people had before, especially with respect to disaster resilience.

In practice, different ways of capacity building are represented. At times, there is an emphasis on skills training of the local artisans, masons or residents in safe and quality construction (Sudmeier et al., 2013). At other times, the emphasis is on the involvement of women in capacity-building work (Unnati, 2008) or the significance of embedding new skills in local knowledge and livelihoods (Development Alternatives, 2004; Development Alternatives & Niazi, 2001b; Iyengar, 2009). Capacity building also relates to the earlier discussion about the changing nature of community formation and the social and economic vulnerabilities, which all emphasise processes rather than preconceived outcomes. The challenges of capacity development through the process of reconstruction are implicit in its definition by UNISDR

(2009, p. 6):

> Capacity development is a concept that extends the term of capacity building to encompass all aspects of creating and sustaining capacity growth over time. It involves learning and various types of training, but also continuous efforts to develop institutions, political awareness, financial resources, technology systems, and the wider social and cultural enabling environment.

It is the sustainability of introduced capacities, which is of importance for capacity development, as per this definition. However, the sustainability of built capacities is often overlooked by disaster recovery agencies that focus on the completion of their recovery projects. For example, masons who are retrained in safe construction skills are rarely provided with extended support to find livelihoods from their newly developed skills, and this can prevent such practices from becoming embedded in the local construction sector (Development Alternatives, 2004). Hence, only sustained capacity building can ensure that ODHR intervention will reduce disaster risk and "pay for itself many times over in the form of disaster avoided and lives safeguarded" (Clinton, 2006, p. 22). This also partly answers the fourth question referred to above of 'when' the impact of resilience can be enhanced and observed.

This third section examines ways of operationalizing the theoretical concept of systemic disaster resilience during practical, post disaster response for disaster risk reduction (DRR). Given the insurmountable conceptualisation of the concept, operationalizing and measuring systemic disaster resilience, is challenging. Many scholars and organisations have proposed resilience frameworks and their own metrics, which limits their generalizability and applicability in different contexts. For example, some frameworks are fairly conceptual (e.g. community resilience framework by Berkes and Ross (2013) and the IFRC (2012) (see Figure 2.8). As shown in Figure 2.8, IFRC's (2012) framework is draws on various scholarly sources and clarifies the difference between: 'assets' that are community owned; 'resources' that are typically from external sources; 'capacities' that emerge over time; and 'qualities' of systemic disaster resilience.

Figure 2.8 Conceptual framework for community resilience (source: IFRC 2012; copyright permission granted)

Other frameworks are for macro-scale, such as, the city resilience (Jo da Silva, 2014). Few others have proposed highly detailed program evaluations with emphasis one or two of the system components (e.g. cost-benefit analysis of DRR, see IFRC, 2008a). See Bond (2017, p. 5-19) for further discussion on various resilience frameworks and their pros and cons. While some of these frameworks have remained influential, there has been no acceptable framework at project scale or community scale to be used by practitioners. An integrated framework for owner-driven housing reconstruction (ODRH) with SES resilience objective is developed for this PhD in Section 2.5.

In summary, with its humble beginnings in engineering, then social science and then ecology, the concept of resilience has evolved to a systemic understanding. SES resilience has evolved from mere coping to adapting to transforming, from everyday coping to long term adaptation and from one stable state to multiple or alternative stable states (Walker & Salt, 2006). In post disaster housing reconstruction context, the SES resilience concept has helped focus on systems rather than context, and integrate concepts from various disciplines (technical resilience, social resilience and human capabilities development) (Chambers, 1995; IFRC, 2004; Jha et al., 2010; Lizarralde et al., 2010a; UNDRO, 1982, 2010). Nonetheless, the term 'systems' can be all-encompassing with limited ability to translate into practical use, the same way in which the term 'community' can be highly contentious. The task of examining whether and how an ODHR project has led to enhanced disaster resilience of people and human settlements is a difficult problem and hence this has remained largely unexamined. The project management experts propose that they may have the tools and techniques required to turn the

rhetoric on ODHR and its ability to enhance disaster resilience into reality, at project scale.

2.4.5 Project management studies

As explained in Vahanvati and Mulligan (2017, p. 2), the international Project Management Institute (PMI) has maintained that PM approaches can offer a suitable framework for ensuring the efficiency of PDR projects. To do so, PM offers the knowledge, tools (log-frame analysis, theory of change), techniques and skills required by the implementing agencies for mapping out how a program or project can achieve the designed outcomes (Kulatunga, 2011; PMI, 2005, p. 2). The suggested benefits of applying a traditional construction PM approach to PDR projects are: the delivery of project goals in the fastest time and specified budget (Steinfort, 2017; Steinfort & Walker, 2007); and the establishment of synergy among various stakeholders for working towards a common project vision and project efficiency through the project life cycle (Baum, 1970; PMI, 2005).

Some scholars and practitioners (e.g. Kulatunga, 2011; Steinfort & Walker, 2007) have argued that a traditional PM approach remains highly ineffective for managing PDR projects, with key limitations being identified as: it focuses on a single project life cycle or inflexible time frame for project completion; it tends to identify PDR work as a technical challenge (fits into engineering resilience thinking), to the exclusion of other complex systemic challenges; and it measures project effectiveness in terms of project outcomes (i.e. static state) rather than ongoing processes (Vahanvati & Mulligan, 2017, p. 2-3). According to Steinfort and Walker (2007, p. 5), a project is defined as "a temporary endeavour that delivers benefits using temporary teams that mainly come together for short bursts of time to deliver a result that has a defined phased life cycle moving from initiation through design, delivery to closeout and while these phases may be recursive they are generally well defined". While this formulation includes the observation that progress can be recursive rather than linear, the emphasis on closeout suggests that the work is completed within a particular time frame. This closeout and rigid time frame encourage haste and premature withdrawal from site with unfinished initiatives, in terms of long term resilience and sustainable development (Mulligan et al., 2012).

Lee Bosher (2008, p. 13) has shifted the emphasis, from one-off to a longer term focus (in line with shift from engineering resilience to systemic resilience), to an extent by arguing that post-

disaster housing and settlements need to be:

> designed, located, built, operated and maintained in a way that maximises the ability of built assets, associated support systems (physical and institutional) and the people that reside or work within the built assets, to withstand, recover from, and mitigate from the impacts of extreme natural and human-induced hazards.

Bosher (2008) explains that post-disaster reconstruction (PDR) projects have to factor in long-term housing operation and maintenance issues, which extend way beyond the time scope of a single project or normal construction projects. Consequently, project closeout falls short of dealing with the long-term issues, let alone ensuring the social-political support required for ensuring hazard-safe construction standards are adhered to and embedded in the local culture and institutional structures (Mulligan & Nadarajah, 2012).

Diagrammatically, the PhD author represents a single-project lifecycle-bound project management (PM) approach (in line with a resistance or engineering resilience thinking) as a closed cycle (see Figure 2.9). Such a closed cycle is found problematic, due to its short-sighted objective which are ineffective in reducing disaster risk, and the disregard for disaster related changes will make it impossible to go back to pre-disaster state (Walker & Salt, 2006). A few scholars have thus proposed representing this idea as an "upward spiral" to represent the "real situation" (also termed as the disaster resilience spiral) (Walker & Salt, 2006, p. 262-263); or an ongoing spiral, which is systems based (Niazi, 2001). Such systems based and multi-project-based concepts were utilised during post-disaster reconstruction implementation by an Indian CSO, Development Alternatives and CARE India, after the 1999 super cyclone in Orissa in 1999-2001.

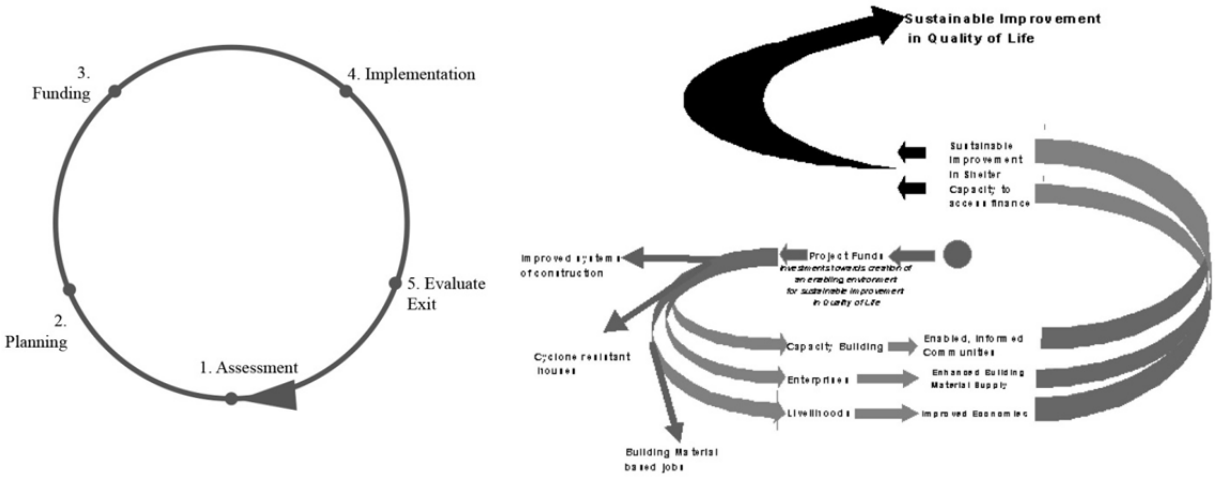


Figure 2.9 Left – a closed-loop, single-project life-cycle approach to project management (source: author); right – an upward spiral, multi-project life-cycle approach to leapfrogging from disaster to sustainable development (source: Niazi, 2001)

In contrast to conventional construction PM, the long-term success of PDR projects is determined by a much wider array of considerations. As discussed by Vahanvati and Mulligan (2017), a range of scholars have identified a broad range of critical success factors (Ahmed, 2011; Kim & Choi, 2013; Ophiyandri et al., 2013). There is not yet any consensus on which success factors are most critical. This is because circumstances vary a great deal in regard to: type and duration of the disaster; pre-existing vulnerabilities; existing skills and competencies within the affected communities; and the competencies of project stakeholders (Meding et al., 2016). However, the need to consider a wide array of success factors has led to a process-oriented, rather than project outcome–oriented, approach to evaluating PDR projects (PracticalAction, u.d.b; Turner, 1976; UNISDR, 2015). Such emphasis on process is reflected in the work of those advocating a 'participatory' approach to ODHR (Barakat, 2003; Ganapati & Ganapati, 2009). Vahanvati and Mulligan (2017, p. 4-5) note that the ability of PDR projects to enhance the disaster resilience of communities can easily be overstated, although the concept of the adaptive capacities of communities is useful for considering the social outcomes of 'hard asset' recovery (Barenstein & Iyengar, 2010). The spiral representation of project life cycles in Figure 2.9 emphasises the need to reconsider funding models, which deflects attention from long-term strategic outcomes.

Putting process over product, thinking beyond single-project life cycles and thinking beyond technical resilience may be the way to formulate an ODHR project for strategic success at enhancing disaster resilience. However, good outcomes also require good planning, timely implementation and thinking through of all the project phases and understanding how they

interlock in order to help build the prospects of long-term success. Evaluation needs to occur across the life of the project, not only at the end, and this needs clear milestone objectives. For the purpose of this research, the influential log-frame analysis (LFA) has been used to identify four main phases of a project life cycle, as informed by AusAID (2005) and scholars such as Lizarralde (2002), Bosher (2008) and Tauber (2013), as illustrated in Figure 2.10.

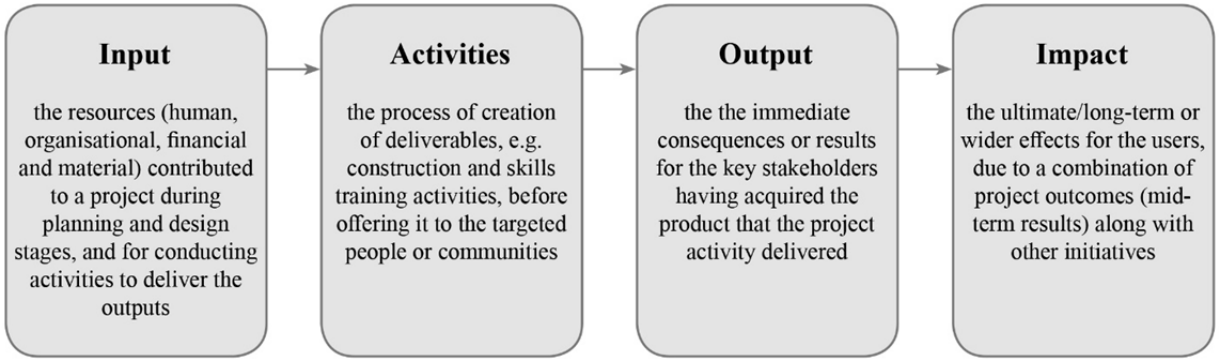


Figure 2.10 Generic representation of four phases of a project life-cycle or impact pathway or a project's theory of change (source: author)

The project life cycle represented in this figure is also termed as 'impact pathway' (p. 32) or 'a project's theory of change' (p. 92) by the Network of Networks for Impact Evaluation (NONIE, 2009). While LFA seems to be linear, it is best suited for the purpose of this research trying to establish linkages between processes (or pathways) through different stages of a project.

2.5 TOWARDS AN INTEGRATED FRAMEWORK FOR ODHR FROM SES RESILIENCE PERSPECTIVE

Post disaster housing reconstruction and ODHR in particular has certainly been influenced by many concepts promoted by various fields of studies, as discussed above, to the point where it is seen as a major contributor for enhancing disaster resilience, internationally. However, due to the complexity involved in post disaster interventions, contextual specifics, systemic issues and housing typology, enhancing systemic resilience for long term human and sustainable development, raise questions that often extend beyond the scope of any particular recovery operation, no matter how well planned or executed it might be. As Kelly and Adger (2000) noted, it is no easy task to operationalise the systems conceptualisation of vulnerability or resilience. Nonetheless, there is a need for turning the concepts emerging from the social,

economic, technical and ecological studies into an integrated analytical framework for measuring the disaster resilience impact of such recovery work. However, efforts to do so require following three important considerations:

i) **spatial and temporal scales:** define "habitual boundaries of direct responsibilities and corresponding disciplines" (Lizarralde et al., 2010a, p. 250) at which the disaster-resilience impact of ODHR is expected (Folke, 2006; Kapucu et al., 2013; Turner, 1976)
ii) **key system components and feedback loops in ODHR projects:** reduce the number of or prioritise the variables (controlled or uncontrolled) to the bare essentials (Adger, 2006; Turner et al., 2003)
iii) **sensitivities and capacities of system components by subsets:** identify interrelationships between context-specific variations and macro-level similarities (Chambers, 1983; Folke, 2006; IFRC, 2004; Twigg, 2009)

These three considerations have been taken by the PhD author as a starting point for developing conceptual and analytical frameworks for examining the case study ODHR projects. The research aims to develop a framework for future ODHR project development and management in order to strategically operationalise disaster resilience from a socio-ecological systems perspective. The concept of resilience is used as a lens for thinking about the long-term consequences of each consideration, as described below.

2.5.1 Spatial and temporal scales for assessment of disaster resilience impact

The issue of scales – both spatial and temporal – at which an ODHR project operates is an important consideration, as resilience can be examined only at a particular scale and in a specific space (Folke, 2006), just as disasters are confined in space and time (Turner, 1976).

A longitudinal and impact investigation of ODHR projects demands an 'ex-post-reconstruction completion' (Lizarralde, 2002) done by an external person long after the reconstruction completion, since impacts or wider effects (socio-economic changes) often take years to become apparent. A rough time line is associated with each phase of a project life cycle to consider relevant time frames for evaluating outcomes:

Phase I: INPUTS = few weeks to months since disaster
Phase II: ACTIVITIES = 2–4 years since disaster, sometimes more
Phase III: OUTPUTS = 3–5 years
Phase IV: IMPACTS = >6 years since disaster

The author's task of investigating the long-term effects of ODHR projects (>6 years later) has its challenges, because, "The further one moves from the time of the intervention, the more difficult it is to determine whether changes that have taken place are the result of the intervention or of some other factor, such as other interventions, or socioeconomic or political forces" (ALNAP, 2006, p. 57).

Spatially, drawing "habitual boundaries of direct responsibilities and corresponding disciplines" (Lizarralde et al., 2010a, p. 250) clarifies the scale at which the disaster-resilience impact of ODHR is expected. For example, scales range from individuals and communities (the micro scale) to CSOs (the meso scale) to the nation-state and its institutions (the macro scale) (see Figure 2.11). Over a decade ago, Turner et al. (2003) noted that the risks and developmental needs of individuals and of their nation-state may be entirely different. By way of example, the losses of housing and livelihoods, which have dire consequences for the households and communities concerned, may have little or no impact on the nation-state interested in macro-scale economic development. Hence, the meaning of resilience and the tools required to enhance or measure it in context of specific hazard interactions in a particular context (Kapucu et al., 2013), occurs differently as different scales, as illustrated in Figure 2.11. Consequently, disaster resilience requires a focus on households and communities (Folke, 2006; IFRC, 2004), and this echoes the calls by Chambers (1983) and Twigg (2009, p. 8) to concentrate on "what communities can do for themselves and how to strengthen their capacities".

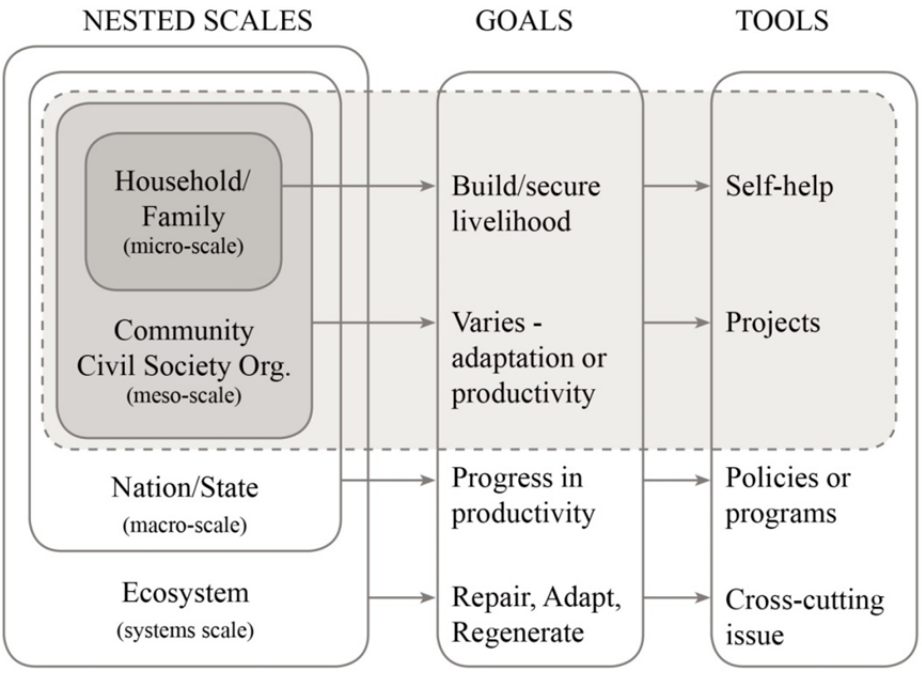


Figure 2.11 Nested scales in which resilience occurs and some of the differences in the term's meaning and tools required for building it in context of particular disaster and context (source: author)

As highlighted in Figure 2.11 and previously discussed in the Introduction (Chapter 1), this PhD focuses on remote rural settlements in the Indian context because disaster risks are high for people living in such spatial contexts. Yet people, even in the most remote villages, do not exist in isolation, as they belong to wider forms of community. Furthermore, communities are also affected by disturbances which emanate from non-local spaces or extended temporal scales (e.g. climate change). However, for analysis of the prospects for enhancing disaster resilience, the starting point needs to be on households and communities existing in particular places and times.

2.5.2 Key system components and feedback loops in ODHR intervention

As discussed earlier, ODHR operates within a complex array of geographic, social, cultural and political contexts. However, it is impossible to consider all of the system components or variables and their possible impacts on the development of a particular project. Multiple attempts have been made by scholars and practitioners to identify key system components in order to reduce this complexity to the most pressing considerations, as shown in Table 2.5.

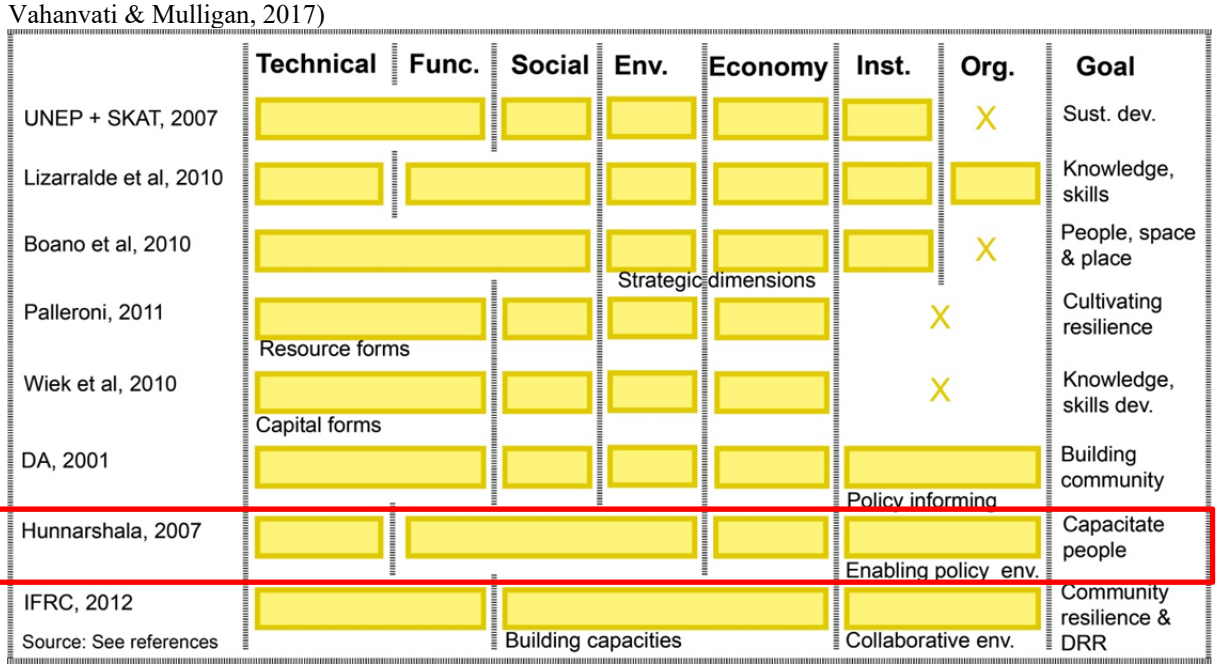
This table is taken from the paper by Vahanvati and Mulligan (2017), which summarises the key system components (identified as 'factors') and organises them according to their stated goals or objectives. System components or system of systems have been defined by various scholars but using varying terminology. For example, Palleroni (2011) uses the term 'resource

forms' while Wiek et al. (2010) uses 'capital forms' in discussing the social, environmental and economic considerations. Boano and Zettern (2010) group these components into just two wider categories: 'immediate' and 'strategic'. The physical/technical aspects of housing reconstruction are commonly located within the domain of 'immediate' needs. Hunnarshala (2007); UNDP and Hunnarshala (2006), IFRC (2012) and Lizarralde et al. (2010a) all stress that post-disaster housing reconstruction requires organisational complexity in order to contribute to what Hunnarshala (2007) calls 'capacity building'. This discussion highlights the imperative of starting with a consideration of long-term/strategic goals. While there is no agreement on what to call the system components, the PhD author finds that systems thinking is as good as any approach and it clearly relates to the SES concept of resilience.

From all of the system components proposed by various scholars and practitioners, four components have been selected for consideration in this PhD, based on Hunnarshala's (2007) categorisation (highlighted in red in Table 2.5), as:

1. physical/technical
2. social
3. financial
4. project management

Table 2.5 Key factors in post-disaster housing reconstruction and their long-term goals (first published by Vahanvati & Mulligan, 2017)



While the first component is a 'hard' asset and is a bare essential requirement for an ODHR project, the second component is a 'soft' asset (i.e. adaptive capacities) and the third

component relates to the residents' longer term livelihoods or resourcefulness. As Figure 2.12 shows, the first three components can be represented as systems (termed as components in this PhD) within a system, while the fourth component must tie all these system components together during implementation. These systems components, as per the SES resilience concept, cannot be framed as having mere linear cause-and-effect relationships; rather, they have complex interconnections. Hence, these components are represented in a Venn diagram (see Figure 2.12).

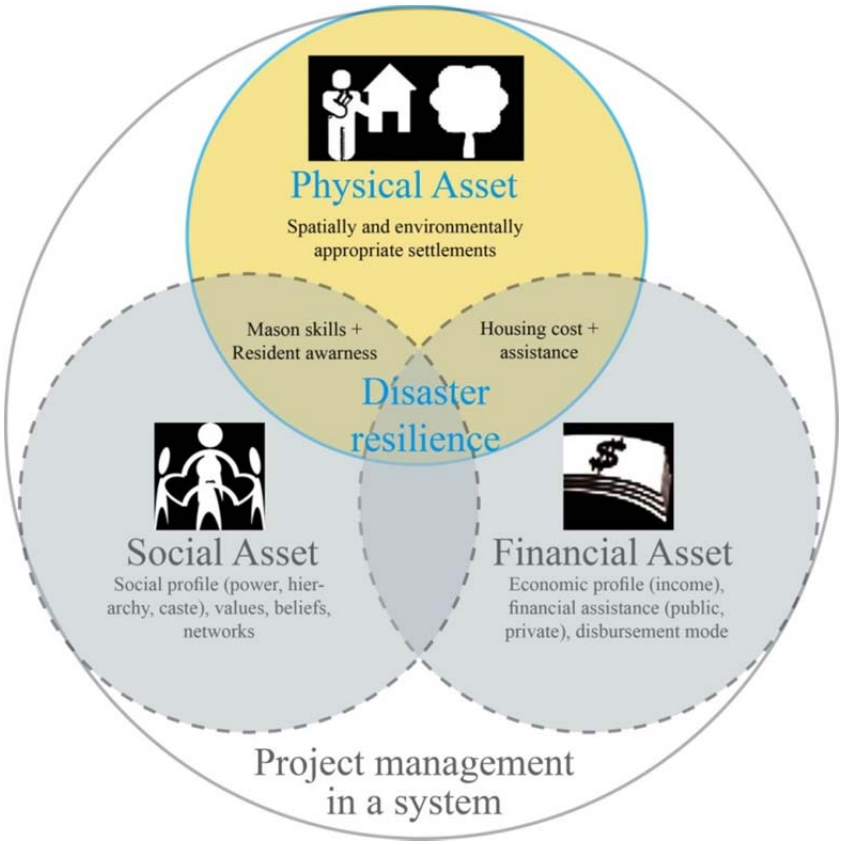


Figure 2.12 Conceptual framework with focus on four components of ODHR (source: author)

Systems thinking introduced the term 'feedback loop' to consider interactions between components in the practice of ODHR projects. As early as 1976 Turner suggested the need to build feedback loops into housing projects; such feedback loops focus attention on "the interaction of the people (or actors) and their products (or achievements) through the medium of their roles and responsibilities (or activities)" (p. 59). More than 40 years later, the need to focus on the interactions between different components of ODHR projects seems even more important, given that global mobilities have brought even more factors into play. Bevc (2013) and Twigg (2009, p. 19), among others, claim that ODHR can be a catalyst for "altering underlying patterns of development".

2.5.3 Sensitivities and capacities of system components and sub-components

Specificities of a context and future aspired outcomes can add two layers of complexity to the conceptual model presented in Figure 2.12. Figure 2.13 draws on the way that the SES concept of resilience has been discussed by a wide range of scholars. This figure integrates feedback and feed-forward loops as proposed by Turner (1976). The outer layer of this model focuses on future expectations, which are a combination of citizen aspirations and/or project objectives of enhancing disaster resilience. This detailed conceptual model provides a foundation for developing an analytical framework and using the research findings of this PhD to develop an operational model for effective ODHR practice.

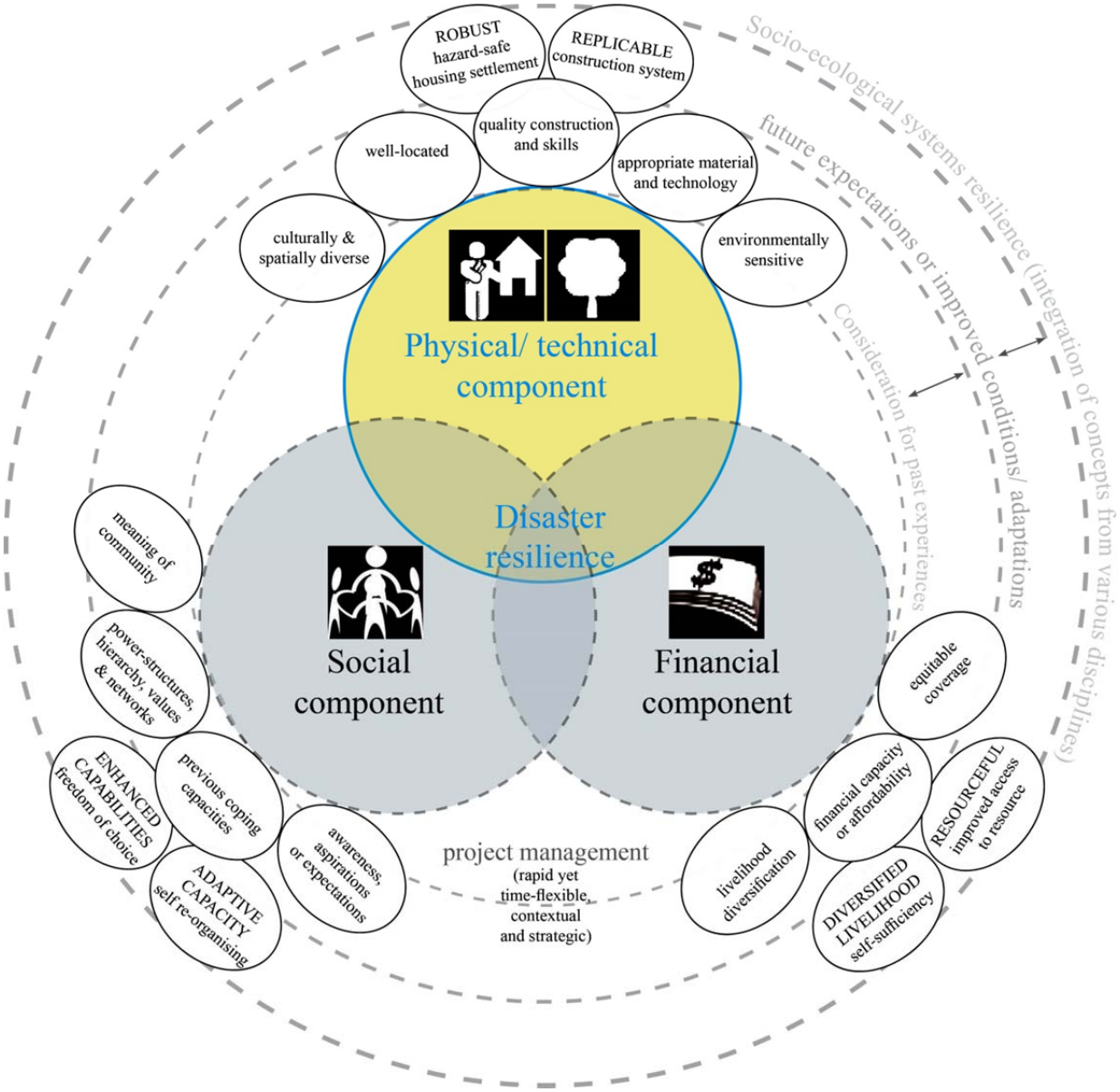


Figure 2.13 Detailed conceptual framework for ODHR within a spatial and temporal systems context, with feedback (and feed-forward) loops between past experiences and future expectations (source: author)

This review and critique of existing literature on the ODHR subject matter since the 1970s reveal that housing reconstruction continues to remain problematic due to various reasons, with a narrow technical focus and/or short-sightedness, being a major one. However, an overview of concepts and frameworks that have been introduced by scholars from various fields of study has certainly influenced ODHR approach and how such projects could potentially create pathways towards disaster resilience and 'development' in the longer term. The literature review also suggests that many concepts (from different fields of study) have been used in a rather shallow manner. The detailed framework proposed in this PhD is an effort in analysing how an ambitious goal (SES disaster resilience) can be achieved by linking the underlying feedback loops and patterns of interaction between system components throughout project development and implementation.

3. RESEARCH DESIGN

A research design can be framed as "a logical plan for getting from here to there", where 'here' is defined as the initial set of questions to be answered and 'there' is some set of conclusions (answers) about these questions (Yin, 2009, p. 26). 'Research design' is a term used to broadly encompass all aspects of the research, including the selection of an overarching research methodology, a particular research method and technique(s), and means of analysis to answer the research question(s) (Bryman, 2004; Evans & Gruba, 2010; Evans, 1995).

The aim of this chapter is to explain how I planned to evaluate the ODHR projects in India, having already considered: 'why' it is imperative to evaluate – to attain the objective of disaster resilience impact as was discussed in the literature review; 'what' to evaluate – the projects and their impacts (hard and soft assets); 'for whom' to evaluate – the primary stakeholders, the beneficiaries; and 'when' to evaluate – long after the disaster (> six years).

This chapter is divided into four sections. The first describes the research methodology, methods, sampling strategy and data collection techniques. The second section develops an analytical framework. The third discusses the research rigour, validity/trustworthiness, quality and ethical considerations. This section also explains the conduct of the field study, which is followed in the fourth by a description of the case studies.

3.1 RESEARCH METHODOLOGY AND METHOD

The research methodology provides an overarching plan for the research design. It can be defined as a "conceptual approach" from which the research method can draw (Grix, 2004, p. 32). Fundamentally, there are three broad research methodologies – qualitative, quantitative and mixed methods.

In this PhD, a qualitative and interpretive methodology is primarily used. As discussed by Vahanvati and Beza (2017), this methodology has been used because the investigation is concerned with identifying project issues that influence "robust results" (Robson, 1993, p. 119) or "program improvement" (Blessing & Chakrabarti, 2009, p. 241). The identification of project/program improvement is also supported through the use of a qualitative methodology,

which seeks to understand a particular context in depth, including the complexities of people's subjective opinions, practices and product outcomes (Blessing & Chakrabarti, 2009). This methodology aligns with the concern of this research – to understand "how things work in a particular context" (Mason, 2002, p. 1). For analysing ODHR project impacts, a qualitative methodology has allowed the author to produce an in-depth understanding and well-founded cross-contextual generalities that have allowed the data to be interpretively analysed (Robson, 1993).

Although the investigation is predominantly qualitative, some features of a quantitative methodology have been adopted. Quantitative methodology is capable of providing breadth, rather than depth (Grix, 2004; Yin, 2009). In essence, the techniques used in this methodology are closed methods of enquiry, which include experiments, surveys and regression-based techniques (NONIE, 2009). This PhD is focused on examining long-term impacts of ODHR projects in terms of disaster resilience in housing and communities, which has far too many variables to eliminate bias or error in the findings, thus undermining the reliability of a wholly quantitative methodology.

A mixed methodology involves a mix of qualitative and quantitative data collection methods (Robson, 1993) and it is considered suitable for conducting impact evaluations of reconstruction projects (ALNAP, 2006; NONIE, 2009).

3.1.1 Research methods

A research method, which sits within a methodology, provides the specific "techniques or procedures used to collate and analyse data" (Grix, 2004, p. 31) to appropriately answer the research question (Blaikie 2000: 8). As the research methodology provides a bird's eye view, the research method provides a zoomed-in view of the research. It serves two purposes – to identify both "methods of data generation and data sources" (Mason, 2002, p. 25), that is, how to get evidence, from whom and where.

Case study research methods are appropriate for investigating the outcomes of particular ODHR projects. As discussed in Vahanvati and Beza (2015), case study research is defined as empirical enquiry that "investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Schramm 1971 in Yin, 2009, p. 13). Case study research allows an understanding of

context-specific issues, such as specific hazards, local socio-economic conditions and how the different elements of a project interact with each other. The strength of case study research lies in its ability to draw on a variety of forms of evidence (such as documents, artefacts, interviews and observations) which are not limited to qualitative evidence and hence it supports a mixed methods methodology (BetterEvaluations, n.d.; Robson, 1993; Yin, 2009).

Case study research has often been associated with particular academic disciplines, such as ethnography (Madden, 2010). However, since this PhD is concerned with the process of housing as a social artefact (Ahmed, 1998) in the complexity of disaster, it draws on a combination of approaches from social sciences and architecture (Vahanvati & Mulligan, 2017). Thus, this PhD is multidisciplinary case study research which bridges the disciplinary divide.

Case study research has also been adopted because it has an evaluative capacity suitable for comparing ODHR project outcomes (Robson, 1993, p. 119). It has been argued that an evaluative method is the most suitable way of investigating (Davis, 1978b; Gray et al., 1980) ex-post-reconstruction projects (after completion) (Lizarralde, 2002). Understanding whether or not a reconstruction project met its strategic objectives is half of the story; the other half is how and why the intervention met its particular objectives or not (ALNAP, 2006; NONIE, 2009).

While there are many tools for evaluating projects, impact evaluation has been considered most appropriate for this study (ALNAP, 2006). Impact is defined by the Development Assistance Committee of the OECD (DAC) (ALNAP, 2006, p. 56) as:

> the wider effects of the project – social, economic, technical, environmental – on individuals, gender- and age-groups, communities and institutions. Impacts can be intended and unintended, positive and negative, macro (sector) and micro (household) … assessment of impact usually examines the longer-term consequences of achieving or not achieving those objectives, and the issue of wider socioeconomic change.

As this definition indicates, the impacts are the wider effects of an ODHR project, not only those that were intended. Impact evaluation has also been called a “black box” approach, concentrating on “what goes into the box (i.e. the project processes), and in particular what

comes out" (Robson, 1993, p. 180). An impact evaluative case study approach has allowed the researcher to go beyond explaining the impact of ODHR projects by focusing on "the presumed causal links in real-life interventions" (Yin, 2009, p. 19-20), including "a decision or set of decisions: why they were taken, how they were implemented, and with what result" (Yin, 2009). However, as the definition suggests, assessment of impact may involve "multiple simultaneous causes for the outcomes, and causal mechanisms differing across contexts and complex (recursive, with feedback loops, and with emergent outcomes)" (NONIE, 2009, p. X).

There is a two-fold challenge in conducting an impact evaluation of a case study. First, the impact is the last stage in a project's life cycle (inputs > activities > outputs > impacts) and, second, case study research has been criticised for a lack of "research rigor and limited basis for generalization of study's findings beyond immediate case study" (Vahanvati & Beza, 2015, p. 367-364). To deal with the issue of long-term assessment, the "attribution problem" is proposed by NONIE (2009, p. 11-14) and ALNAP (2006) (see Section 3.1.2). According to this approach, informal control groups of the affected population who have not received assistance can be interviewed, because circumstances usually make it impossible to set up more formal control groups (ALNAP, 2006, p. 57). It is important to note that the attribution problem is not a comparison between the 'before' and 'after' conditions of people affected by an intervention; rather, it is a comparison of the situations of communities who were affected by an intervention versus those who were not.

In relation to the above 'obstacles', Yin (2009) suggested that case study research can overcome some of these limitations by following the logic of four tests: 1) construct validity; 2) subjectivity (internal validity); 3) external validity (generalisation); and 4) reliability. Research rigour is mainly reliant on construct validity and a researcher's own "subjective" judgements of the case under investigation (Yin, 2009, p. 41-42). To meet the test of construct validity, Yin (2009) highlighted the need to develop a conceptual framework for an investigation (see Figures 2.12 and 2.13). In order to be able to make generalisations (external validity) or theorise findings, Yin (2009, p. 43-44) also suggested selecting multiple case studies for comparison or otherwise applying "replication logic", which means assessing the outcomes from one case study and checking whether the same results emerge/are replicated in another case. However, the long time frames of ODHR work make this very difficult, so the former route has been taken in this PhD. As Robson (1993, p. 161) noted, "if multiple good-practice projects with similar or complementing factors (processes) are selected and they arrive

at similar results, then it has potential for analytic generalization".

3.1.2 Sampling strategy

Purposive sampling has been used to ensure that the multiple case studies drew on a range of comparable experiences and perspectives (Vahanvati & Mulligan, 2017). The idea of purposive sampling is for the researcher to first carry out initial sampling guided by a conceptual framework. This initial sample information is then used to direct the selection of final samples fit for the purpose of this PhD research. Final samples are selected, informed by the 'gatekeepers' or 'key informants' (Robson, 1993), which in the case of India were community leaders (*panchayats* – meaning informal rural village leaders) and social workers from local CSOs, respectively.

To enhance the validity of data, some form of triangulation is recommended (Mason, 2002). In order to finalise the sample, the author had to make decisions on the 'who, where, when and what' of the cases. The answer to the question of 'who' has provided insights into positive and negative impacts of the ODHR projects, relying on the perspectives of the primary stakeholders – the disaster-affected households and communities who benefited from the housing reconstruction projects. Apart from the primary stakeholders, data was also collected from two other sample groups, as shown in Figure 3.1.

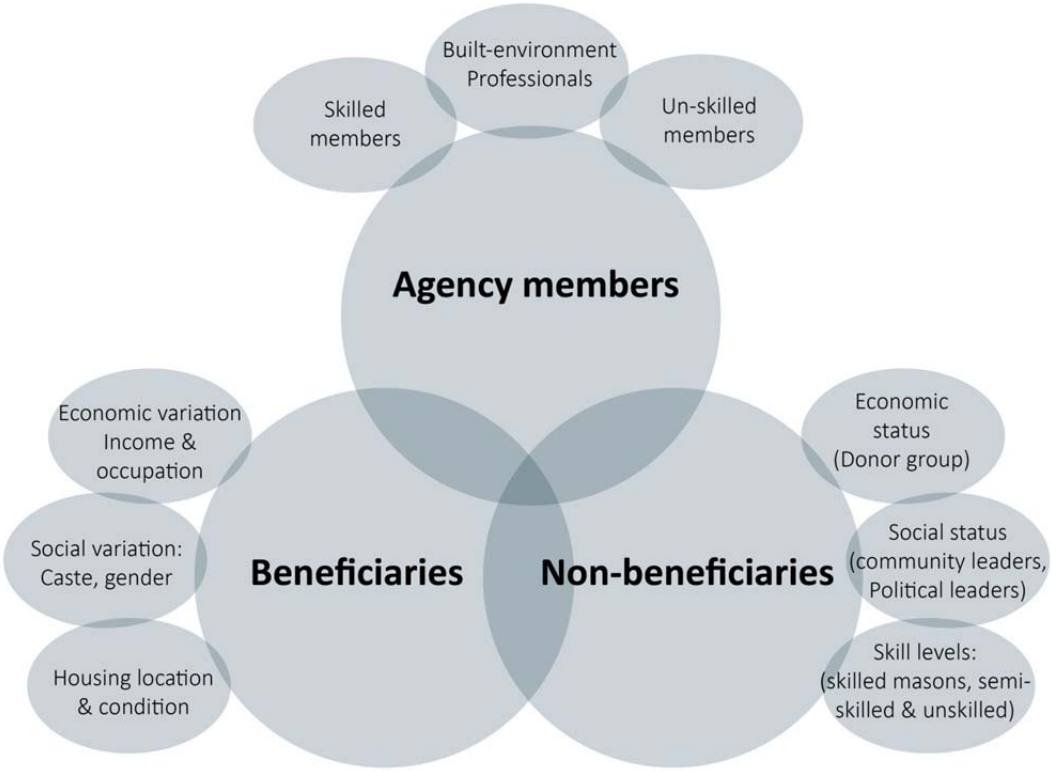


Figure 3.1 Triangulation of data from three respondent groups i.e. samples (source: author)

This figure also shows how particular samples were purposively identified from within these three groups (for triangulation), as follows:

1. Beneficiaries: were selected based on their socio-economic grouping – gender, caste, occupation, age, income and housing typology/condition. However, since beneficiaries' views may be biased or coloured by their own experiences and aspirations, their views may not provide a complete picture of reconstruction projects
2. Non-beneficiaries: included disaster-affected people who did not benefit from a housing reconstruction project. To address the attribution problem, the non-beneficiaries' views and conditions have been corroborated against those of the beneficiaries
3. Agency members: included CSO staff, professionals such as architects, engineers, construction managers, other stakeholders from government authorities, donors and masons

"A small sample of approximately ten household residents, five agency representatives (architects, engineers), and three other stakeholders were selected from each case study project" (Vahanvati & Mulligan, 2017, p. 6). Typically, a small sample of 12–18 is recommended for carrying out qualitative research in order to obtain depth of information (Bryman & Burgess, 1999; Jacob & Furgerson, 2012; Maxwell, 2005). The number of beneficiaries was kept high as it was essential to represent their views adequately and this also constitutes an ethical requirement of researchers. Moreover, the views of non-beneficiaries were recorded only for the purpose of comparing them with those of the beneficiaries (the attribution problem/challenge – see Section 3.1.1).

The answer to the question of 'where' these respondents were interviewed is simple. The beneficiaries were interviewed in their homes so they could demonstrate any positive and/or negative issues with the (re)constructed house's quality and link these back to their perceptions. Similarly, the non-beneficiaries were interviewed in their own context: in or near their homes. There were challenges in organising interviews with agency members and government officials, as some had moved to other roles or other organisations. Hence, a variety of interview formats were needed, from face-to-face interviews at their offices to video-calls (via Skype or other digital means).

3.1.3 Data collection technique, analysis and interpretation plan

Data collection techniques answer the question of how the author obtained information, once the who, where, when and what questions have been answered (Robson, 1993). Given that this research is following a mixed methods methodology from a multidisciplinary perspective, a range of techniques were used to collect the data.

As discussed by Vahanvati and Mulligan (2017), data collection in the publications primarily relied on the social science research methods of semi-structured interviews and focus group discussions (Mason, 2002; Robson, 1993). The interview questions were partly structured in accordance with the system components identified in the conceptual framework, for having "conversations with a purpose" (Mason, 2002, p. 62). Such interviews were not tightly structured so as to provide greater freedom in the sequencing of questions and amount of time and attention allocated to different topics, in order to allow new issues to emerge (Robson, 1993). The purpose of interviews with the households was to enable them to tell their own stories and to use their own knowledge and interpretations of experiences and interactions during and after the housing reconstruction process (Mason, 2002).

Often in the Indian context focus groups are inevitable, as people in the surrounding area tend to join in conversations. The benefit of group conversations is that they can act as ice-breakers, opening up issues for discussion among people who have had similar experiences in an informal setting. However, the disadvantages are that it becomes almost "impossible to follow up the views of individuals; and group dynamics or power hierarchies affect who speaks and what they say" (Robson, 1993, p. 241). Hence, focus group discussions were used sparingly. Architectural discipline specific techniques such as photographs and sketches of housing and settlements were also used as discussed by Vahanvati and Beza (2017). Comparisons of houses that were rebuilt after the disaster with newly extended ones and those of the non-beneficiaries have allowed the author to examine houses' robustness, acceptance of the proposed technology by residents and the impact of the construction method on other aspects of the households. Some secondary data sources – such as CSO and government documentation – were also used to follow up issues raised in interviews and conversations.

The quantitative technique of small surveys on a sliding scale of 1–5 has been used to complement the qualitative research. In this regard, for quantitative data collection a hurdle to overcome was the illiteracy of respondents. Consequently, self-administered postal surveys or

questionnaires were not feasible. Hence, small surveys were conducted along with semi-structured interviews to allow the PhD author to measure respondents' satisfaction with various aspects of the ODHR approach (on a sliding scale of 1–5).

Data analysis does not only take place after all data has been collected, for it can begin as early as the literature review in order to explore the research themes and questions (Robson, 1993; Yin, 2009). It occurs at different stages in the research process and is iterative or non-linear. Nevertheless, the overall approach to data analysis can be summarised as:

2 establish a conceptual and analytical framework (see Figures 2.12 and 2.13)
3 conduct a research analysis
4 refine the framework

A thematic or content analysis of the qualitative data was used to group the research findings into key processes, within the identified themes of the conceptual framework, as explained by Vahanvati and Beza (2016). In addition, quantitative data analysis was conducted via an Excel spread sheet. The analysis of the small quantitative surveys was then integrated into the much larger analysis of the qualitative data.

3.2 ANALYTICAL FRAMEWORK

Based on the review of the literature, four main categories of evaluation frameworks were identified: 1) generic evaluations; 2) program evaluations; 3) project output (housing product) evaluations; and 4) humanitarian action evaluations.

As discussed in the literature review (Chapter 2), LFA is a widely used generic evaluation tool due to its ability to provide logical links between the main elements in a project (CAPAM, 2004). Program evaluation tools such as the Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS) (United Nations et al., 2006) and that of IFRC (2008a) have been used by researchers to evaluate specific programs. While such program evaluations are useful, they are typically large scale, require many resources and are predominantly quantitative, which is not the purpose of this PhD. Those project output evaluations were designed to examine houses' suitability, habitability or affordability. This PhD is specifically critiquing such evaluations, which focus narrowly on houses as the output, rather than the long-term disaster resilience (see Chapter 2). Some examples of project output evaluation

frameworks, as suggested by Ahmed and Charlesworth (2015, p. 302), are: “ASPIRE by Arup and Engineers Against Poverty (Pearce and Batchelor, 2010); Post-Occupancy Evaluation by Emergency Architects (EAA, n.d.); and Adequate or Minimum Housing Standards by Habitat For Humanity (HFHA, n.d., a; HFHI-SL, 2009)”.

The fourth type, humanitarian action evaluations, are concerned with the quality of intervention, the accountability of agencies and the rights of the beneficiaries, not with the disaster resilience impact of projects. Examples are the framework developed by ALNAP (2006), the Core Humanitarian Competency Framework (CHCF) by Core Humanitarian Standards (CHS Alliance, n.d.) (previously known as the Humanitarian Accountability Partnership – HAP) and the Humanitarian Accountability Framework by the Sustainable Environment and Ecological Development Society (SEEDS, 2012). Such evaluations of humanitarian actions are typically large scale and inter-sectoral, which is beyond the feasibility and intent of this PhD. Only the LFA aligns with the intent and practical feasibility of this PhD, as discussed below.

3.2.1 The logical framework analysis

As discussed earlier in Section 2.4.5 the LFA was found to provide a perfect fit for this PhD. Despite its weaknesses, such as mainly been used to design, monitor and evaluate ongoing projects, rather than completed ones, LFA is adopted in this research for two reasons. One, it allowed for conducting mixed-methods research and two, it allowed for establishing causal linkages between four distinct project life-cycle phase, as follow (Baum, 1970; Steinfort, 2017):

Phase I. INPUTS
Phase II. OUTPUT
Phase III. RESULTS/ OUTCOMES
Phase IV. IMPACTS (UNINTENDED OUTCOMES)

Such a project life-cycle approach of LFA is found to be a useful way of conceptualising impacts. While this PhD predominantly focuses on Phase IV, the phases are never strictly sequential or siloed, and tend to merge into one another. Moreover, since the earlier phases largely determine the long-term consequences, the interviews and discussions focused on all the project phases.

3.2.2 Analytical framework for impact evaluation of ODHR projects

As well as looking at the phases of ODHR projects, the literature review has explained why it is important to focus on different project components, specifically:

1 physical/technical components
2 social components
3 economic components
4 project management components

Moreover, the author's interest in the disaster resilience impacts of ODHR projects means that the identified components of disaster resilience need to be kept in mind; specifically: robustness; redundancy; resourcefulness; rapidity; and adaptive capacity.

This PhD has developed an analytical framework based on a modified LFA proposed by Lizarralde (2002) for the evaluation of projects post-completion (termed 'ex-post-evaluation'). The proposed analytical framework has also been informed by the work of Ahmed and Charlesworth (2015) and the socio-technical assessment of post-tsunami reconstruction interventions in the Indian state of Tamil Nadu by the UNDP and Hunnarshala (2006). Table 3.1 outlines that, apart from the technological and social aspects of housing, the sustainability of projects is also considered, the description of which aligns with the characteristics of disaster resilience.

Table 3.1 Multiple criteria for socio-technical assessment of post-tsunami reconstruction in Tamil Nadu (adapted from UNDP & Hunnarshala 2006)

TECHNICAL FACTORS OR SUB-COMPONENTS	DESCRIPTION
Construction system	Hazard-specific resilient technology integrated Quality control Compliance with guidelines Building materials and labour skills
House design	Plan (dimensions/building aspect ratio) Spatial layout/functional provision (culturally sensitive) Extension possibility
Settlement planning (& location)	Settlement layout plan (open space) Location (elevation, waterlogging) Public buildings Infrastructural services (groundwater table, water supply, waste disposal)
Sanitation	Toilets Wastewater treatment
Sustainability	Robust construction system Diverse Sustainable (replicable and environmentally friendly) Cost-effective (low maintenance) Enhanced adaptive capacities of communities Livelihood potential (resourcefulness)

Table 3.2 shows the analytical framework, which combines the four project components (technical, financial, social and project management) with the resilience goal through the four project life-cycle phases (as described above). The table incorporates the resilience factors of the technical component of ODHR (numbers 2, 6, 9, 12 and 13), the financial component (3, 7, 11 and 14), the social component (1, 5, 8 and 15) and the PM component (4 and 10). It must be noted that ecological sustainability is considered a cross-cutting issue which is part of all the project phases and decision-making processes.

Table 3.2 Analytical framework for impact evaluation of ODHR projects in enhancing disaster resilience (source: author)

Project cycle	Resilience factors	Key questions
Inputs/planning & design	1. Participatory	Were residents engaged in decision-making?
		Were residents in charge of their house design and its location?
		Was socio-financial support provided (e.g. access to funds/land title)?
	2. Context sensitivity	Were disaster-safe technologies incorporated?
		Were spatial layout, functions and dimensions contextual?
		Were basic amenities and infrastructure incorporated?
		Were the community's past coping mechanisms incorporated?
		Was the rural technology legal?
	3. Equitability/ coverage	Did the community have a say in beneficiary selection?
		Was funding for the housing project provided by government authorities?
		Was the housing assistance uniform for all beneficiaries?
		What was the means of assistance delivery? (M=material, C*3=cash in 3 instalments)
		Were both male and female residents in control of assistance?
	4. Agility	Was an incremental approach used to tailor a contextually appropriate reconstruction project?
Activities	5. Ownership	Were residents in charge of technology selection?
		Were residents in charge of labour selection?
	6. Quality	Were construction materials provided to residents?
		Was the quality of construction good and managed collaboratively?
	7. Capacity building	Was livelihood or training integrated in housing construction assistance?
		Were locals provided with skills training and employment in safe construction?
		Was the cost of housing acceptable?
Outputs/short-term outcomes	8. Pertinence	How satisfied are residents with the consultation? (%)
		Did the most at-risk people benefit from this project?
		Did the resilience options meet residents' needs?
	9. Multi-hazard safety	Do residents feel safe in resilient housing?
		Are the resilient houses environmentally 'good'?
		Is the housing outcome diverse?

	10. Rapidity	Was the time frame efficient and sufficient?
	11. Effectiveness	Are the houses cost-effective to maintain and repair?
		Are productive assets hazard-insured? (%)
		Has funding been allocated for infrastructure and for livelihood support?
Impacts/long term outcomes	12. Robustness	Is the resilient housing technology replicated?
		Have the housing and settlement survived any hazards since construction?
	13. Redundancy	Has redundancy (physical or functional aspect) been built into housing?
	14. Resourcefulness	Has the project enhanced entrepreneurship in building material supply?
		Has residents' capacity to access resources (information, finances, materials and skills) improved?
		Have residents' livelihoods diversified/improved since project completion?
	15. Adaptive capacity	Has the PDR project enhanced residents' awareness of risk?
		Is the local community organised to maintain housing resilience?
		Has the project increased the safety and dignity of women, children and elders (social change)?
Strategic goal: disaster resilience		Has the ODHR project enhanced the disaster resilience of human systems (coupled with socio-ecological systems)?
		Is multi-hazard, safe technology replicated and rooted in local livelihoods?
		Is risk awareness fresh in local residents' minds?

3.3 RESEARCH RIGOUR, TRUSTWORTHINESS AND ETHICS

Ethics approval for this PhD was granted by RMIT University's Human Research Ethics Committee on 18 December 2012. The ethics approval number is CHEAN A-2000780-09-12 (see a copy of the approval in Appendix B). During the field study, prior to interviews respondents were given a clear understanding of the purpose of the project and the risks and rights that were covered by the approved research methods. Those who could not sign a consent form gave consent via voice recording. The confidentiality of research participants has been ensured by using identity codes such as HA-X 2014, where H refers to the location, A refers to 'agency member' and X is the number assigned to each respondent followed by the year of interview.

The data was collected in two stages. The first reconnaissance field trip was conducted in November–December 2012. For the author of this PhD, it was important to have first-hand confirmation of whether the identified case studies were appropriate for answering the research questions. During the first field trip, 15 agency members and a few residents were informally interviewed. This initial field trip allowed the author to confirm the selection of case studies, make contact with key informants and refine the data collection approach based on a better

understanding of the challenges involved. The challenges for the author included the need for extra care when venturing into remote parts of Bihar, as the region is notorious for organised crime, political instability and lack of electricity. In addition, almost all the rural settlements did not have access to proper toilets. The second and major field trip was conducted in October–December 2014, which included interviewing 35 beneficiaries, 19 agency members and 9 non-beneficiaries.

3.4 RESEARCH CONTEXT: INDIA'S DISASTER MANAGEMENT

India has been chosen as the context for this research primarily because the Government of India has been at the forefront of ODHR policy and practice, on a large scale, since the 1990s. At the same time, India's growing disaster risks, discussed below, are associated with its geographical setting, as well as a host of other complex challenges. Aside from such challenges, India is also the world's largest democracy and home to some of the most ancient civilisations, with immense diversity of people, languages and cultural traditions. India offers strengths as well as weaknesses for assessing post-disaster recovery interventions. While disasters come in many forms and occur in varied contexts, it is important to consider the international relevance of ODHR experiences in India in seeking to address the research gaps.

India is one of the ten most disaster-prone countries in the Asia–Pacific region (Relief Web, 2011) (see Figure 3.2). Geographically, out of 31 states and union territories in India, 22 are identified as disaster prone (SEEDS, 2007), with approximately 12% of the total landmass being flood prone (Kumar, 2009), nearly 50% located in moderate to high seismic risk zones and almost 75% of its coastline prone to cyclones and storm surges (NIDM, 2010). As identified in Figure 3.2, India's multi-hazard risk is associated with five distinctive geographical regions – the north and north-eastern Himalayan region, the alluvial plains, the central desert, the hilly part of the peninsula and the coastal zones (GoI & UNDP, 2011). The two circled regions in Figure 3.2 – the north-eastern alluvial and Himalayan foothills region of Bihar, and the central western desert region of Gujarat – are the focus of this PhD.

As highlighted in Vahanvati and Beza (2015, p. 367-362) in the last 15 years the country has experienced some high-profile, rapid-onset disasters such as tsunamis, cyclones and earthquakes, as well as slow-onset disasters such as floods and droughts which occur on a regular basis. The global toll of disasters on human lives and the national economy has risen

substantially since 1999, especially in Asia and Africa (Guha-Sapir et al., 2012). For instance, as shown in Table 3.3, in India in 1999 as a result of the Orissa supercyclone, 10,000 human lives were lost and 1.6 million houses were damaged, in 2001 as the result of an earthquake in Gujarat over 1 million houses were damaged and in 2008 the Kosi River flood resulted in damage to over 2 million houses (NIDM, 2001, 2010).

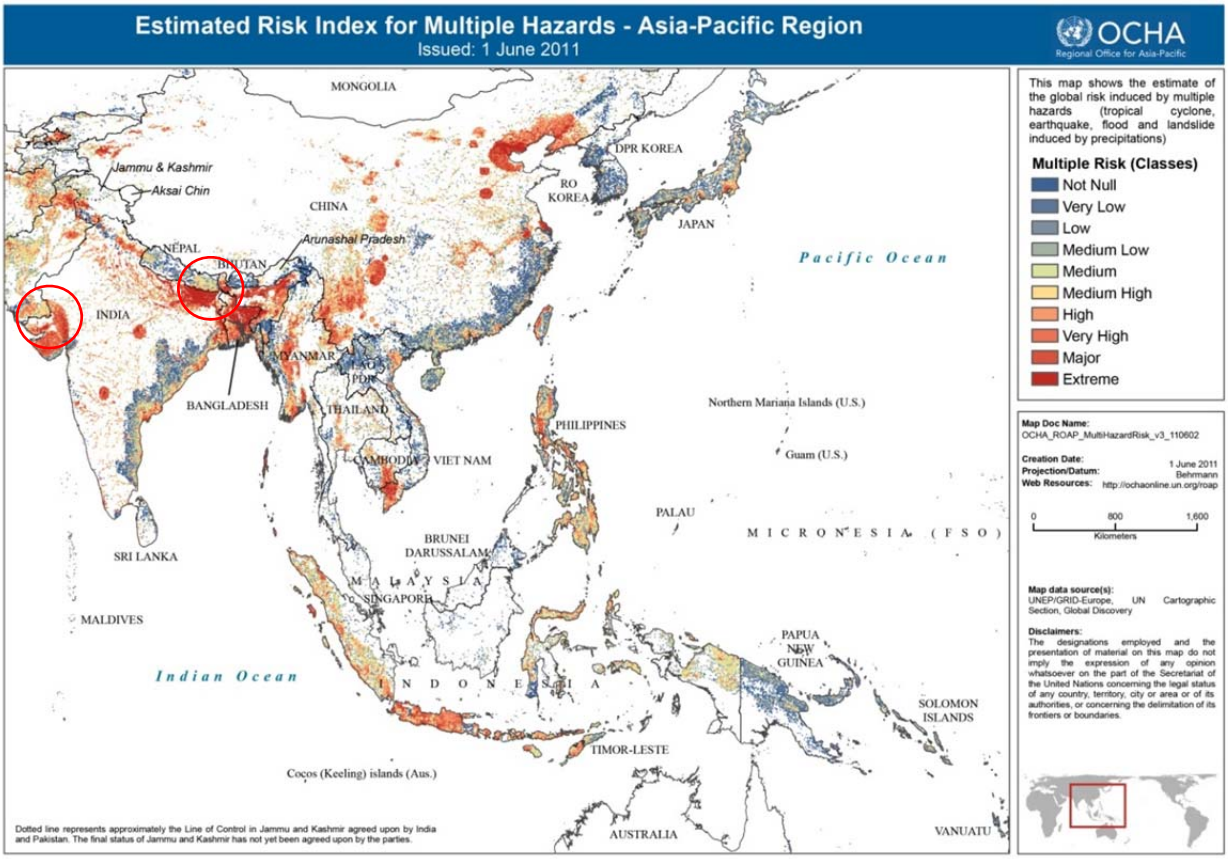


Figure 3.2 Multi-hazard map of India with Gujarat and Bihar highlighted due to extreme risk; the two circled areas are the locations of the case studies examined in this PhD (source: Relief Web, 2011)

Table 3.3 Impact on lives and houses after major disasters in India; the highlighted disasters are the case study regions examined in this PhD (source: GoB et al., 2010; GoI & UNDP, 2011; NIDM, 2001)

Disaster	Human + livestock deaths	Affected	Houses damaged
1999 Orissa supercyclone	10,000	unknown	1.6 million
2001 Gujarat earthquake	13,805	1.67 million	>1 million
2004 Indian Ocean tsunami	10,749 + 5640 missing	2.79 million	139,881
2005 Pakistan earthquake	86,000	unknown	unknown
2008 Bihar, Kosi River flood	527 people + 19,323 livestock	3,329,423	236,632
2010 Leh, cloud burst	196 + 65 missing	unknown	3661

Apart from hazard exposure, India's disaster risks have been exacerbated by rapid population growth and deep-rooted structural issues such as socio-economic disparity, political instability and unsafe housing construction practices (NIDM, 2001). Presently, India is the world's second most populous country – exceeding 1.2 billion – and accounts for one-sixth of the

global population (UN-DESA Population Division, 2011). At the same time, India is also one of the world's fastest growing economies (UNDP, 2013). On average, India loses about 2% of GDP each year to disasters (GoI & UNDP, 2011). Rapid population growth and accelerated economic development, combined with urbanisation, are putting pressure on housing, land security, livelihoods and the environment (NIDM, 2010). Furthermore, India faces a land shortage as it has to accommodate a rapidly growing population on a land surface area of about 2.4% of the planet (Census of India, 2011d). In 2003, as per Hause (2003, p. 87), India had an approximate density of 789 people per square mile (roughly translated to 305 people per square kilometre). As shown in Figure 3.3, in 2011 an estimated 77% of the entire building stock constituted housing. The great majority of Indian housing is in poor condition (not only informal settlements, but also urban settlements) due to poor regulations or unscrutinised construction practices (Shah, 2012; Unnati, 2008).

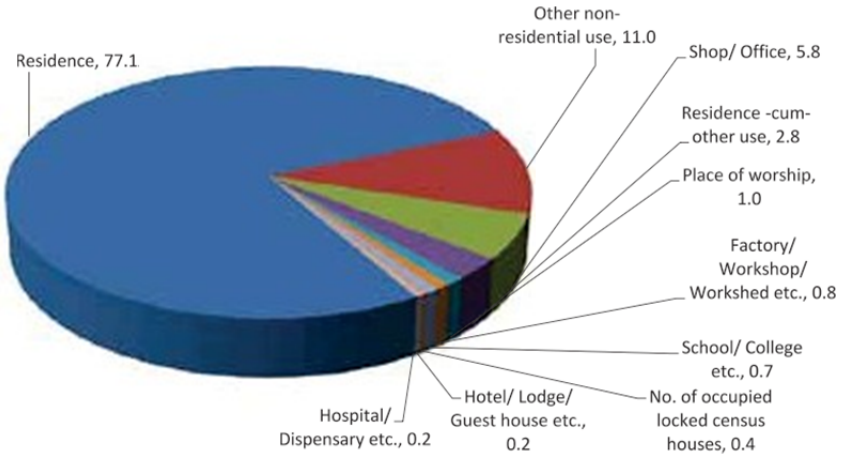


Figure 3.3 Percentage of houses in India (source: Census of India, 2011c)

The rising threats of hazards combined with poor-quality housing put three-quarters of India's building stock at risk. The need to build resilience in housing and human settlements is an urgent one in India. However, as the following section expands, the Indian Government has been at the forefront of holistic disaster management as well as adopting ODHR policies and implemented them on a large scale since 1993, as discussed in the following section.

3.4.1 India's disaster management

As a federation, the states have primary responsibility for disaster recovery management in India. As shown in Figure 3.4, the Government of India has a well-established National Disaster Management Policy, with emphasis on holistic disaster management as a continuous process. This policy also clearly defines the roles and responsibilities of various government

authorities in a hierarchical structure (GoI & NDMA, 2011). For example, after a disaster the National Disaster Management Authority (NDMA) develops the overall policy and guidelines for the state government, and mobilises funding. The State Disaster Management Authority (SDMA) takes the responsibility for rescue, relief and rehabilitation, as well as long-term disaster preparedness. The District Disaster Management Authority (DDMA) takes the responsibility for planning, coordination with various agencies and implementation of relief and reconstruction efforts (GoI & UNDP, 2011). The DDMA has the power to enforce necessary safety standards.

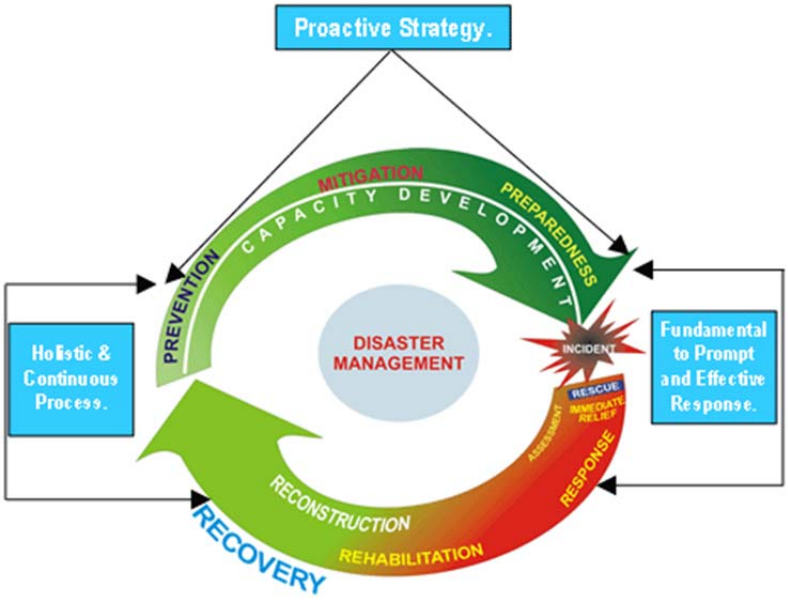


Figure 3.4 Indian Government's holistic and proactive disaster management continuum (source: NDMA & IGNOU, 2012, p. 21)

Table 3.4 Key dates and developments in India's disaster management

Date	Event description
1990	Establishment of permanent institutional set-up, mainly focused on emergency relief under Ministry of Agriculture, during the UN International Decade for Natural Disaster Reduction (IDNDR)
1993	Promotion of ODHR approach after Latur earthquake in some villages
2001	Adoption of ODHR policy by Gujarat state government for first time in Indian history
2002	Disaster management division shifted to Ministry of Home Affairs, with focus on long-term recovery that extends beyond relief
2005	Disaster Management Act – for implementing, drawing on and monitoring disasters through institutional mechanisms
2005	Set up National Disaster Management Authority (NDMA)
2005	Adoption of ODHR approach by Kashmir state government after the earthquake
2008	Kosi River flood in Bihar – evolved form of ODHR adopted by state government

Table 3.4 encapsulates key dates and major shifts in India's disaster management, highlighted in the red box. These two programs – post 2001 Gujarat earthquake and post 2008 Kosi River

flood – are of particular relevance for this PhD research focused on ODHR. As described by Vahanvati and Beza (2015, p. 367-363), the Indian Government has progressively evolved its reconstruction approach since the 1990s, including:

- a shift from a charity-based to an enabling approach (Barenstein & Iyengar, 2010); and
- development in disaster management from a top-down, government approach to an inclusive, multi-stakeholder–driven governance approach (UNDP & Abhiyan, 2005)

3.4.2 Disaster recovery management, post 2001 Gujarat earthquake

In 2001, India saw a unique disaster recovery program – an ODHR – the likes of which had never been witnessed before. After the earthquake on January 26, the Indian Republic national holiday, the state Government of Gujarat (GoG) was devastated by the second-largest recorded earthquake in Indian history (after 1737 or in the last 280 years) (GoI & UNDP, 2011). As discussed by Vahanvati and Mulligan (2017), an ODHR policy was adopted for the first time in the Indian history of disasters (UNDP & Abhiyan, 2005). Within two weeks of the earthquake, a new nodal agency – the Gujarat State Disaster Management Authority (GSDMA) – was established to lead disaster management activities (GSDMA, 2001a).

As shown in Figure 3.5, a top-down, hierarchical structure, from national to local level, was set up for disaster management in the state. The figure also shows that non-government organisations (NGOs), CSOs and the private sector became involved in the process only during the implementation phase. In a record two years' time, the GoG claimed to have rebuilt over 200,000 houses and repaired over 900,000 houses, making this the world's largest and fastest housing reconstruction program (Price & Bhatt, 2009, p. 9). For this reason, as discussed by Vahanvati and Mulligan (2017), the GSDMA was awarded the prestigious UN Sasakawa award in 2003 (GSDMA, 2005) and a Commonwealth award for making a "paradigm shift from the conventional approach from response post disaster to mitigation and preparedness" (CAPAM, 2004, p. 5).

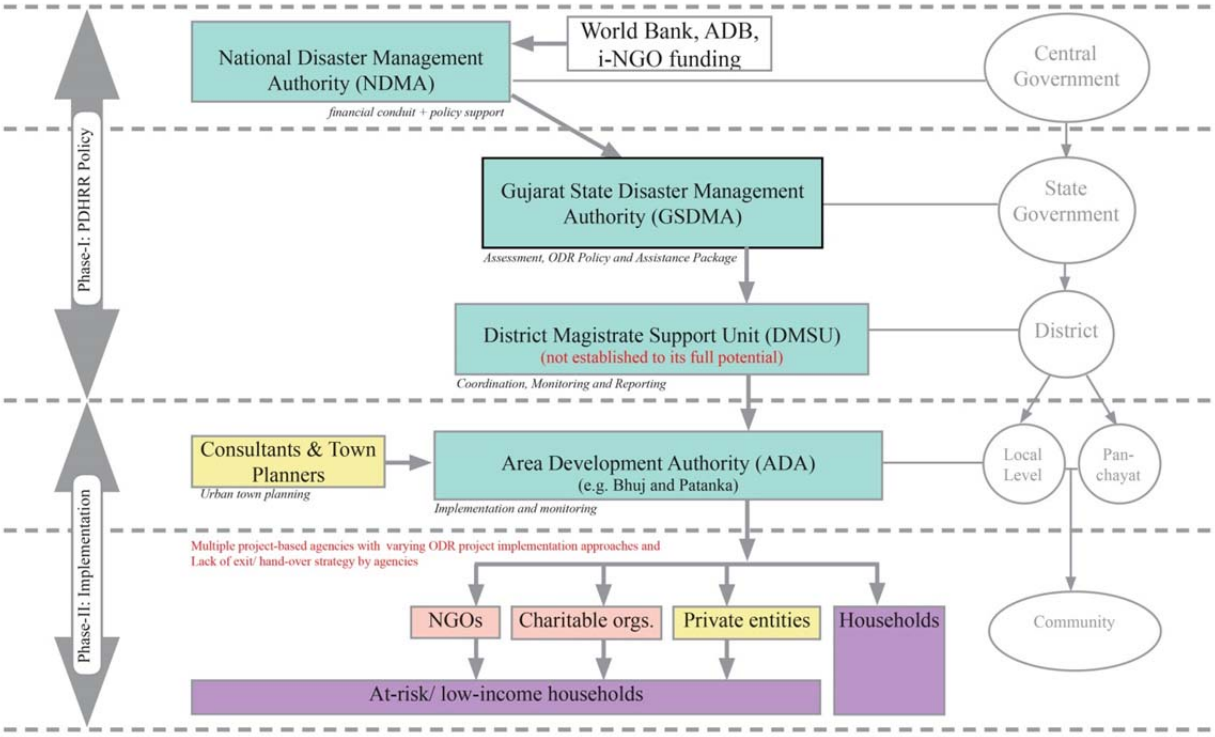


Figure 3.5 Institutional structure with roles and responsibilities for management and implementation of ODHR in Gujarat post 2001 earthquake (source: author)

3.4.3 Disaster recovery management, post 2008 Bihar Kosi River flood

Once again, after the 2008 Kosi River flood the state Government of Bihar (GoB) followed an unprecedented recovery effort, in a context where the already poor and marginalised people had never seen a recovery effort. While the floods were believed to have been caused due to a rupture in the river's embankment on the Nepal side of the Nepal–India border, the GoB also acknowledged their mistake in having tampered with the river's natural flow by building dams. The devastation was so massive that it was declared a national calamity by the federal government.

As discussed by Vahanvati and Mulligan (2017), the GoB had invited an owner-driven reconstruction collaborative (ODRC) for policy advocacy. The ODRC was a consortium of approximately 27 organisations, including the UNDP, national and state Disaster Management Authorities, Indian CSOs (Abhiyan, SEEDS, Unnati etc.), the Asian Coalition for Housing Rights (ACHR) and the World Habitat Centre, Switzerland, among others (GoB & ODRC, 2008b, p. 3). Figure 3.6 shows that Bihar was leading the way in a decentralised governance set-up. The special disaster management authority at the national level – the Bihar State Disaster Management Authority (BSDMA) – which was established just nine months prior to the floods, was working collaboratively with the ODRC from the early days after the floods. At

that time there was no special purpose vehicle (SPV) at the district level, so the district magistrates were proposed to act as one. Apart from that, the governance set-up in Bihar was highly decentralised (GoB & ODRC, 2008a). For the first time in Indian history, the agencies were given a chance for advocacy and were not only implementing ODHR projects.

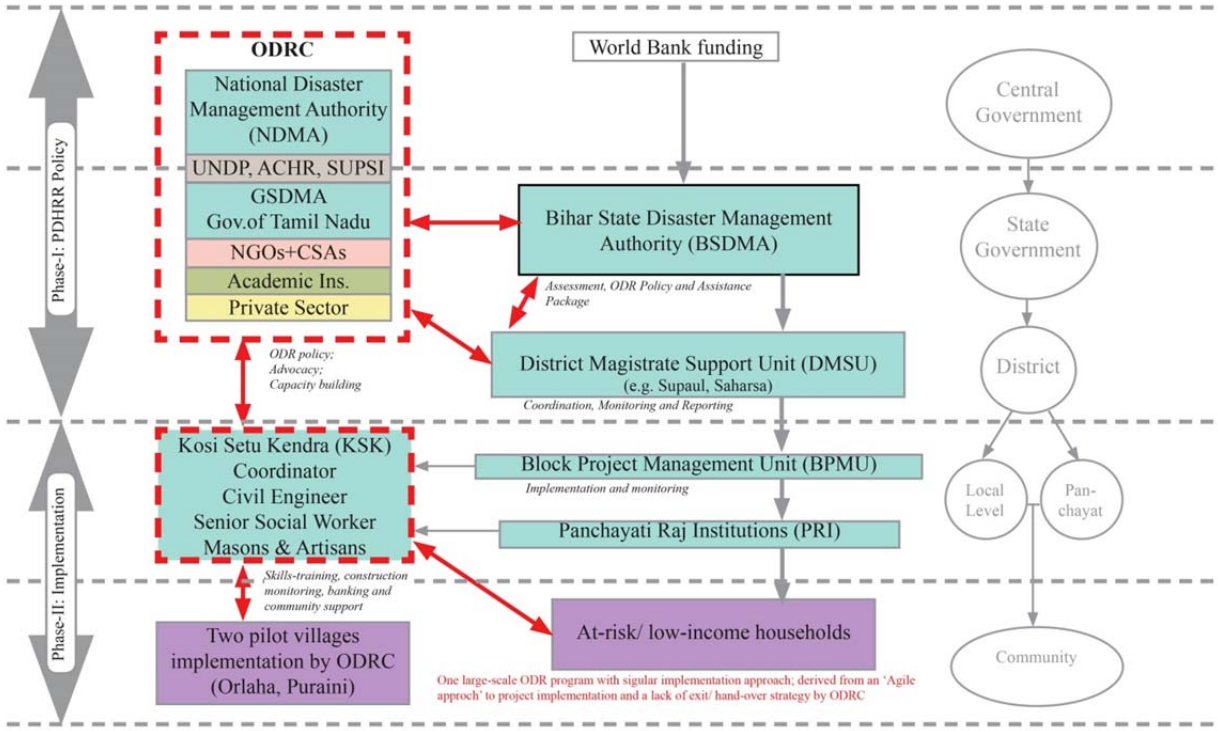


Figure 3.6 Institutional and organisational structure with roles and responsibilities for management and implementation of ODHR in Bihar post 2008 Kosi River flood (source: author)

3.5 SELECTION AND DESCRIPTION OF CASE STUDIES

This PhD conceptually compares the macro-scale governance set-ups in Gujarat (in 2001) and in Bihar (in 2008), as well as the reconstruction responses to two different disaster types – earthquake and flood – that occurred in different socio-ecological and economic contexts. However, it thoroughly compares on-ground ODHR projects' (as cases) implementation and its long-term impacts in Gujarat and Bihar.

3.5.1 Selection of case studies

The selection of the case studies was based on the key selection criteria, informed by three of the four project components discussed earlier:

(i) physical/technical: disaster-resilience features explicitly incorporated in housing

(ii) social: owner-driven or community participatory approach

(iii) economic: upfront consideration of skills training and capacity building

Table 3.5 shows that, apart from similarities in terms of the key selection criteria, the four ODHR projects selected as cases had enough variables to ensure that the findings would have wider relevance. Variation was sought in terms of hazard exposure, social and economic context, housing typology, building practices and years since completion of the project.

Table 3.5 Criteria for selection of case studies (first published by Vahanvati & Beza, 2015, p. 33)

	Reconstruction programme	**Post 2001 Gujarat earthquake**		**Post 2008 Bihar Kosi floods**	
Key selection criteria	CSOs/agencies involved	*Abhiyan*	*SEEDs*	*ODRC*	
	Physical: Resilience features explicitly incorporated in housing	√	√	√	√
	Economic: Upfront consideration for skills training & capacity building	√	√	√	√
	Social: Owner-driven/ participatory	√	√	√	√
	Special mention/ awards	UN-Habitat, UNHCR & IFRC, 2008			
Variables	Hazard exposure	Earthquake, drought, sandstorms		Cyclone, floods, earthquake	
	Location	*Bhuj*	*Patanka*	*Supaul*	*Trivenigung*
	Project wholly/largely complete	Wholly	Wholly	Largely	Largely
	Years since the disaster	13 years		6 years	
	Implementing agency setup	Not-for-Profit	Non-government organisation	A Consortium	

In addition, as the table shows, to ensure the logic of replication (Yin, 2009) and arrival at analytical generalisations (Robson, 1993), best practice ODHR projects from Gujarat were compared against those in Bihar. Two ODHR projects from Gujarat following the 2001 earthquake were the Hodko settlement and the Patanka settlement. The other two cases, from Bihar following the 2008 Kosi River flood, were the Orlaha and Puraini settlements. Moreover, since the impact of a project is evident only long term (a minimum of 6 years) since a disaster, the projects from Gujarat took place 13 years previously, while those in Bihar took place 6 years previously (before 2014, when the author conducted the field study). The reasons that these case studies were selected are explained below.

The two CSOs, who were involved in Gujarat as well as Bihar, are:

- Kachchh Nav Nirman Abhiyan (hereafter referred to as Abhiyan); and
- Sustainable Environment and Ecological Development Society (SEEDS).

3.5.2 Case study 1: Hodko settlement, post 2001 Gujarat earthquake

Hodko settlement in the Kachchh district of Gujarat was very close to the epicentre of the earthquake and suffered major destruction. The work of a Kachchh-based consortium of NGOs called Abhiyan was cited internationally as good practice (UN-Habitat et al., 2008, 2009). The scale of the reconstruction program Abhiyan managed and the number of NGOs it coordinated was huge. Hodko settlement was selected by the author of this PhD based on consultation with Abhiyan during her exploratory field study.

Kachchh – being an arid and dessert region – is also prone to recurring and prolonged droughts and sandstorms. Kutch is also of high ecological significance due to its arid grasslands (Asia's second largest grassland in the world) and marshy salt desert (Sahjeevan, n.d.). Although the region was one of the poorer regions, economically, at the time of the earthquake; it is rich in traditional construction skills and renowned for its crafts sector (e.g. colourful embroidery). The main livelihood of people is cattle breeding and a secondary livelihood is service provision (making leather items or dairy products). Traditional houses were cylindrical in shape with high conical roof (termed as *bhungas)* and were built from mud, grass and wood (Desai, 2002) (see figure 3) (for more information, see Vahanvati and Beza (2016)). Almost 90 percent of people in Hodko were Muslims (descendants of the royal family from Sindh) and remaining were Harijans (the untouchables).

3.5.3 Case study 2: Patanka settlement, post 2001 Gujarat earthquake

The Patanka settlement in the Patan district of Gujarat was located further away from the epicentre of the earthquake, but it also suffered great damage. SEEDS, a New Delhi–based NGO, implemented a reconstruction program called Patanka Navjivan Yogna (PNY) in Patanka and Datrana villages. The program was formulated by SEEDS alongside the Disaster Mitigation Research Centre (EDM) and the UN Centre for Regional Development (UNCRD) (ADRC, 2005). The SEEDS reconstruction program in Patanka was claimed to be successful in having enabled the disaster resilience of communities by going beyond the rebuilding of houses, incorporating intentional skills training for farmers and providing them with an alternative livelihood (IFRC, 2004). SEEDS's support to the disaster victims in solving the

water-shortage issue faced by the farmers stricken by intense drought for over three years, via accessing government funding, was highly commended in the report (IFRC, 2004; SEEDS, 2007).

Patanka, like Hodko, is also located in an arid region. The main livelihood of the people in Patanka is farming, the region is known for cumin produce. Traditional houses were rectangular in shape with pitched roof and were built from stone or unburnt brick (with mud plaster) and thatch roof (figure 4). By 2001, affluent households were building houses from burnt brick, concrete mortar and reinforced cement concrete (RCC) flat roof. Generally, the quality of construction was very poor. 70 percent of people in Patanka were Hindu Brahmins and other of different castes (Vahanvati, 2018 under review).

3.5.4 Case studies 3 and 4: Orlaha and Puraini settlements, post 2008 Bihar Kosi River flood

The two case study projects in Bihar consist of two settlements, Orlaha in Tribeniganj Block and Puraini in Basantpur Block, both in the district of Supaul (GSDMA & UNDP 2005, PiC 2010). As described by Vahanvati (2017), Orlaha settlement was situated far from the embankment of the Kosi River, which burst, while Puraini settlement was very close to the same embankment. Both these settlements suffered major devastation to their houses and lost livelihoods, which required a disaster response. Internationally, floods have received limited donor or media attention, and such had been the fate of the Bihar people, who had never seen a strategic recovery. In addition, as discussed by Vahanvati and Beza (2015), the collaborative process of ODHR policy formation and implementation was highly praised by a few Indian CSOs during the author's reconnaissance field trip to India in 2012. Despite such mature policy and decentralised governance set-up, very few researchers had ventured into the region or analysed the program outcomes, due to the region's reputation of being unsafe. The author also came to know that the outcomes of the reconstruction projects in the two pilot settlements might be different despite the similar implementation approach (Vahanvati & Mulligan, 2017). Hence, the two pilot settlements – Orlaha and Puraini – where the reconstruction implementation was managed by the ODRC in order to pilot the process prior to policy/program formation were selected for the purpose of this PhD research.

Orlaha and Puraini settlements are in a sub-tropical zone, which gets heavy rains and is frequented by floods, earthquakes and storm surges. The region is covered with a network of

over eight rivers including the Kosi and Ganges. These rivers and the great Himalayan Ranges significantly influence Bihar's landform, climate, hydrology and culture. Since these rivers rejuvenate the soil annually with rich alluvial deposits, the locals enjoy three harvests per year. Apart from agriculture, other modes of livelihoods are mud-based industry (bricks, tiles) and mining. The traditional houses were rectangular with pitched roof and were built using mud, grass and bamboo (Census of India, 2011b). Generally, the quality of construction was poor. Nonetheless, skills in bamboo technology were excellent (with an exception of few issues such as lack of bamboo treatment). Hindus formed a majority with Muslims as a minority in this region.

4. CONCLUSIONS

All of the four publications included in Volume 2 (V2) of this PhD present their own conclusions and Table 4.1 summarises how these papers relate to the research questions presented in Section 1.4 of this volume. This table was previously graphically represented as Figure 1.1 (Chapter 1). Key findings are summarised in relation to the research sub-questions, followed by their implications for answering the primary research question. A discussion on the significance of this research is followed by a consideration of opportunities for further research which could build on these findings.

Table 4.1 Key themes versus publications structure (source: author)

<table>
<tr><th>Research sub-questions</th><th>ODHR project components</th><th>Case studies in Gujarat post 2001 earthquake</th><th>Case studies in Bihar post 2008 flood</th><th>Primary research question</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Physical/technical component: built environment studies</td><td>–</td><td>Conference Publication (not included)</td><td rowspan="5">Publication 4: Vahanvati, 2018</td></tr>
<tr><td colspan="2">Conference Publications (not included), Publication 2: Vahanvati & Mulligan, 2017</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Financial component: development & economic studies</td><td colspan="2">Publication 2</td></tr>
<tr><td rowspan="2">–</td><td rowspan="2">Publication 1: Vahanvati & Beza, 2017</td></tr>
<tr><td>3</td><td>Social component: human geography & political studies</td><td colspan="2">Publication 3: Vahanvati, 2017</td></tr>
<tr><td>4</td><td>Systems component: PM studies</td><td colspan="2">Publication 2</td></tr>
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4.1 FINDINGS IN RELATION TO RESEARCH SUB-QUESTIONS

The primary research question this PhD intends to answer is:

> How can owner-driven housing reconstruction (ODHR) projects enhance disaster resilience of at-risk communities in India?

While this PhD investigation aims to answer the primary research question, the breadth of ODHR projects and disaster resilience concept means that this question has had to be split into manageable sub-questions. As discussed previously in the literature review (Chapter 2), the sub-questions have been split in accordance with the four fields of studies (termed the system-of-system or project components) which have developed ODHR scholarship and practice. Hence, discussions of these four sub-questions, which provide some answers, are discussed before the primary question is addressed.

4.1.1 Sub-question 1: Technical component of ODHR projects

This section addresses how the PhD research answers the following sub-question:

> What approaches to spatial design or technical support during reconstruction are most likely to enhance the multi-hazard safety of the house over the long term, for ensuring pertinence, quality of construction and effectiveness (cultural adequacy, environmental sustainability, habitability and affordability)?

The relevant publications which address this sub-question are:

- Publication 2: Vahanvati & Mulligan (2017)
- Publication 4: Vahanvati (2018 under review)

The PhD research findings from all four case studies demonstrate that a focus on technical modifications is significant for building multi-hazard-resilient houses. However, the key approaches that ensured the proposed technologies were sustained or replicated and could be maintained by their residents over a longer period of time were:

- providing multiple technological choices
- up skilling local artisans to rebuild robust houses.

In contrast to the ODHR projects in Gujarat post 2001 earthquake, multiple technological choices were proposed after the 2008 Bihar flood. For example, brick and bamboo-based technologies were proposed in Bihar, whereas in Gujarat CSOs proposed only a single construction technology – mud-based in Hodko and stone in Patanka. As discussed by Vahanvati and Mulligan (2017), the CSOs adopted these options in Bihar because the long-term outcomes in Gujarat were not optimal. The uptake or replication of proposed technologies was limited in Gujarat, despite CSO and government efforts to legalise rural, indigenous construction technologies. Evidence suggests that the main reason for the limited technology uptake in Gujarat was the difference in perception of the CSOs (trying to promote sustainable construction technologies) compared to that of the communities (aspiring to build modern houses from more convenient, ready-to-use or industrial technological options). After the Gujarat experience, in Bihar the same two CSOs improvised their practice and proposed multiple technological choices – modified traditional technology (bamboo-based), as well as aspired technology (brick and cement based). Evidence presented by Vahanvati (2015) suggests that, six years after the flood in Bihar, almost all of the new or extended homes were

being built from brick-based technologies, which suggest that the bamboo-based technology has not found continuity. In addition, visual inspection by the author revealed that these houses incorporate flood, cyclone and earthquake resilience features in their construction. Thus, providing multi-hazard-resilient technological choices to these residents has meant that at least one of the technologies has survived the test of time and found continuity in the local construction sector.

Another major finding from the case study ODHR projects is giving precedence to skills training and employment of locals over non-locals. As deduced by Vahanvati and Mulligan (2017), while employing skilled, non-local masons seemed like an appealing option for CSOs intending to attain speedy and quality construction, its long-term outcomes were negative. By contrast, the ODHR projects where CSOs trained only local masons/artisans meant that, in the long term, local residents had easy access to skilled masons and the disaster-resilient technology had a better chance of being embedded in the local culture. As highlighted by Vahanvati and Beza (2016), such positive outcomes are evident in Gujarat's Patanka settlement. Due to its success in Gujarat, the same approach was adopted in Bihar's Orlaha and Puraini settlements. For skills training, SEEDS in Patanka adopted a mason exchange program. As part of this program, SEEDS brought masons highly skilled in earthquake-resistant construction from Nepal to train local residents of Patanka. This mason-to-mason skills exchange worked well as it relied on a hands-on learning approach to transferring skills, which worked despite the language barrier. Other minor changes evident in the practices of Abhiyan and SEEDS from 2001 to 2008 are giving up on setting up 'material banks' to distribute construction materials and instead promoting time incentives (e.g. the gift of a solar light) to encourage residents to complete their houses in the given time. As highlighted by Vahanvati (2018 under review), the most important factor in the success of the technological component of ODHR is the masons' skills and the way those skills were spread into the local construction sector.

Contribution to knowledge: The abovementioned papers align partly with the minor technical modifications promoted by pioneers such as Turner (1976), Cuny (1978) and Davis (1978a), as well as the BBB promoted by Clinton (2006). However, enhancing resilience in housing has been a challenge due to its long-term and incremental nature (e.g. maintenance and extension). The findings presented in this PhD contribute to this challenge by focusing on the technical approach that has had long-term success. These findings highlight the significance of two

aspects. One is the need to provide residents with technological choices so they have power to make decisions for their own homes, as the preferences of CSOs do not necessarily secure community acceptance in the long term. Interestingly, while people's freedom to choose has been emphasised by scholars focused on development studies (e.g. Sen, 1997) as discussed in Section 2.4.2, this has never been discussed in the context of built environment studies. Secondly, providing relevant skills training to 'only local' residents proves even more important than technological choices, especially for embedding multi-hazard-resilient construction in local culture beyond the reconstruction phase itself. While skills training to local residents has been emphasised by international community, need for quality and speedy recovery means that CSOs often employ non-local skilled masons. Thus, skills training need to relate to capacity building, which relates to the concept of the resilience of the people and the construction system.

4.1.2 Sub-question 2: Financial component of ODHR projects and capacity building

This sub-question isolates the financial component of housing reconstruction and asks:

> What mechanisms of housing assistance and capacity building are likely to enhance residents' capacity to access resources (information, finance, materials and skills) to maintain the safety of their houses?

The relevant publications that address this sub-question are:

- Publication 1: Vahanvati and Beza (2017)
- Publication 2: Vahanvati and Mulligan (2017)
- Publication 4: Vahanvati (2018 under review)

All four case studies demonstrate that, over 2001–2008, the following mechanisms of housing assistance and capacity building had the potential to diversify local residents' livelihoods and hence enhance their resilience:

- ensuring equity in financial assistance (beneficiary selection and package types)
- funding allowing the initiation of other projects to improve resilience and quality of life beyond housing completion

As highlighted by Vahanvati and Beza (2017), equity issues arose in some cases in Gujarat and Bihar, which seems to have caused grief among residents. Equity concerns emerged in relation to the selection of beneficiaries – who would receive financial assistance, how much and for

what purpose. Empirical evidence suggests that discrepancies in beneficiary selection were not linked to the caste or economic condition of the disaster survivors but, rather, to the abuse of power. Those people with influence and power undermined the equity of beneficiary selection and financial assistance, leaving some people in dire circumstances (e.g. in Bihar). While housing assistance and beneficiary selection were beyond the scope of the CSOs, their efforts to resolve any discrepancies were mostly in vain. In order to avoid such discrepancies and to ensure that the assistance reached the neediest, the author supports claims made by some CSOs that they need to have some power to make changes in beneficiary lists after on-ground evidence of discrepancies. Other issues in terms of how much financial assistance the beneficiaries received are discussed by Vahanvati and Mulligan (2017). In Gujarat, the financial package was non-uniform and its amount was determined based on the house damage categorisation, location (urban or rural), house size and quality (*kachchha*/impermanent or *pucca*/permanent). Such non-uniform financial assistance was evidently biased towards those who owned larger houses and who already had the financial means to recover their lost housing. By contrast, in Bihar, since all the devastated houses were in rural areas, a uniform package worked well in ensuring equity across all affected by the disaster. The findings conclude that, while a non-uniform package was essential in Gujarat, more care should have been taken to ensure the poor people with limited means were supported more than those with resources of their own.

While funding for capacity-building activities is emphasised in ODHR internationally, both Indian CSOs – Abhiyan and SEEDS – understood the significance of sustaining such activities over a longer period of time. Nevertheless, they could only continue capacity-building activities past reconstruction completion when circumstances and funding permitted. As discussed by Vahanvati and Mulligan (2017), when sustained capacity building was provided by CSOs, the longer term outcomes were positive. For example, in Hodko Abhiyan's efforts to sustain capacity building – by moving on to other livelihood or empowerment projects – has increased residents' livelihood options and pride in their local culture. Similarly, in Patanka SEEDS's more than nine years of support to the trained masons has strengthened their livelihoods, which in turn has allowed these residents to provide better education for their children (Vahanvati (2018 under review). In addition, these CSOs ensured that the beneficiaries received funding for more than the house (e.g. toilets, lighting, tree planting) to ensure improved standards of living. Improved livelihoods combined with improved living standards recovered in a dignified manner have meant that the residents are more likely to

invest in the safety of their housing in future.

Contribution to knowledge: While scholars (e.g. Development Alternatives, 2004; Unnati, n.d.) have advocated for extending the time frame for capacity building to link to development, each community and their context (social, political or economic) may demand varying degrees of support. Furthermore, donor mandates and fixed time frames for project completion have not helped either. The research confirms that capacity building can only be achieved over a prolonged period of time, often extending beyond the normal reconstruction project life cycle. This research advances current scholarship on capacity building by identifying ways and means of doing so by learning from some of the most experienced CSOs in India. Furthermore, the author of this PhD also stands by the recommendation that CSOs must have some power to demand changes in beneficiary lists in order to achieve greater equity during reconstruction. This PhD research concludes that it is essential to maintain the momentum of ODHR (in the form of mobilised communities), at least until residents are self-sufficient or resourceful enough to maintain their own disaster resilience.

4.1.3 Sub-question 3: Social component of ODHR projects and mobilisation

This section addresses how the research answers the following sub-question:

> What approaches to community participation during an ODHR project are most likely to enhance residents' engagement, awareness and dignity for maintaining the safety of their houses and settlements in the long term?

The relevant publications which address this sub-question are:

- Publication 1: Vahanvati and Beza (2017)
- Publication 3: Vahanvati (2017)
- Publication 4: Vahanvati (2018 under review)

This PhD research focuses on reconstruction projects rather than programs, such as the one in Bihar. Empirical evidence suggests that many lessons learnt in Gujarat by CSOs at the project level were introduced at the program level in Bihar. At the program level, in both Gujarat and Bihar the mechanism that worked well in creating ownership among disaster survivors was the transfer of assistance money directly into the residents' bank accounts (in the names of both male and female households) (Vahanvati and Beza, 2017). Even more important are the

findings at the project level, in relation to how the CSOs ensured effective community engagement, ownership and informed decision-making throughout the process of the community's self-reorganisation during and through housing reconstruction. Two processes found in the practice of one or both of the CSOs that have potential for long-term community awareness in a dignified manner are:

- gaining community trust
- mobilising the community by formation of a *setu kendra* or shelter hub

Gaining community trust was identified as an essential ingredient of ODHR projects by both CSOs. Both Abhiyan and SEEDS understood that adequate and appropriate engagement during ODHR relied on relationships built on trust. In this regards, trust was viewed as a foundational or essential ingredient in creating an environment for engagement. Trust had to work both ways, the residents regaining trust in their own abilities, as well as in the ability of the CSOs to enable them to build safe houses. The CSOs had to adopt a patient approach to building community trust.

While they both were patient, CSOs' approaches for building trust were different in different contexts i.e. Gujarat and Bihar. As discussed in Vahanvati (2018 under review), as a local CSO based in the Hodko region of Gujarat Abhiyan had the benefit of the pre-established trust of the communities and a thorough understanding of local social structures and cultures. Hence, Abhiyan was approached by the village elders seeking help with rebuilding. Despite this well-established trust, Abhiyan conducted verbal forms of communication (such as door-to-door surveys and weekly or fortnightly community meetings – including women) in order to mobilise disaster survivors to act for themselves. Written forms of communication such as newsletter distribution were also used, at the time, albeit sparingly, as rural communities are not literate. They also targeted particular men – those with influence and those without – and worked closely with masons, other local CSOs and government. Over time Abhiyan staff who worked collaboratively with local households managed to understand their needs and priorities and disseminated information about government schemes etc. On the other hand, SEEDS in the Patanka settlement of Gujarat and the ODRC in Bihar, as non-local CSOs, had to devise other ways to establish trust. Partnering with a local CSO that had pre-established community trust was one of the ways. This is evident in SEEDS' efforts in Patanka; however, it did not work out. So they adopted another approach – demonstrating their abilities via 'shake-table tests' on half-sized model houses. All three mechanisms – verbal/oral communication, visual

demonstration of CSOs' abilities and partnering with a local CSO – used by SEEDS and Abhiyan in Gujarat were once again employed in Bihar.

Trust building only imparted CSOs with an understanding of multiple ways in which the local community were formed prior to the disaster; however, post-disaster demanded such communities to be mobilised in order to be reconstructed (as discussed in Section 2.4.3). One mechanism that worked well in reconstructing and mobilising communities was the formation of *setu kendras (SKs).* SKs – literally meaning bridging centres – were shelter and facilitation hubs. As discussed by Vahanvati (2015), the SKs comprised local community members (local masons, artisans and others) who worked collaboratively with a team of social workers, built environment professionals and financial experts. The SKs were established informally in Hodko by Abhiyan after the 2001 Gujarat earthquake. This allowed for two-way communication – for information dissemination from the government to the community, as well as providing the community with a conduit to voice their concerns in a manner that could be heard by the government. Due to their success in Gujarat, the SKs were re-adopted after being formalised and institutionalised in 2008 in Bihar. Although the SKs were set up informally in Gujarat, their appeal meant that they prevailed even after reconstruction completion. Presently, these SKs are entirely run by local community members in Gujarat. Thus, SKs proved as an empowering mechanism for enabling community mobilisation during ODHR as well as long after its completion.

Contribution to knowledge: Various scholars have contributed to our current understanding of the meaning of community and ways of community formation (e.g. Bulley, 2013; Delanty, 2003); deconstructed participation (Ganapati & Ganapati, 2009); proposed varying degrees of people's participation (e.g. Arnstein, 1969; Lawther, 2009); and advocated for reconstruction to create positive social change (e.g. Mulligan, 2012; Oliver-Smith, 1990). However, few scholars have pinpointed particular mechanisms that have been successful in creating positive social change as well as sustaining it. In this regard, the findings presented in the set of publications as part of this PhD are significant contributions to advancing disaster management scholarship on community, engagement and mobilisation. This research proposes two processes – building trust and mobilising the community – as essential for the success for ODHR projects. Furthermore, a new framework for operationalizing community mobilisation for effective engagement is published by Vahanvati (2017). This framework also highlights that a patient or time-flexible approach is required to build trust and mobilise community

during ODHR project management (PM). The research shows that, while attention to social mobilising is essential for ODHR projects to succeed – technically as well as socially – they can only proceed if trust is established.

4.1.4 Sub-question 4: Project management/systems component of ODHR projects

This sub-question isolates the PM component of housing reconstruction projects and asks:

> What project lifecycle management strategy is effective for realising and monitoring ODHR projects in order to enhance long-term disaster resilience?

The relevant publications that address this sub-question are:

- Publication 2: Vahanvati and Mulligan (2017)
- Publication 4: Vahanvati (2018, under review)

Comparative analysis of the four case studies has identified a key component of effective ODHR project development – the need for systems analysis. Theoretically, project management of ODHR projects from SES resilience perspective would involve a wider analysis (of social, political, environmental, technical etc. vulnerabilities and capacities) in the specific context as well as link pre disaster understanding with long term goals (feedback and feed-forward loops – Figure 2.13). In PM terminology, such systems analysis is termed 'front-end planning' (Steinfort, 2017) and it occurs during the early days after a disaster, during the pre-construction scoping phase. As discussed by Vahanvati and Mulligan (2017), the findings from the case studies suggest that following PM strategies have been effective in systems analysis and thus ODHR project/program formulation:

- scoping a program of projects (not just one project, like system of systems) with long-term goals in mind
- adopting an 'agile' strategy to formulate a context-specific project or program which addresses systemic issues and adjusts as the project/program unfolds

While the CSOs in Gujarat in 2001 witnessed a project-based approach to ODHR implementation, which had to operate within the constraints of the policy framework formulated by the government; the same CSOs in Bihar in 2008 had the opportunity to work collaboratively with the state government to formulate and implement a program-based approach. As discussed by Vahanvati and Mulligan (2017), in 2001 the government of

government of Gujarat outsourced the implementation of ODHR to various project-based CSOs and the private sector. This approach resulted in a diversity of ODHR implementation modes and project outcomes. Vahanvati and Mulligan (ibid.) clarifies these varying PM approaches in Gujarat as: closed-loop, open-loop and spiral approaches (by Abhiyan). In the closed-loop PM approach the CSOs withdrew from the site as soon as the housing reconstruction was completed or as soon as funding was finished. In the open-loop PM approach, evident in the practice of SEEDs in Patanaka, despite the CSOs' long-term vision based on systemic understanding, they had to withdraw from the site prematurely. The spiral PM approach is represented by Abhiyan's ability to move from the housing reconstruction project to other projects in order to provide sustained capacity-building for building change among the residents in Hodko. Empirical findings prove that such a spiral approach to PM has been successful in enhancing the disaster resilience of the targeted communities. However, such success was reliant on the CSOs' ability to move from one project to another and from one funding body to another. The merit of a spiral approach lies in the strategy's focus on envisioning longer term goals (of enhancing disaster resilience in both housing and communities) during project planning/formulation, which requires flexibility in the time that CSOs spend on site and the scoping of their work.

A similar spiral approach to project scoping was up-scaled – from project to program scale – in Bihar post 2008 Kosi River flood. A change in scale of ODHR – from diverse projects to a single program – implied a more consistent implementation mode and outcomes. A spiral approach to the ODHR program meant that all the flood-affected survivors would benefit equally. Such a change was possible because of the involvement of experienced CSOs from India and the Asia–Pacific in advocacy role and also because of the GoB's willingness to work collaboratively with them. Furthermore, the government of Bihar accepted the problems with the traditional control mechanisms (or engineering resilience) for managing river basins and were open to SES resilience thinking.

A limitation of this PhD research is that it focuses on examining the long-term outcomes of ODHR projects, not programs. Thus, apart from the broader findings, the long-term outcomes of the ODHR program in Bihar were not yet clear – six years after the floods – despite the CSOs having applied their knowledge gained or lessons learnt from past experiences in influencing the reconstruction policy in Bihar. However, the case study projects in Bihar suggest that better long-term outcomes can be achieved when reconstruction programs are

planned jointly by CSOs and relevant government authorities.

As well as planning for the long term, the ODRC in Bihar adopted an agile approach to piloting prior to policy formulation. Such trialling ensured that the program addressed all the systemic challenges and concerns relevant to that particular context. As discussed by Vahanvati (2018, under review), some of the systemic challenges facing the local people in Bihar that were addressed in its ODHR program were poverty and lack of political capability (legacy of colonisation) , land shortages, lack of basic amenities (e.g. energy, clean drinking water, toilets) and environmental degradation, which is far more than just addressing technical vulnerabilities. In this regard, Bihar's ODHR program was more comprehensive than Gujarat's. Bihar's agile approach was also possible due to the willingness of its government to assume responsibility for disaster recovery management and seek help of the ODRC. Although an agile approach was effective for formulating a context-sensitive ODHR program, this also was time consuming at the beginning – it took nearly two and a half years in Bihar – just to implement pilot projects and to tailor ODHR policy; however, the long-term outcomes are likely to be much better.

To conclude, this PhD research challenges the PM success metrics – predetermined goals, time frames and budgets – as they are narrowly focused on one aspect of reconstruction, rather than following a systems understanding. Such a PM approach can lead to rapid project completion, as was the case in Gujarat; however, the more patient approach adopted in Bihar has more chance of actually delivering long-term disaster resilience outcomes. The research findings demonstrate that the infusion of international aid, as seen in both Gujarat and Bihar, can make reconstruction programs lean more towards a DDR approach, and so less agile or less time flexible, despite an overarching ODHR policy. These challenges suggest that donors also need to be patient and not rush to see outcomes.

Contribution to knowledge: The findings in this PhD highlight the importance of the early stages of decision-making, as they can determine "the future form of the new settlement and even the long-term economic development of a community" (Davis, 1978a, p. 91). This PhD advances this understanding by linking it to the concept of SES resilience. The SES resilience concept was introduced into the field of disaster management by scholars from ecological studies (Holling & Walker, 2003), with an intention to encourage thinking about interconnections between people and ecosystems, rather than narrowly focusing on one

component. The new spiral PM approach to ODHR, which was evident in these Indian case studies, combines the understandings from both technical and socio-ecological fields of study. The spiral approach to ODHR PM has proven that the goal-driven and one-size-fits-all approach sometimes demanded by donors never works in the uncertainties of disaster contexts; only a patient and process-oriented approach will be effective. The findings conclude the need in ODHR projects/programs for: a time-flexible, agile and systems approach to project scoping; and long-term planning.

4.2 ADDRESSING THE PRIMARY RESEARCH QUESTION

The primary research question this PhD intends to answer is:

> How can owner-driven housing reconstruction (ODHR) projects enhance disaster resilience of at-risk communities in India?

The primary research question is addressed in the following publications:

- Publication 2: Vahanvati and Mulligan (2017)
- Publication 4: Vahanvati (2018 under review)

Having characterised disaster resilience of society as being robust yet diverse, redundant, resourceful yet equitable, rapid yet time-flexible, agile and strategic and transformative/ adaptive capacity, the findings from the four case studies prove that a lot went well in these Indian ODHR projects. For example, robust houses were built in a participatory manner, rural technologies were revived and legalised, mason skills (capacities) were improved; livelihoods restored and diversified (resourcefulness), people's dignities were enriched and projects were completed in a timely manner (rapidity). However, some mistakes were also made and, based on the learning from their successes and failures, efforts were made by the CSOs and the government authorities to improve ways of implementing and managing future ODHR projects. The findings, based on the knowledge gained from the highly experienced Indian CSOs and from empirical evidence, have been presented separately as four project components or research sub-questions. All of these findings are combined together to develop a new spiral framework for the strategic success of ODHR projects. The spiral framework is developed to inform practitioners in a field where lessons from the past have often been narrowly documented and long-term project outcomes have largely remained unexamined.

A preliminary framework for the strategic success of ODHR has been developed and first published in Vahanvati and Mulligan (2017). Later, the framework was refined and detailed byVahanvati (2018 under review). The framework comprises four project components – technical, financial, social and PM components – which are organised as (an upward) spiral shape to represent a continuous, interconnected, multi-scalar and self-renewing mode of project life cycle, as discussed below.

1 Systems analysis: As discussed in Sections 2.4.4 and 4.1.4, while systems analysis may seem similar to context analysis, it is more than that. Context analysis can be a passive account of pre-existing physical and/or socio-economic conditions. In contrast, systems analysis brings into play the interconnected relationships between the various components and between what already existed and future goals. In the context of ODHR, systems analysis was done by both Indian CSOs in order to understand existing and traditional housing typology (spatial design and technology), the needs and aspirations of the disaster survivors, and the particular geographical, social, cultural, political and historical contexts in which the projects took place. Without consideration of such wider systemic issues during ODHR project/program scoping and planning, the projects may not have been able to address deep-rooted issues and not achieved longer term gains or gone beyond closed-loop thinking (recovering housing). However, analysing and understanding systemic issues by CSOs demanded some form of agility and time-flexibility.

2 Social mobilisation: This is potentially the core of an ODHR project. It involves gaining community trust as well as maintaining the dignity and wellbeing of marginalised people. As previously discussed in Sections 2.4.3 and 4.1.3, without the foundation of trust a community cannot be mobilised for engagement throughout the entire process of ODHR. *Setu kendras* were found to be an efficient way of mobilising people after disaster. People's ownership over the process as well as the product output (housing), their satisfaction and a change in perception of vulnerable construction practices, all hinge on a paradigm shift from a top-down to a participatory, social mobilisation approach.

3 Technical modification: Minor changes, which were necessary, were proposed to pre-existing construction technologies to ensure that the rebuilt houses were multi-hazard-

resilient, rooted in the local skill base as well as aligned with their residents' aspirations. As previously discussed in Sections 2.4.1 and 4.1.1, the mason-exchange program worked well for skills training. However, growing aspirations among the people to continuously improve their living standard means that mere improvement of pre-disaster construction technology is not sufficient. Rather, there is a need to provide a few technological choices for residents, accompanied with skills training. This freedom of choice is not a new concept for scholars in development studies.

4 Capacity building: This relates to continuous learning or training to ensure access to resources (e.g. money, information, tools and technology), as well as resourcefulness (skills, abilities) to continuously evolve or re-organise oneself in context of uncertainties. As previously discussed in Sections 2.4.4 and 4.1.2, at the micro scale capacity building relates to people, at the meso scale it relates to CSOs and to government authorities at the macro scale. The research findings show that when the CSOs continue capacity-building initiatives beyond skills training during ODHR projects, this result in improved livelihoods, self-sustenance and dignity among the people. At the same time, when the CSOs get involved in the capacity building of government authorities (e.g. in Bihar), the ODHR programs become more mature and comprehensive. However, sustaining capacity-building initiatives is one of the most challenging aspects of ODHR in the context of funding constraints or government mandates. One of the ways in which the Indian CSOs have addressed this challenge is by incorporating strategic and systemic planning.

These four components are illustrated as separate flanges in the proposed spiral framework. These components interact with each other by way of CSOs transferring their learning between them (see Vahanvati, 2018 under review). While these four components of ODHR projects are organised sequentially, in practice, these components are more likely to work in tandem, happen iteratively, overlap or even occur concurrently. (Vahanvati, 2018 under review). Each project component (e.g. social mobilisation) incorporates an objective and processes at various stages of a project (as per the log-frame analysis). Although examples of successful processes from the ODHR case study projects in India have been incorporated into the framework, they must be taken as prompts, and not as a prescriptive recipe.

Contribution to knowledge: As discussed previously in Section 2.5, while ODHR has

absorbed many concepts from many fields of study to the point that it is now seen as a major contributor to enhancing disaster resilience internationally, little progress has been made in turning such influences into a comprehensive framework. The main reason for this is that post-disaster reconstruction projects are highly complex, requiring consideration of social, ecological, technical, financial and other aspects during the one project. While attempts have been made to propose a framework, these have been either fairly conceptual (e.g. IFRC, 2012), or designed for macro-scale program evaluations (e.g. GFDRR, World Bank, EU and UNDP 2015). There has been no accepted framework for micro-scale ODHR project analysis. Moreover, any project-scale framework that has been proposed has been segregated by disciplinary boundaries (e.g. technical outcomes – housing, or post-occupancy evaluation or cost–benefit analysis) and not conceived from a systems perspective. There is no doubt that integrating multiple components (e.g. social, technological) and SES resilience characteristics (e.g. robustness, adaptive capacity) into one ODHR project management framework is not an easy task (Kelly & Adger, 2000). This PhD has aimed to do exactly that. The author acknowledges that post-disaster ODHR interventions are 'wicked problems' – where neither the problems nor the outcomes – can be clearly explained. Despite the challenges, this PhD has sought to bring multidisciplinary perspectives into play by comparative examination of ODHR projects through the lens of SES resilience.

This PhD answers the primary research question by proposing a multi-pronged approach, as discussed by Vahanvati (2018 under review); for ODHR to have a long-term positive impact of disaster resilience, it must:

- understand the systemic issues in the particular context in which an ODHR project takes place
- adopt an agile approach to planning the reconstruction strategy so as to formulate a contextually sensitive program of projects
- gain community trust (e.g. by setting up *setu kendras*) for mobilisation and engagement in a way that maintains their dignity
- provide multiple choices of materials and technologies, along with skills training, for residents, and
- ensure continued capacity building beyond ODHR completion for supporting communities until they are self-reliant, resourceful and resilient.

Although developing a framework for the strategic success of ODHR projects is the largest contribution of this PhD, this framework needs to be tested in practice and adapted to suit particular contexts. It must be noted that – neither Gujarat, nor the Bihar – states of India had a culture of Owner Driven Reconstruction (ODR) policies when this was introduced in the case study reconstruction projects examined in this thesis. The research findings suggest that ODHR policies can succeed, at least partially, where such cultures are not pre-existing. Thus, despite the framework having been developed on the basis of the assimilation of a wealth of knowledge and practice during ODHR projects in India, these findings are unequivocal and perhaps the world can gain from them. Having said that, any attempts to replicate the work in very different social, cultural or political contexts would require careful calibration of how the context might influence outcomes.

Most importantly, the framework asks donors, policymakers and practitioners to draw from an array of disciplinary expertise if ODHR is to be successful in enhancing community resilience, maintaining their dignity, as well as embedding safe construction skills in the local culture. For example, the way in which a burnt eucalyptus forest waits for the appropriate weather conditions in order to regenerate, similarly strengthening the resilience of disaster-stricken communities also requires optimum conditions (e.g. social, financial, technical support). To sum up, ODHR projects which provide freedom of choice (capabilities) of residents (in terms of duration, construction technology selection or skills training engagement) and sustained multiple capacity building efforts beyond reconstruction completion (in line with on-going nature of SES resilience), has the potential to leave a legacy of disaster resilience (self-organising and capable residents).

4.3 FURTHER RESEARCH

Every researcher has to draw some boundaries in terms of their expertise, time-frame constraints and the practicalities of conducting the research. Despite the author's expertise in architecture and the built environment, she has managed to include social sciences, development studies and SES resilience studies so as to bring a cross-disciplinary perspective to this PhD. However, this has meant that she was unable to include some aspects of the concept of SES resilience (e.g ecosystem regeneration) in more detail in this PhD. By way of example, understanding of river systems, mangroves, the impact of human-built dams on their natural flows and the ways that people have learnt from past mistakes and worked with the

ecosystem, rather than against it, in the river basin region of Bihar would be important components of SES resilience. However, these were beyond the scope of this PhD. The abovementioned ecosystem regeneration as a component of ODHR project/program management would form an excellent topic for future research.

Since the focus of this research is not specifically on PM, the specifics of ODHR projects in terms of the time spent by the CSOs for systems analysis, social mobilisation, housing reconstruction, extended capacity building for communities, their livelihoods and ecosystem regeneration after construction completion are not incorporated in this PhD. Apart from the time aspect of PM, other aspects such as project risk management and monitoring of project milestone achievement have intrigued the author. In addition, while there is some emerging research on the organisation structure and competencies of CSOs involved in disaster recovery management, the SKs or shelter hubs established in India would be worth examining from a project-scale perspective. Some of the questions that could be addressed are: How many people are part of an SK? What are their skills? How many houses can one SK manage? Furthermore, the impact of the informal set-up of SKs at the project scale (in Gujarat) versus the institutionalised set-up at the program scale (in Bihar) demands further research, due to the simplicity and effectiveness of this approach. Since this PhD is focused on the project scale and not on the program scale, the long-term outcomes of Bihar's mature ODHR program could not be examined. Such program-scale research would also require a focus on governance and the disaster management capacity of the government authorities, and could be conducted in a few years' time (as Bihar's reconstruction program was still ongoing in mid-2017).

Last but not least, the author would like to test and further refine the proposed ODHR framework by working with CSOs on-the-ground. This is so that the proposed framework does not stagnate; rather, it needs to constantly evolve and adapt based on the knowledge gained by CSOs and changing circumstances if it is to be relevant for leading the way through a continuous progression of resilience amid rising adversities and uncertainties.

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APPENDIX A

A.1 SEMI-STRUCTURED INTERVIEW QUESTIONNAIRE

This semi-structure interview questionnaire was structured as per the components discussed in the PhD. This is the questionnaire that was used for households, while a slightly modified version was used for non-beneficiaries and those involved in the implementation of ODHR projects.

Name	Location	Date	Code No.

Your age?

1	2	3	4	5
16-29	30-44	45-59	60-74	>75

Your gender?

1	2
Female	Male

HOUSEHOLD PROFILE (*no. of members, ages, occupations, social & economic status etc.)*

How many people live in this house (no.)?

1	2	3	4	5
1	2-3	4-5	6-8	>9

Whom do you live with in this house?

1	Alone
2	Single adult with children
3	With partner (husband/ wife)
4	With partner, one/ both of parents and children
5	With extended family (e.g. brother/ sister/ friends)

Financially speaking, would you consider your household to be:

1	2	3	4	5
Struggling	Not so good	Neutral/ making ends meet	Comfortable	Well-off

What is the highest level of formal education you/your family members have completed?

0	1	2	3	4	5
No schooling	Primary school (grade 1-6)	Partial secondary school	Finished secondary school (6-12)	Trade training	University (undergraduate)

How would you consider your health?

1	2	3	4	5
Poor	Not so food	Sometimes good, sometimes poor	Good	Very good

GEOGRAPHY AND COMMUNITY PROFILE

How long (yrs.) have you lived in this neighbourhood?

1	2	3	4	5
<1	1-5	6-10	11-20	>21

What or whom do you identify as your main community?

1	Place you live in (e.g. village or suburb)
2	Particular caste (which, defined by what?)
3	Extended family

4	Organisation (e.g. workplace/ school/ community centre/ religious centre)	
5	None of above (explain why?)	

What type of livelihood activity do households practise in house?	
What type of subsistence activities do households do (poultry, garden etc.)?	

HOUSING AND SETTLEMENT – POST-DISASTER RECONSTRUCTION

Input – Design

Who designed settlement layout?

1	By government authority
2	Completely by agency
3	Partially by agency and govt with community
4	Partially by homeowner with technical support of agency
5	Completely by homeowners

Who designed the house?	
What were technology and skill options for housing? - 1 2 3 4 5 +	
How were builders and contractors selected?	

Output – Design

Is there adequate provision of drainage and water table incorporation? Show… - 1 2 3 4 5 +	
Are lot sizes adequate and configuration suitable? - 1 2 3 4 5 +	
What is the quality of internal road layout? Show… - 1 2 3 4 5 +	
What is the quality of open/ communal spaces? Show… - 1 2 3 4 5 +	
Has appropriate landscaping been incorporated (shade, wind etc.)? - 1 2 3 4 5 +	
Do households have adequate privacy in their houses? - 1 2 3 4 5 +	
Can they maintain links with their community? - 1 2 3 4 5 +	
What disaster-safety features were included?	

	Was the construction quality and materials good at the time? - 1 2 3 4 5 +	
Result – Design	Is the house too big or small (dimensions)? - 1 2 3 4 5 +	
	Are the houses of same size and design? Show… - 1 2 3 4 5 +	
	Does the house layout meet the needs of its residents? Show… - 1 2 3 4 5 +	
	Does the house have adequate space for livelihood & subsistence activities? Show… - 1 2 3 4 5 +	
	Are houses climatically comfortable (hot/cold; natural ventilation; dark/ bright; protects from rain)? - 1 2 3 4 5 +	
	What is the condition of house now? Show… - 1 2 3 4 5 +	
	What type of repairs does the house require? Show… - 1 2 3 4 5 +	
	How easy is it to access information, material and labour skills, locally for repair/modifying? - 1 2 3 4 5 +	
	Have you made extensions to your house? How easy is it to extend or modify the house? - 1 2 3 4 5 +	
	Does the implementing agency provide back-up support? - 1 2 3 4 5 +	
	Are the households prevented from making extensions? - 1 2 3 4 5 +	
Impact	Do you think the planning and house design provided hazard safety? - 1 2 3 4 5 +	Were any technical innovations made? (Agency)

	Do you think the extensions are hazard-safe? - 1 2 3 4 5 +	
	Is your family's need for social amenities (infrastructure, communal spaces) met? - 1 2 3 4 5 +	
	Is the access to services (water, sanitation, waste mgmt.) improved? - 1 2 3 4 5 +	
	Is there adequate electricity supply (in house and on streets)? - 1 2 3 4 5 +	
	Is there adequate public transport and access to primary roads? - 1 2 3 4 5 +	
	Has planning and housing increased safety of women, children and minority groups? - 1 2 3 4 5 +	
	Which agencies are responsible for infrastructure and services?	
	What are the three things you dislike about housing and settlement design?	
	What are the three things you like the most about housing and settlement design?	

FINANCIAL ASSISTANCE – POST-DISASTER RECONSTRUCTION

Input – Finance

From whom did the most important source of housing assistance come from?

1	2	3	4	5
Local people	Local organisation	Government program	National organisation	International organisation

What was government housing assistance scheme – uniform or non-uniform for houses to be reconstructed? (equal to all irrespective of damage or pre-disaster housing size)

1	2
Uniform package	Non-uniform package

What was the means of delivering housing assistance to survivors?

1	2	3	4	5
Conditional cash transfer	Unconditional cash transfer	Mix of both (cash + materials)	Construction material/ vouchers	Fully built house

What was the total amount of assistance offered by government? Out of that how many instalments of assistance did you receive? - 1 2 3 4 5 +	

	What form of land title householders have? - 1 2 3 4 5 +	
	What was the estimated cost of the house? (per house and per m2) 1: INR 200-349 / 2: INR 350-499 / 3: INR 500-649 / 4: INR 650-799 / 5: >INR 800	
	What was the actual cost of the house? (per house and per m2) 1: INR 200-349 / 2: INR 350-499 / 3: INR 500-649 / 4: INR 650-799 / 5: >INR 800	
	How much money/ labour did household contribute?	
Output – Finance	Was the cost of housing okay? - 1 2 3 4 5 +	
	Was housing assistance timely, sufficient and well-spent? - 1 2 3 4 5 +	
	Do you think that livelihood or training was integrated in housing assistance? Was it helpful? - 1 2 3 4 5 +	
Results – Finance	Are houses cost-effective to maintain and repair? - 1 2 3 4 5 +	
	Has household's livelihood increased / diversified since housing recovery? How much? - 1 2 3 4 5 +	
Impact – Finance	Have the local skills, entrepreneurship increased since reconstruction? - 1 2 3 4 5 +	
	Is your house, livestock, boats/ machinery insured against disaster? - 1 2 3 4 5 +	
	Is your household able to access housing finance? - 1 2 3 4 5 +	
	Does the agency provide back-up support for livelihood? - 1 2 3 4 5 +	
	What are the three things you would like to change about financial assistance?	
	What are the three things you liked the most about financial assistance?	

COMMUNITY PARTICIPATION – POST-DISASTER RECONSTRUCTION							
Inputs – Participation	How do you think agencies selected beneficiaries and allocated houses?						
	What consultation (if any) took place?						
	-	1	2	3	4	5	+
	What form of land title householders have?						
	-	1	2	3	4	5	+
	Did community participate in safe-construction/ monitoring skills training?						
	-	1	2	3	4	5	+
	What sort of engagement community had in raising awareness about DRR?						
	-	1	2	3	4	5	+
	Name 5 people who you think, played the most important role in your house's reconstruction (from agency)?						
	1 (least imp.)	2	3	4	5 (most imp.)		
Output – Participation	Did the beneficiaries have a say in the location of housing and its design?						
	-	1	2	3	4	5	+
	Where their previous coping mechanisms considered and incorporated?						
	-	1	2	3	4	5	+
Results – Participation	Did the most at-risk people benefit from this project?						
	-	1	2	3	4	5	+
	Who did not attain resilient housing? Why?						
	Did anybody build resilient housing themselves?						Who?
	1	2					
	No	Yes					
Impact – Participation	How satisfied are you with the process of consultation?						
	-	1	2	3	4	5	+
	How organised your community is (forming networks/ helping each other in need)?						
	-	1	2	3	4	5	+
	Do you think you are aware of ways in which to reduce the disaster risks?						
	-	1	2	3	4	5	+

	Do you feel you can approach gov. authorities for getting work done in you settlement? - 1 2 3 4 5 +	
	Do you feel the time frame for which the reconstruction agency stayed to support them was sufficient? - 1 2 3 4 5 +	If not, how long is a good time frame according to you? Why?
	Do you feel the reconstruction process led to recovery at many front, not just housing recovery? - 1 2 3 4 5 +	
	What are the three things you dislike about housing and settlement design?	
	What are the three things you like the most about housing and settlement design?	
EXTERNAL FACTORS- POST-DISASTER RECONSTRUCTION		
	Did anything outside the control of the community and agency affect the success of the project? - 1 2 3 4 5 +	
	How was it addressed?	
	What are the three things during PDHR, which were most effective in building people's disaster-resilience?	
	What are the 3 things that people would like to be done differently in future reconstruction?	

A.2 ETHICS APPROVAL

The letter of approval from an authorised RMIT committee for this research – CHEAN A-2000780-09-12 – was granted on 18 December 2012, for conducting research with humans.

RMIT UNIVERSITY Design and Social Context College Human Ethics Advisory Network (CHEAN)
Sub-committee of the RMIT Human Research Ethics Committee (HREC)

Notice of Approval

Date:	18 December 2012
Project number:	CHEAN A-2000780-09-12
Project title:	Post-disaster housing reconstruction as a bridge to building community resilience the case of eastern India
Risk classification:	Low Risk
Investigator/s:	Dr. Esther Charlesworth, Mrs. Mittul Vahanvati
Approved:	From: 18 December 2012 To: 18 December 2015

I am pleased to advise that your application has been granted ethics approval by the Design and Social Context College Human Ethics Advisory Network as a sub-committee of the RMIT Human Research Ethics Committee (HREC).

Terms of approval:

1. **Responsibilities of investigator**
   It is the responsibility of the above investigator/s to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by the CHEAN. Approval is only valid whilst the investigator/s holds a position at RMIT University.
2. **Amendments**
   Approval must be sought from the CHEAN to amend any aspect of a project including approved documents. To apply for an amendment please use the 'Request for Amendment Form' that is available on the RMIT website. Amendments must not be implemented without first gaining approval from CHEAN.
3. **Adverse events**
   You should notify HREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
4. **Participant Information and Consent Form (PICF)**
   The PICF and any other material used to recruit and inform participants of the project must include the RMIT university logo. The PICF must contain a complaints clause including the project number.
5. **Annual reports**
   Continued approval of this project is dependent on the submission of an annual report. This form can be located online on the human research ethics web page on the RMIT website.
6. **Final report**
   A final report must be provided at the conclusion of the project. CHEAN must be notified if the project is discontinued before the expected date of completion.
7. **Monitoring**
   Projects may be subject to an audit or any other form of monitoring by HREC at any time.
8. **Retention and storage of data**
   The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.
9. **Special conditions (if applicable)**

In any future correspondence please quote the project number and project title.

On behalf of the DSC College Human Ethics Advisory Network I wish you well in your research.

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Owner-driven housing reconstruction as a means of enhancing disaster resilience of at-risk communities in India

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

VOLUME ONE: Dedicated PhD sections

VOLUME TWO: Four publications

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An owner-driven reconstruction in Bihar

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Abstract

Purpose – The purpose of this paper is to identify "key processes" during the owner-driven reconstruction (ODR) process by implementing agencies, to enhance the long-term disaster-resilience of housing and community.

Design/methodology/approach – A mixed methods methodology and "case-study" approach is adopted to compare good practice reconstruction projects in India in the past 15 years. This paper discusses findings from investigations conducted in two settlements of Bihar – Orlaha and Puraini, after major flooding in 2008. The sites were visited during 2012 and 2014.

Findings – One of the key processes that lead to the success of the ODR process in terms of its effect on the long-term disaster-resilience in Bihar is community mobilisation it functions primarily as an information and communication device promoting the success (or otherwise) of the reconstruction project.

Originality/value – The findings are based on empirical evidence gathered during in-field investigations and interviews to post-disaster reconstructed villages. While these findings represent a snapshot of diverse and complex disaster experiences in the Indian context, the comparison offers insight on how to turn the rhetoric surrounding "owner-driven" or "built back better" into positive long-term community outcomes.

Keywords India, Participatory approaches, Resilience, Post-disaster reconstruction, Built environment, Owner driven

Paper type Research paper

1. Background

1.1 Linkages between reconstruction and disaster-resilience

Internationally, there is a growing consensus on the linkages between post-disaster reconstruction and disaster-resilience (IFRC, 2004; UN-Habitat *et al.*, 2012). For example, "Build back better" was first coined by a special envoy and former US President, Bill Clinton (Office of the UN Secretary-General's Special Envoy for Tsunami Recovery and Clinton, WJ, 2006) and is implicit in United Nations Disaster Relief Organisation (UNDRO) guidelines for shelter after disaster and in Sphere guidelines (Davis, 1978a; UNDRO, 1982). According to these organisations, disasters, apart from the destruction, offers an opportunity to improve the living condition of those at risk to disaster through an effective reconstruction process (Jha *et al.*, 2010). Apart from realising robust houses for those effected by disaster – resulting in a physical asset (UNNATI, 2008), if the reconstruction process is participatory, "build back better" can also achieve disaster-resilience in households. Participatory reconstruction process involves those who are affected in every stage of decision-making for their housing it may lead to a change in the collective mind-set/memory about disaster risks (Nield, 2011)

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and/or brings a shift from unsafe construction practices towards safer ones (Niazi, 2001). In disaster management, such participatory reconstruction process is termed "owner-driven reconstruction" (ODR). ODR is claimed to be essential for the long-term sustainability of reconstructed houses and reducing the risk to households (Barenstein, 2010; Lizarralde *et al.*, 2010). Hence, the "process" of reconstruction is equally important, if not more so than the housing product itself.

1.2 An ODR approach

Depending on the role of the households (e.g. house owners/renters/squatters) in reconstruction of their houses, two dominant approaches to reconstruction exist, as:

(1) top-down or donor-driven reconstruction (DDR); and

(2) bottom-up or ODR.

As this paper focuses on the variations within the ODR approach, the DDR approach is not extensively discussed.

In an ODR approach, effected community members are enabled and informed so that they have the ability to make decisions throughout all stages of their houses' reconstruction (Barakat, 2003; Schilderman and Lyons, 2011). This approach to reconstruction is not entirely new, especially for the disaster-affected poor and the marginalised people, as "it is the fall-back mode when people do not receive external assistance" (Schilderman and Lyons, 2011, p. 223). The positives of the ODR approach are that participants have a strong sense of ownership, higher satisfaction with the outcome and are able to sustain the disaster-resilience of their housing over the longer-term (Ganapati and Ganapati, 2009; Hunnarshala, 2007a; Lyons, 2010). Furthermore, research suggests that this approach is quicker, less expensive, has the potential to strengthen a community's social capital and promote better livelihood outcomes (Davis, 1978a; Jha *et al.*, 2010). However, during the on-ground application of the ODR approach by agencies, many variations can be observed. For instance, anthropologist Barenstein's (2010) research in the following three Indian states identified variations in the ODR process:

- Maharashtra, post-1993 earthquake;
- Gujarat, post-2001 earthquake; and
- Tamil Nadu, post-2004 tsunami.

These variations are:

(a) owner-driven without the involvement of a non-governmental organisation (NGO);

(b) owner-driven with an NGO, including a financial/material top-up; and

(c) participatory (Barenstein, 2010; Barenstein and Iyengar, 2010).

Furthermore, Barenstein's (2010) investigation suggests that household satisfaction and the ability to maintain disaster-resilience of their housing was highest in the above approaches of "b" and "c" due to greater participation, awareness and enabling from the NGO during reconstruction.

1.3 The case of India

Fundamentally what is under investigation in this paper is the merit of ODR in the long-term. The ODR approach is examined through case studies of reconstruction efforts in four settlements in India (out of which two are discussed in this paper). Using Barenstein (2010)

and Barenstein and Iyengar (2010) scholarship as philosophical platforms to build upon, this paper's central purpose is to identify "key processes" during the ODR project that can be used as reference to enhance the long-term disaster-resilience of housing and community.

India, in the past 15 years, has witnessed high-profile rapid-onset disasters such as tsunamis, cyclones and earthquakes. The country has also experienced slow-onset disasters such as floods and droughts, which happen on a continual and regular basis. The toll of disasters on human lives and the national economy has risen substantially since 1999 (Guha-Sapir *et al.*, 2012). For instance, in 2001 after Gujarat earthquake, over 1 million houses were damaged; in 2004 after the Indian ocean tsunami, over 1,39,881 houses were damaged; and in 2008 due to the Kosi river floods, over 222,754 house were damaged (NIDM 2001, 2011). These disasters occur in India due to a combination of unique geo-climatic as well as socio-economic condition. Socio-economically, majority of Indian people in the country are at risk due to endemic poverty, unsafe housing practices (non-engineered and un-scrutinised construction) and illiteracy (NIDM, 2001; SEEDS, 2007). India henceforth is listed as one of the top ten disaster-prone countries in the world (NIDM, 2011). Hence, with rising threats of extreme weather events from climate change, the need for resilience to be "built in" to housing reconstruction practices and community self-reliance in India is urgent.

To address this need, the Indian government has progressively evolved its reconstruction approach. For example, up until the late 1980s, there was a prevalence of relief as a form of disaster recovery, that is, providing completely built social housing units to disaster-survivors (Barenstein and Iyengar, 2010). In 2001, after the Gujarat earthquake, an ODR approach was adopted for the first time within a reconstruction policy framework and on a large scale. The ODR approach was adopted again in 2005 in Kashmir and in 2008 in Bihar; with the exception of a DDR approach used in Tamil Nadu in 2004 (Aquilino, 2011; Barenstein and Iyengar, 2010).

This background to India's vulnerability and evolving approach to disaster reconstruction underscore the purpose of this paper by inferring to the need to investigate the effectiveness of the ODR processes. Hence, to "ground" this investigation, the following section provides a description of the research approach used to answer the following ODR-focussed research questions:

RQ1. How can post-disaster housing reconstruction projects increase the long-term disaster-resilience of at-risk communities in India?

RQ2. What approaches to community participation and capacity-building during an ODR approach, are most likely to enhance the awareness and confidence in decision-making of at-risk communities?

2. Method of research

2.1 Methodology and method

A qualitative-interpretive methodology is primarily used in this research as the investigation is concerned with identifying issues that influence "robust results" (Robson, 1993, p. 119) or "program improvement" (Blessing and Chakrabarti, 2009, p. 241) that support positive long-term community outcomes. In this research, "qualitative" is used as a means to understand a particular context in depth, including the complexities of people's subjective opinions, practices and product outcomes (Blessing and Chakrabarti, 2009). Though the investigation is predominantly qualitative, some features of a quantitative approach are adopted for this investigation. That is, the measure of effectiveness of one

good-practice ODR project in India from another. This combined approach reflects a mixed methods methodology (Robson, 1993).

In addition to this mixed methods methodology a "case-study" approach is used to compare and examine good-practice reconstruction projects, which are empirically based (Robson, 1993). A case study is defined as an empirical inquiry that "investigates a contemporary phenomenon in depth and within its real-life context, especially when, the boundaries between phenomenon and context are not clearly evident" (Schramm 1971 in Yin, 2003, p. 13). The strength of a case study comes from its ability to draw upon a variety of evidence and is not limited to only qualitative evidence (Robson, 1993; Yin, 2009). Conversely, a case study is identified to have limited basis for generalisation of its study findings and to lack research rigour. To overcome this weakness, the "logic of replication" or multiple good-practice ODR projects with complementing factors are selected to check if they arrive at similar findings, and if they do, then the results have potential for "analytic generalisation" (Robson, 1993, p. 161). Various ODR projects which shared similarity in the three key areas, as shown in Table I, were selected as case studies.

2.2 Selection of case studies

To conduct comparative case-study analysis of good-practice ODR processes, two settlements are selected from each state, Gujarat – after the 2001 earthquake – and Bihar – after major flooding in 2008. As Table I shows, these projects share similarities in terms of key selection criteria and also have some variations – in partnership, these case studies provided a robust data set for use in this paper. However, to "focus" this paper and meet the journal's publication requirements, only the key processes (i.e. themes) related to Bihar are reported here in detail.

In August 2008, the Indian State of Bihar was severely affected by flooding of the Kosi River. These floods affected over 3 million people and damaged more than 200,000 homes and a significant number of cattle and crops in 1,000 villages throughout the five districts of

Reconstruction programme	Post-2001 Gujarat earthquake reconstruction program		Post-2008 Bihar Kosi River flooding reconstruction by ODRC	
Key selection criteria				
Agencies involved	*Abhiyaan + Hunnarshala*	*SEEDs*	*ODRC* (*Hunnarshala*, SEEDs, PiC, CEPT etc.)	
Resilience features explicitly incorporated in housing	√	√	√	√
Owner-driven	√	√	√	√
Upfront consideration for capacity-building	√	√	√	√
Special mention/awards	UN-Habitat, UNHCR and IFRC 2008			
Variables				
Hazard exposure	Earthquake, drought		Cyclone, floods, storm	
Location	*Bhuj*	*Patanka*	*Supaul*	*Madhepura*
Project wholly or largely complete	Wholly	Wholly	Largely	Largely
Years since the project built	12 years old		5 years old	
Implementing agency set-up	NFP	NGO	NFP	NGO

Table I. Criteria for the selection of case-studies

Araria, Madhepura, Purnia, Saharsa and Supaul (GoB, 2010). Although flooding is a recurring feature in this state (which is covered by a network of rivers and tributaries), the 2008 floods were not usual, as the river Kosi burst its embankments, upstream – near the Nepal border, changing its natural river course and inundating the so-called "protected area", which had not experienced flooding for several decades (GoB, 2010). The devastating effect of the flood on people, their livelihood and housing can be seen in Figure I.

An ODR approach was adopted by the State Government of Bihar (GoB) in partnership with United Nations Development Programme (UNDP) for housing reconstruction in this area and was implemented by Owner-Driven Reconstruction Collaborative (ODRC). The ODRC was composed of a network of Indian developmentally oriented agencies and institutions with experience and expertise in community-led post-disaster reconstruction (Government of Bihar and ODRC, 2008; GSDMA and UNDP, 2005). This collaboration was invited so that these organisations could share their expertise in ODR, as India's understanding of the ODR process has and is evolving in terms of its:

- fundamental properties;
- in-field use; and
- mainstreaming in Government policy (Government of Bihar and ODRC, 2008).

Apart from this project being a collaboration at-scale, it had another unique feature of piloting the reconstruction process prior to policy implementation (BA-2, 2014) (Please note that throughout this paper data from respondent interviews are extensively used as supporting material. Each respondent has been de-identified by using the following reference code, BA-X 2014, where "B" refers to the location of the interview, "A" refers to agency member and "X" the number assigned to each individual respondent; and year of interview. This code is used throughout this paper). Piloting was done in the two settlements of Orlaha (in Supaul district) and Puraini (in Saharsa district) because of their proximity to the dam and the extent of devastation. The intention was to construct climate-resilient houses and promote sustainable livelihoods and environment through empowering communities to own the reconstruction process (NIDM, 2011). Hence, these pilot projects "fit" well within the scope of this research investigation and were used as case studies.

Figure 1.
Left = Map of Bihar with red oval showing location of two case-study settlements (Source: Compare Infobase 2008) Right = Flood devastation (Source: www.gfdrr.org.indiapdna2008)

2.3 Sampling strategies

Purposive sampling method was selected to identify samples within the selected multiple cases (Robson, 1993) for detailed investigation. The purposing sampling approach is guided by a conceptual framework that is as follows:

- Capacity-building;
- spatial design and construction; and
- funding mechanisms.

These three focus areas and information provided by the "key informants" allowed the researcher to identify an initial sample of households and agency members. Furthermore, a triangulation method was used to support and enhance the quality of data provided by the above approach (Mason, 2002). Three groups of people were identified as samples – beneficiaries, non-beneficiaries and agency members as shown in Figure II.

In Bihar, the key informants were local social workers, who were identified during a Stage-1- reconnaissance field trip to India, conducted in November-December 2012. A final selection of appropriate samples of households was done inductively, with support of key informants (social workers) during a Stage-2 field trip to Bihar in 2014. A small sample of about eight to nine households/beneficiaries, about three to four non-beneficiaries and six to seven agency members were identified as sufficient to give an understanding of the entire project. See Table II for number of samples in the case of Bihar.

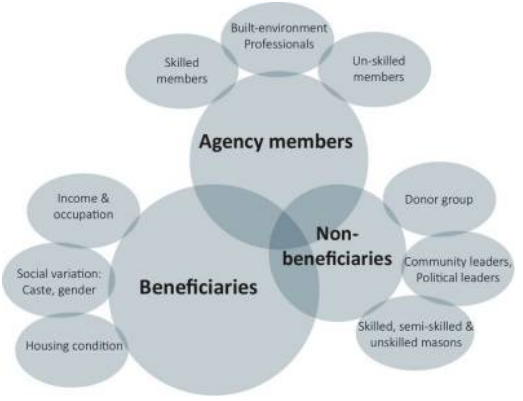

Figure 2.
Purposive sampling from three groups of people based on social, economic and housing condition

Table II.
Sample size compared to number of beneficiaries in two case-study settlements – Orlaha and Puraini in Bihar

Settlement name	Households	Beneficiaries	Interviewees
Orlaha	110	41	9 Beneficiaries 11 (Agency members + Non-beneficiaries)
Puraini	102	89	8 Beneficiaries 10 (Agency members + Non-beneficiaries)

2.4 Data collection techniques, analysis and interpretation plan

Qualitative techniques such as face-to-face semi-structured interviews and focus group discussions with the selected samples comprised a main aspect of this empirical investigation (Mason, 2002; Robson, 1993). This tactic was considered appropriate for the study as it stands halfway between an emergent, open-ended interview technique and a well-defined, structured interview technique (Robson, 1993). Another hurdle to overcome was the illiteracy of respondents. Hence, conducting small interview surveys was found more appropriate than self-administered, postal surveys or questionnaires. In essence, the small surveys were conducted along with semi-structured interviews to allow the researcher to measure respondent's satisfaction with various aspects of the ODR approach (on a sliding scale of 1-5). In addition, secondary data such as agency documentation, photographs, sketches of houses and settlements were also used to document the reconstruction process at points in time (Robson, 1993).

For data analysis, a three-tiered approach was adopted, it is a non-linear iterative and on-going process, which is as follows:

- establish a theoretical/conceptual framework (see Section 2.3);
- conduct mixed-method research analysis (inductive + deductive); and
- refine the theoretical framework (Yin, 2003).

For the qualitative data, a thematic analysis was used to group the outcomes into key processes (i.e. themes), whereas for the quantitative data, excel spreadsheet was used to support analysis. Please note that quantitative and qualitative data are integral to the larger framework in this research project; however, to meet the length requirements of this journal publication, the qualitative data are only discussed in the following section.

3. Key themes – discussion

In the context of the research question "how can post-disaster housing reconstruction projects increase the long-term disaster-resilience of at-risk communities in India?", four themes have emerged as key processes during ODR in Bihar. These themes are identified in Figure III and have emerged based on the analysis of the interviews, focus groups and observations of the housing in settlements under investigation. The Themes 2-4 are briefly discussed below with detailed elaboration on Theme 1 following.

Theme 2 is titled Housing Design and Construction for Disaster-resilience. This theme consists of seven sub-themes which revolve around the various aspects of housing design and construction that play an important role in ensuring diversity in housing design, local versus modern materials and technology selection and more. The importance of this theme is that it relates to housing as one of the most basic and yet most expensive asset of most people worldwide. Achieving disaster-resilience of a house plays a significant role in developing safety for residents.

Mode of housing assistance and livelihood incorporation is the title given to Theme 3. This theme of imparting housing assistance to those in need was thought to be very important by researcher; however, after field study, it was discovered that Theme 4 may have played even an bigger role than Theme 3.

An unexpected result was identified during the field study and is noted as Theme 4 – Participatory/informal governance. This theme suggests that local governance structures play an important role in Indian rural areas (e.g. *Panchayat*) to ensure that no social tensions emerge despite aid discrepancies. The villagers wholeheartedly welcomed whatever

Theme-1	Community mobilisation and its role in maintaining an "owner-driven" process
a.	Identifying at-risk communities (beneficiary)
b.	Community facilitation hubs (later known as "Kosi Setu Kendra"or KSK)
Theme-2	Housing design and construction for disaster-resilience:
c.	Model house for design support
d.	Legalising traditional construction technology
e.	Labour selection: Owner-driven NOT NECESSARILY owner-built
f.	Capacity building in construction sector/ Livelihood incorporation
g.	Monitoring for safe and quality construction
h.	Access to basic services
i.	Incentive based timely completion
Theme-3	Mode of housing assistance and livelihood incorporation
j.	Housing assistance to give households control – both male and female
k.	Livelihood incorporation/ diversification with reconstruction
Theme-4	Participatory/ Informal governance
l.	Participatory/ informal governance great as a concept – but what does it really mean?
m.	Informal governance – how and why did it work?
n.	Transition from civil society to local government

Figure 3.
Findings from long-term research on best-practice owner-driven housing reconstruction in rural India grouped as sub-themes under four key themes

external support they got and helped each other to recover. This theme seems to have played a significant role in ODR process's long-term effectiveness.

3.1 Theme 1: community mobilisation for ODR process

Theme 1 – community mobilisation and its role in maintaining an owner-driven process is the title given to this key process. The theme relates to community mobilisation for the ODR process which is found to play the most essential role for building trust in the community for whom the agencies and government are working. Because of this trust, a strong foundation was developed for the people to work with ODRC. Two processes within Theme 1, referred to as sub-themes, are noteworthy for ODR's success or failure. These are:

- beneficiary selection; and
- community facilitation hubs.

The beneficiary selection sub-theme refers to:

- community members that become the recipient of a house (i.e. reconstructed or new);
- how many houses someone or a group receives and addressing the issues of land ownership (i.e. land rights); and
- someone or a group not being placed on the beneficiary list.

The second sub-theme relates to the setting up of a hub composed of multi-disciplinary team for managing community facilitation. This community hub is referred to as "Kosi Setu Kendras" (KSKs) in the site under investigation and when translated literally means a Kosi Bridging Hub. That is, a hub which acts as a bridge between the community and the government and an enabler for the local communities to make informed decisions during the process of their housing reconstruction. Both these sub-themes (see Figure III) have had

either positive and/or negative impacts on community engagement and hence on overall effectiveness of ODR approach adopted in Bihar.

3.1.1 Sub-theme 1: beneficiary selection. In Orlaha settlement, 41 households, out of approximately 110 households, received housing assistance from ODRC. Despite most of the houses being damaged due to their original construction practices (made from untreated bamboo, grass and mud) and being inundated in flood waters for months, not all those affected received housing assistance. To some extent, the beneficiary selection process appeared *ad hoc*, for example, one widow's name (OB-8 2014) got added to the list while another widow (ONB-2 2014) in similar circumstances could not get her name added to the list, after initial public display of beneficiary list in Orlaha. Hence, the widow OB-8 2014 received a model ODR house (see Figure IV, left) while the other another widow ONB-2 2014 missed out (see Figure IV, right).

In the Puraini settlement, on the other hand, 89 of 102 households received housing assistance. Despite almost everyone's name on the beneficiary list, some issues still arose in the village. In this instance, the issues related to the number of reconstructed houses allocated per family. For example, if one parent had three boys, they were given assistance for the realisation of three houses; one house was in the name of the parents and the other two in the name of two of their eldest children. (It was assumed that the youngest son would share the house with the parents and after the parents' death that house would be passed onto that youngest son.) However, some influential people managed to get housing assistance for their parents as well as all their brothers. To everyone's surprise (as suggested in the interviews), the *panch* (the village leader) did not receive such benefits; he was said by respondents not to be a corrupt man (PA-1, 2014).

Issues of beneficiary selection have emerged in the interviews time and time again despite good policies or good intentions of agencies. In the case of Bihar, beneficiary selection was the responsibility of GoB, which was carried out by the Block Development Officer and the *mukhiya* (political leader at the block level) (BA-3, 2014). Though ODRC was not responsible for beneficiary selection, they assisted community members by maintaining transparency by displaying the beneficiary list in the village and by taking any matter of dispute to the GoB for negotiation and/or resolution (BA-2, 2014). Despite an MOU agreement between GoB and ODRC, the ODRC's request to modify the beneficiary list after checking on-ground realities was not approved by the GoB and the beneficiary list was not altered. Overall, there was dissatisfaction amongst households (in both, Orlaha and Puraini) and amongst agency members regarding beneficiary selection, as housing assistance did not reach some of "those who were in real need of a house at that time" (BA-3, 2014).

Figure 4.
Rebuilt house of one widow who received assistance (left) compared to the one who missed out (right)

To investigate whether this discrepancy was based on the socio-economic condition of the locals, the researcher looked at the social profile of the place. In both the settlements, people described their communities based on their caste and status, with an underlying hierarchical structure. Table III presents the hierarchical structures evidenced in the villages under investigation, with "1" being highest social status and "4" the lowest. There was no evidence of social or caste-based discrepancy in beneficiary list. For example, in Orlaha, the prime reason for the widow OB-8 2014 getting favoured over another widow (i.e. ONB-2 2014) to be included in beneficiary list was that the villagers argued and voted for her during a land-ownership conflict resolution stage. From social profiling, it was determined by the researcher that OB-8 2014 who was favoured by the villages was from the lowest caste, whereas the other widow ONB-2 2014 was from a higher caste. On another occasion, a Muslim widow not only received housing assistance but also got land-purchase assistance due to support from the villagers. This suggests some sort of informal governance (Theme 4) may be at play.

Another issue that played a role in discrepancy in beneficiary selection was social power, in both settlements. One of the local social worker said that "with money came social power and voice" (BA-3, 2014). Few households pointed the finger at their local leader – the *mukhiya* – who was argued to be corrupt and who took advantage of this opportune moment to make money. The locals argued that those who were financially well-off could get more houses or get their names added to the beneficiary list by paying money to the *mukhiya*. Usually, the households with a higher caste such as *Mandals* were also a group that had financial power. And it was observed in Puraini that the *Mandal* community was the one that had managed to get more houses. This example highlights that influence, power and corruption during beneficiary selection process of an ODR can lead to household dissatisfaction.

To some extent, local ignorance about the reconstruction process also had a role in beneficiary selection. Locals had never in the past witnessed assistance for rehabilitation of permanent houses. So, in the initial stages when damage assessments were carried out to identify beneficiaries, the locals were not sure what that processes meant to them. Partly, the reason why people did not know about the process was because they had fled the disaster area and an attempt to make contact with residents was never initiated by the local government. As a result, many locals were not present during the on-site reconstruction discussion to ensure their names were on the beneficiary list.

Despite the discrepancies in the beneficiary list, it was refreshing to see how resilient the communities were, rebuilding their own houses based on observing an agency-supported housing approach. In the future, a social worker pointed out during an interview that there

Table III.
Social profiling of community in Orlaha and Puraini settlements in the Indian state of Bihar (caste-based hierarchic structure with 1= high and 4 = low caste; and livelihood)

Social profile of Orlaha	Status (high to low)	Social profile of Puraini
Mandal (agricultural land owners, contractors)	1	Mandal (agricultural land owners/Master masons)
Patwa (labourer – agricultural/construction)	2	Rajput (driver, migrant labourer)
Muslim (labourer – cotton quilt makers)	3	Mehta (land owners)
Sardar (labourer – masons/bamboo artisans)	4	Harijan (labourers)

needs to be a system whereby an on-ground implementing agency (such as ODRC) should be able to correct and amend the beneficiary list (BA-3, 2014).

3.1.2 Community facilitation hub or KSKs. Within the theme of community mobilisation, the second sub-theme identified setting up of hub composed of a multi-disciplinary team (later known as *Kosi Setu Kendra*).

The ODRC advocated for one community hub for every cluster of two to three *panchayats* or for every 2,000-3,000 houses (BA-1, 2014). "*Panchayats* are community councils of elders that should not be confused with the legislated and government initiated elected *gram panchayats* mandated by the 73rd amendment of the Indian Constitution of 1992" (Duyne Barenstein and Sonja, 2012, p. 166). The community hub in the *panchayat* usually was composed of one engineer, two social workers, two master masons and one manager (Rawal and Virmani, 2012). This group was in-charge of community mobilisation, enabling community engagement and facilitating the ODR process.

In preliminary stages of the ODR process, the most essential task of this group was to gain trust of the local people by allowing an external agency to support them with their own housing reconstruction (also termed as mobilisation). The ODRC had teamed up with a local NGO called *Meghpain Abhiyaan* and others, to identify and involve social workers and masons who are local – familiar with the local culture, technology and language. The social workers provided support with the task of social mobilisation – going from one house to the other, explaining why it was important for the community members to, for example, build disaster-safe housing (BA-3, 2014). It was this process of building people's trust in the agency which was one of the most challenging tasks, but most important in the ODR process.

Once trust was established between the ODRC and community, all the legal and financial issues could be resolved through the facilitation process. For example, in a context of widespread community illiteracy liaising with banks for opening a bank account in the name of a beneficiary could be relatively easily done with either men or women. However, the community hub helped liaison where people where illiterate, gender issues were present in communities and/or the majority of people in these settlements of Bihar never have had a bank account.

Land title was another major issue for the community hub and the ODRC, given that the ODR process was conducted in a rural setting and everything was managed seemingly in an informal manner, without any legal paperwork for land holdings. For the agencies to support households in building a permanent house, land title was mandatory. Hence, ODRC facilitated the process of locals obtaining land title and also helped financially for those who did not have any land (BA-1, 2014). The team of the ODRC thus provided support to the local community in raising awareness and disseminating information from the government, identifying issues and resolving them collectively.

During pre-construction and the construction phase, when few model houses were built, the ODRC's team worked closely with the local masons. There was a two-way exchange of information here. For example, the technical team learned from the local masons about the use of *fita* (recycling waste zip material) for tying bamboo – a local innovation replacing rope which lasted longer and cost less (BA-1, 2014). On the other hand, the community hub acted as a technical skills training centre for local masons to ensure they had skills for constructing hazard-safe houses. In this instance, the local masons were trained in rat-trap brick masonry and bamboo-connection refinement for multi-hazard safety (BNB-3, 2014). On-ground, the team at the community hub also provided technical support mechanisms to the locals in procuring materials, bamboo treatment, monitoring the construction quality and timely access of financial assistance at key construction completion stages.

The process of building the locals' trust and mobilising them was the most important process, as it laid a strong foundation for the effectiveness of the ODR process. During

reconstruction facilitation, a combination of social and technical support to the local construction sector as well as local households ensured their engagement. The community hub acted as a communication and facilitation node in Orlaha and Puraini up until the completion of housing (and toilet construction) and street layout and street-light installation, after which they withdrew from the site. Almost all the households interviewed – beneficiaries or non-beneficiaries – in both the settlements, were completely satisfied with the consultation process and said that "without ODRC's support, their houses wouldn't have been built in time and of good quality" (BNB-3, 2014).

4. Conclusion

The aim of this paper was to identify "key processes" of the ODR approaches that enhance long-term disaster-resilience of housing and their households. Four themes emerged from investigations in the settlements of Orlaha and Puraini. Of the four themes, this paper focussed on the presentation of material related to Theme 1 – community mobilisation for maintaining effective engagement. Two sub-themes within Theme 1 were discussed highlighting some of the positive and negative results of processes.

The first sub-theme highlights a need for more equity in beneficiary selection, as that was found to be a disappointing aspect of the ODR process. The main reason that emerged for a discrepancy in the beneficiary selection process is influence, power and corruption amongst local political leaders. Thankfully, due to the presence of the ODRC – its community-facilitation process and informal governance within the villagers, community disputes were minimised. These two processes combined during beneficiary selection ensured social cohesion was maintained.

The second sub-theme, community facilitation hub, highlights the success of set-up of a multi-disciplinary team dedicated to be nodal agents between government and community (KSK). This team's facilitation process was the key to building the community's trust, providing support to locals and ensuring their engagement through all stages of the ODR process. This team's skills ranging from social, technical and management backgrounds were very important factors in the success of the facilitation process.

The key process that emerged from Theme 1 is to have a strong community mobilisation team, which is made up of locals (who are aware of the local language and culture) as well as externals (unaffected by local power and influence). The channel of information and communication from government to the community worked fairly well; however, the process of channelling the local peoples' discontent upstream to the government (e.g. the beneficiary list) did not seem to work efficiently. In Bihar, within Theme 1 of community mobilisation, these two processes played a negative and positive role in determining peoples' satisfaction and their autonomy in housing resilience.

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A new model for effective post-disaster housing reconstruction: Lessons from Gujarat and Bihar in India

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Abstract

This paper critiques the traditional project management (PM) approach for post-disaster reconstruction work in relation to long-term effectiveness at strengthening disaster resilience of communities. While assessments of post-disaster reconstruction projects normally occurs within a few years of the disaster this paper is based on a study of four 'good practice' reconstruction projects, 15 years after the earthquake and seven years after the flooding disaster from the Indian states of Gujarat and Bihar respectively. This extended timeframe enabled the examination of long-term outcomes related to disaster resilience of communities. The comparison of the four case study projects through extended timeframe enabled authors to articulate critical success factors contributing to project's effectiveness. The research found that the best long-term outcomes were achieved when the agencies implementing post-disaster housing reconstruction projects: 1) adopted an 'agile' approach to project planning and implementation; 2) allocated ample time for gaining and maintaining community trust; iii) provided multiple materials, technologies and skilled labour choices to ensure hazard-safety of housing, and (iv) continued community capacity building beyond the completion of the reconstruction work. These imperatives have prompted the development of a progressive, spiral model for effective post-disaster housing reconstruction project management which is presented in this paper.

Classification: Empirical research paper.

Keywords: Project life-cycle; Housing reconstruction; Post-disaster project management; India; Community capacity; Resilience

1. Introduction

Over the last 10 years, disasters have continued to increase in frequency, magnitude and complexity, affecting the wellbeing and safety of increasing numbers of people and communities, especially those with high levels of hazard exposure most commonly found in 'developing' countries (UNISDR, 2015). This increase in disaster exposure has prompted a growing interest in how post-disaster reconstruction (PDR) work can make affected communities safer and more resilient to future disasters, whether they are deemed to be 'natural' or human-induced disasters (Jha et al., 2010; UNDRO, 1982). The relatively new focus on 'disaster resilience' echoes earlier suggestions that PDR can provide an opportunity to "Build Back Better" (Sendai framework for Disaster Risk Reduction 2015–2030) and can play a role in "building a culture of safety and resilience" for the long term (Hyogo Framework for Action 2005–2015) (IFRC, 2004; UN-Habitat, UNHCR, and IFRC, 2012; UNISDR, 2005, 2015). In theory, effective PDR should aim to enhance disaster prevention and preparedness (GoI-UNDP, 2011) (see Table 1) and should "pay

Abbreviations: EDM, Earthquake Disaster Mitigation and Research Centre; GSDMA, Gujarat State Disaster Management Authority; ODR, Owner Driven Reconstruction; PDR, Post-disaster reconstruction; PM, Project management; SEEDS, Sustainable Environment and Ecological Development; UNCRD, United Nations Centre for Regional Development

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Table 1
Commonalities in core processes across Project management life-cycle (PLC) stages, post-disaster reconstruction (PDR) projects and Disaster Management (DM) (grey background is the focus of this research and red text suggests limitations).

	Project mgmt. life-cycle stages (Baum 1970, PMI 2005)	**Post-disaster reconstruction processes** (IFRC 2010; Jha et al. 2010)	**Disaster Management continuum** (IFRC 2008a; NDMA undated; UNDRO 1982; UNISDR 2007)
1	**Identification**	– Context analysis/ risk identification – Hazard damage assessment – Political commitment (policy, social, financial and technical assistance) – Awareness raising – Beneficiary selection – Programme/ project formulation	**I. Relief / response**
2	**Preparation/ planning**	– Planning reconstruction implementation approach – Participatory	**II. Reconstruction and recovery**
3	**Appraisal or negotiation**	– Test/ pilot project – Partnerships – Refine implementation approach – Shared goals	
4	**Implementation, monitoring, supervision**	– Project implementation – Efficient resource management – Monitoring, information management – Capacity building – Social and economic development – Knowledge transfer mechanisms – Environmental management	
5	**Close-out**	– Project completion – Hand over to local agency	
	Self-renew/ continue into a new project	Limited continuity in projects beyond reconstruction for long-term gains	**III. Prevention** (resilience impact; disaster risk reduction) **IV. Preparedness**

for itself many times over in the form of disaster avoided and lives safeguarded" (Office of the UN Secretary-General's Special Envoy for Tsunami Recovery & Clinton 2006, p. 22). However, such noble rhetoric can mask the fact that PDR work is highly complex and multi-faceted, requiring reconstruction agencies to address multi-hazard safety of housing construction, multi-stakeholder engagement, whilst also meeting government mandates and donor pressures. Government and donor pressure encourages haste in the completion of PDR projects (Mulligan and Nadarajah, 2012) and this, in turn, has hindered research on the longer term outcomes of PDR projects, which could help agencies to learn the lessons from past experiences.

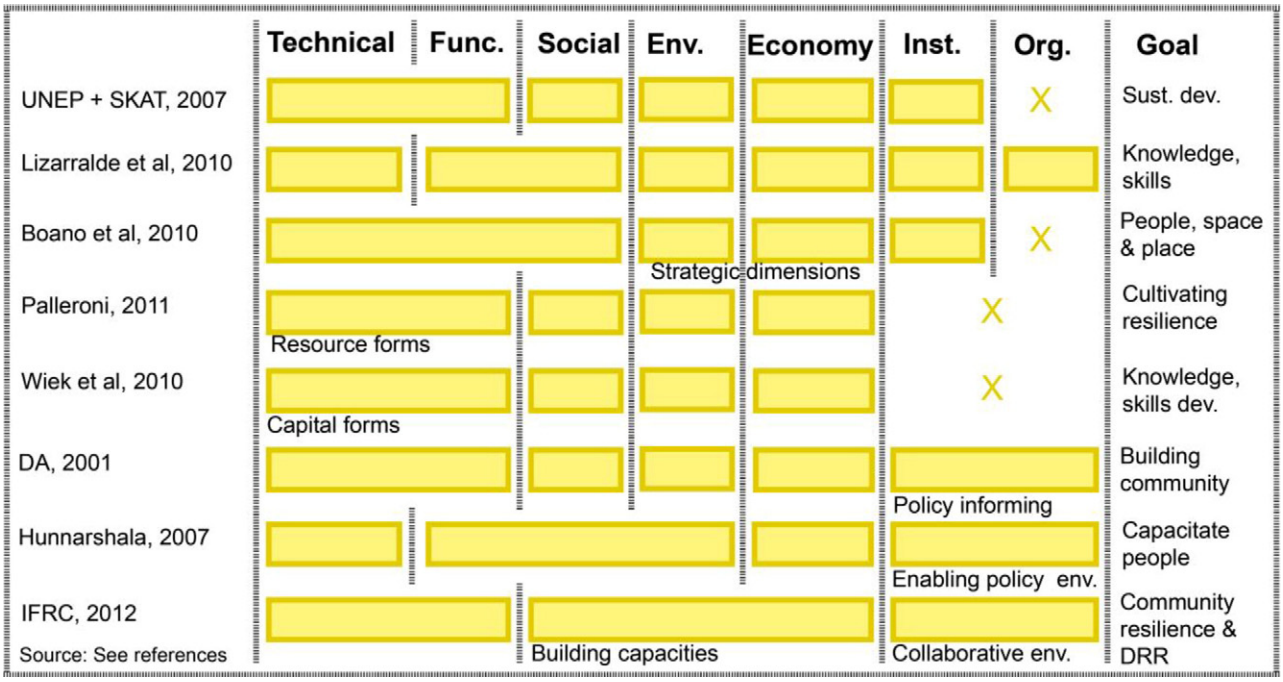
The International Project Management Institute (PMI) has maintained that a well-established project management (PM) approach offers a suitable framework for efficiency of PDR projects by guiding agencies in the coherent application of "knowledge, skills, tools and techniques" (Kulatunga, 2011; PMI 2005, p. 2). The suggested benefits of applying a PM approach to PDR projects are: the delivery of project goals in the quickest time and specified budget (Steinfort and Walker, 2007); and establishment of synergy among various stakeholders for working towards a common project vision and project efficiency through pre-determined closed-loop life-cycle phases (identification, preparation, appraisal, implementation and monitoring/ supervision and close-out (Baum, 1970; PMI, 2005)) (see Table 1). Table 1 draws out some commonalities and difference between PM life-cycle stages, PDR processes and a disaster management continuum. While the PM approach has clear efficiency dividends, this paper presents arguments that it fails to grasp the complexity of PDR projects.

The paper begins with a discussion of the key inadequacies of the traditional PM life-cycle approach for managing complex PDR work. It then describes the case study research in Gujarat and Bihar which underpins the articulation of a new model of managing PDR projects for achieving long-term disaster resilience of communities. Description of four case study PDR projects through their life-cycle phases from planning, implementation, immediate results and long-term impact, follows comparative analysis. The research findings underpin the articulation of a new life-cycle model for PDR work which can deliver better long-term outcomes that the prevailing PM approach cannot.

2. Limitations in traditional Project Management approach for post-disaster reconstruction interventions

The PM approach to PDR work has been criticised for the following limitations: i) it focuses on a single project life cycle or inflexible timeframe for project completion, ii) it tends to identify PDR work as a technical challenge to the exclusion of other complex challenges and iii) it measures project effectiveness in terms of project outcome rather than on-going

Table 2
Key asset-types in post-disaster reconstruction and their long-term goal for communities.



processes. Each of these limitations needs to be discussed in a little more detail.

2.1. Focus on a single project life-cycle timeframe

PDR project is defined as "a temporary endeavour that delivers benefits using temporary teams that mainly come together for short bursts of time to deliver a result that has a defined phased life cycle moving from initiation through design, delivery to closeout and while these phases may be recursive they are generally well defined" (Steinfort and Walker, 2007, p. 5). Unfortunately, the emphasis on a short timeframe and on the need for project 'closeout' within standard timeframe, fails to tackle the complexities and dynamics in play during the life of the project. As Bosher (2008, p. 13) explains, for disaster resilience of communities, housing and settlements needs to be "designed, located, built, operated and maintained in a way that maximises the ability of built assets, associated support systems (physical and institutional) and the people that reside or work within the built assets, to withstand, recover from, and mitigate for the impacts of extreme natural and human-induced hazards". This suggests that PDR projects extend way beyond the time scope of single project. It has been noted that the time allocated during early stages of decision-making can determine "the future form of the new settlement and even the long-term economic development of a community" (Davis, 1978a, p. 91). While the emphasis on achieving project 'closeout' is based on the need for 'efficiency' and on a desire to avoid 'aid dependency', however, it does not even factor in long-term technical aspects of housing operation and maintenance (Bosher, 2008), let alone more complicated questions of ensuring the socio-political support required for ensuring hazard-safety technology gets embedded in the local culture (Mulligan and Nadarajah, 2012).

2.2. Identify PDR project as a technical challenge rather than system change

A range of scholars have emphasised that PDR generally occurs within complex social, cultural and political contexts, as explained in vulnerability and risk theory proposed by social science scholars (Oliver-Smith, 1990, 1996; Wisner et al., 2003), and later in the concept of disaster resilience (Aldunce et al., 2014; IFRC, 2010). Vulnerability and risk theories suggest that housing damage and associated loss of life is not only related to physical or technical vulnerabilities (such as unsafe construction or dangerous locations) but also to various underlying causes such as: i) prevailing socio-cultural values (Jigyasu, 2010), ii) financial affordability issues (Niazi, 2001), (iii) environmental insensitivity in past planning regimes, (iv) low skills in relation to safe construction techniques (Vahanvati & Beza forthcoming) and (v) institutional inability to enforce construction standards (Duyne Barenstein and Sonja, 2012; Schilderman and Lyons, 2011). Since risk relies on so many factors, disasters disproportionately impacts the marginalised people (McEntire, 2012; UNISDR et al., 2009; UNNATI undated). These risk factors have been called "resource forms" (Palleroni, 2011), "capital forms" (Wiek et al., 2010), or areas for "capacity building" (Hunnarshala, 2007; IFRC, 2012) (see Table 2). Later, the concept of 'disaster resilience' (Holling and

Table 3
Analytical framework and corresponding questions

Project cycle	Aspects	Key questions
Planning and design INPUT	Community engagement	Did the community have say in beneficiary selection?
		Were residents engaged in decision-making?
		Were resident in-charge of their house design and its location?
		Was socio-financial support provided for banking/land-title resolution?
	Design and technology selection	Were disaster-safe technologies incorporated?
		Was spatial layout, functions and dimensions contextual?
		Were basic amenities and infrastructure incorporated?
		Were community's coping mechanisms incorporated?
		Was the rural technology legalised?
	Equitable assistance	Was funding for the housing project provided by the State Government?
		Was the housing assistance uniform for all beneficiaries?
		What was the means of assistance delivery?
		Were both- male and female residents, in control of assistance?
Construction **OUTPUT**	Resident control	Was resident in-charge of technology selection?
		Was resident in-charge of labour selection?
	Quality (skills training and monitoring)	Were locals trained and employed in safe construction?
		Were materials provided to the residents?
		Was the quality of construction good and managed collaboratively?
	Cost-effectiveness	Was livelihood or training integrated in housing assistance?
		Was the cost of housing ok?
Short-term **RESULTS**	Pertinence	How satisfied are residents with consultation? (%)
		Did the most at-risk people benefit from this project?
	Acceptability	Did the resilience options meet resident needs?
		Do residents feel safe in resilient housing?
		Are the resilient houses environmentally 'good'?
		Is the housing outcome diverse?
	Maintenance	Are houses cost-effective to maintain or repair?
		Are productive assets hazard-insured? (%)
		Has funding been allocated for infrastructure and livelihood support?
	Time-frame	Was the time-frame for support sufficient?
	Evaluation and project close-out/ Hand-over	Was evaluation of reconstruction done by the NGO?
		Was there a hand-over/ continued support for capacity building of masons and community?
Long-term **IMPACTS**	Awareness	Has the PDR project enhanced resident awareness about resilience?
		Has the project increased women, children and elder's safety?
		Is local community organised to maintain housing-resilience?
	Sustainability	Is the resilience housing technology replicated?
		How easy is it for residents to access info, materials and skills to maintain house?
	Livelihood	Has the resident livelihood diversified/ improved since the project completion?
		Has the project enhanced entrepreneurship in building material supply?
		Has the resident capacity to access resources (finances, materials) improved?
	Strategic objective	Has the PDR project reduced the hazard risks and enhanced the resilience of community?
External factors	Were there any factors beyond the control of the implementing that affected the results of the project? How were they tackled?	

Walker, 2003) also drew attention to the need for 'systemic-change', which unified risk factors with community-owned "assets", the "qualities" of assets, and the "capacities" of communities to adapt to changing circumstances (IFRC, 2012). However, none of these factors are considered in the traditional PM approach of 'asset replacement' (Crawford et al., 2013). Nonetheless, PDR of housing and settlements has progressed from '*no replacement*' to '*insufficient replacement*' to '*replacement*' to '*development/build back better*' (BBB) strategy (Davis et al., 2015). While the ability of PDR projects to enhance disaster resilience of communities can be easily overstated, they can, as a minimum, focus on strengthening 'soft' assets or the affected community's 'adaptive capacities' (Barenstein and Iyengar, 2010), while rebuilding 'hard assets', as emphasised in BBB strategy (Office of the UN Secretary-General's Special Envoy for Tsunami Recovery and Clinton, 2006).

2.3. Measures project effectiveness in terms of product outcome rather than processes

While effectiveness of traditional PM is measured in terms of time, budget and product outcomes, success of PDR is determined by a much wider array of considerations. For example, while the PM approach may be concerned about how to eliminate the "vicious cycle of delays" (often caused by inadequate planning), and rapid evaluation of contractor qualifications (Kim and Choi, 2013), Ahmed (2011) argues that the achievement of 'political goodwill' and active co-operation of communities concerned are just as important

for long-term success. Ophiyandri et al. (2013) identifies an even wider array of critical success factors, including 'soft resources' (community participation and trust), skills (capacity of facilitators and implementers), transparency and accountability, and institutional support (policy formulations). The fact that there is no consensus on the critical success factors for PDR projects suggests that it is hard to generalise desired outcomes when circumstances vary so much in regard to type and duration of the disaster, pre-existing vulnerabilities, existing skills and competencies within the affected communities, and the competencies of project stakeholders (including representatives of government) (Meding et al., 2016). All of these factors are in turn embedded in the local context. The need to consider so many influences and variants has led to a broader consensus on a process-oriented, rather than project outcome-oriented evaluation of PDR successes (PracticalAction, 2010; Turner, 1976; UNISDR, 2015), reflected in advocacy for a participatory or an 'owner-driven' reconstruction (ODR) approach (Barakat, 2003; Ganapati and Ganapati, 2009).

While the limitations of the traditional PM life-cycle approach for PDR have been well articulated, the complexity of ODR makes it hard to suggest alternative approaches. Nonetheless, India has been at the forefront of owner-driven reconstruction (ODR) policy and practice, so we turn our attention to the case study research in Gujarat and Bihar.

Fig. 1. Map of India showing the Indian states of Gujarat and Bihar for case-study location. (Source: www.nationsonline.org)

Table 4
Criteria for the selection of case-studies.

	Reconstruction programme	Post-2001 Gujarat earthquake reconstruction program		Post-2008 Bihar Kosi River flooding reconstruction by ODRC	
Key selection criteria	Agencies involved	*Abhiyan*	*SEEDs*	*ODRC*	
	Physical: Resilience features explicitly incorporated in housing	√	√	√	√
	Social: Owner-driven	√	√	√	√
	Economic: Upfront consideration for capacity-building	√	√	√	√
	Special mention/ awards	UN-Habitat, UNHCR, and IFRC, 2008			
Variables	Hazard exposure	Earthquake, drought, sandstorms		Cyclone, floods, earthquake	
	Location	*Bhuj*	*Patanka*	*Supaul*	*Trivenigung*
	Project wholly or largely complete	Wholly	Wholly	Largely	Largely
	Years since the project built	15 years old		7 years old	
	Implementing agency setup	Not-for-Profit	Non-government agency	A collaborative	

3. Research project

3.1. Methodology and methods

A comparative case study approach and a mixed-method research methodology was adopted in order to explore the long-term effectiveness of PDR projects in both Gujarat and Bihar. The research design explicitly aimed to identify possibilities for "program improvement" (Blessing & Chakrabarti 2009, p. 241). Case study research enables the researcher(s) to investigate 'a contemporary phenomenon in depth and within its real-life context, especially when, the boundaries between phenomenon and context are not clearly evident' (Schramm 1971 in Yin 2003, p. 13). Since this research is concerned with the *process* of housing construction as a social artefact (Ahmed and Ahmed, 1994) in a particular context, it used a combination of methods drawn from social sciences and architecture disciplines. The researcher(s) adopted an evaluative emphasis (Davis, 1978b; Gray et al., 1980), however, remained entirely open to what could be learnt from comparative experiences.

3.2. Sampling strategy, data collection, analysis and interpretation

Purposive sampling was used to ensure that multiple case studies drew on a range of comparable experiences and perspectives (Robson, 1993). A small sample of approximately ten household residents, five agency representatives (architects, engineers), and three other stakeholders were selected from each case study project. Data collection primarily relied on the social science research methods of semi-structured interviews and focus group discussions (Mason, 2002; Robson, 1993) as well as architectural research methods of sketches and photographs. The fieldwork was conducted in two visits undertaken in 2012 and 2014. The confidentiality of research participants is ensured by using identity codes, such as HA-X 2014, where 'H' refers to the location, "A" refers to agency member and 'X' the number assigned to each respondent followed by the year of interview.

3.3. Conceptual and analytical framework

Time and resource constraints meant that the research could not focus on all possible dimensions of PDR effectiveness, so the research focused on the: social, technical, and financial dimensions of PDR project (see Table 3). The Logical Framework Approach (LFA), which is a widely accepted tool for evaluating 'development' and PDR projects (CAPAM, 2004) was used. However, LFA is used for evaluation on-going projects. Hence, a modified version of LFA that allowed for evaluation of post-completion projects by researchers who were not part of the project implementation (Bornstein et al., 2012; Lizarralde, 2002), has been adapted in an analytical framework (informed by several scholars such as, Charlesworth and Ahmed, 2012; Lizarralde, 2002; UNDP and Hunnarshala, 2006) (see Table 3).The phases of the traditional PM approach have been replaced by the following phases in the life of a PDR projects (informed by Bosher, 2008; Tauber, 2013):

Phase I. INPUT/Planning
Phase II. OUTPUT/Construction
Phase III. RESULT/Post-completion
Phase IV. IMPACT/Long-term consequences of the project

Thematic analysis was used for the analysis of qualitative data sets.

3.4. Research setting and case study selection

India offers a great diversity of ODR case study options, with each region having its specific socio-economic, environmental and political systems. For example, since 2001, there has been an increasing emphasis on the "owner-driven

reconstruction" (ODR) approach (Barenstein and Iyengar, 2010; GoI and NDMA, 2011), on resilience rather than just vulnerability (NDMA undated) and has evolved from top-down government to decentralised governance (Rumbach, 2016). India adopted an ODR policy following the 2001 Gujarat earthquake, which was strengthened in response to the 2005 earthquake in Pakistan-occupied Jammu and Kashmir and again following the 2008 Bihar Kosi River flooding.

The research focused on four "good practice" reconstruction case study projects – two from the state of Gujarat (Hodko and Patanka settlements) and two from Bihar (Orlaha and Puraini settlements) (see Fig. 1). These case studies were selected on the basis of few similarities and enough variables to ensure that the findings could have wide relevance (see Table 4). While there was an enabling policy environment, the interpretation and implementation of ODR by agencies varied (Barenstein, 2006; UNNATI, People In Action, and Cordaid, 2012).

4. The 2001 Gujarat earthquake and reconstruction program

On January 26, 2001 – Indian Republic day – the western state of Gujarat was devastated by the second largest recorded earthquake in the Indian history (GoI-UNDP, 2011). It measured 7.9 on the Richter scale causing nearly 20,000 deaths (UNDP, 2009), and destroying over one million houses (GoI-UNDP, 2011). As the earthquake's epicentre was in the district of Kachchh, it suffered over 90% of total deaths and approximately 85% of all asset losses (UNDP, 2009). The Kachchh region, being an arid and desert region, was prone to recurring droughts and occasional sand storms. The region was one of the poorer regions economically at the time of the earthquake. Moreover, the earthquake had hit the state when it had not yet fully recovered from droughts in the previous two years (1999 and 2000), making recovery without external assistance impossible (PA-3 2014).

The government of Gujarat announced a housing recovery program, which had to be amended later to become Owner Driven Reconstruction (ODR) due to the influence of many Indian agencies (UNNATI, 2008). An ODR policy and the public-private partnerships for implementation of ODR projectswere two unique features of the 2001 reconstruction program (GoI-UNDP, 2011; UNDP and Abhiyan, 2005). Funding for reconstruction was primarily provided by the state government with loans from multilateral agencies, such as World Bank and Asian Development Bank (GSDMA, 2001a). The funding model was non-uniform determined by the extent of damage, house type (*kachchha*/semi-permanent or *pucca*/permanent) and location (in rural or urban, near or far from epicentre). Financial assistance was provided to beneficiaries in their bank account (in the name of both male and female householders) and was disbursed in three instalments after certification from the government engineers (ADRC and Sinha, 2001). Citizens and agencies were encouraged to top up government funding by 50% (GSDMA, 2001a). While skills training of masons was recommended during reconstruction, there was a lack of technical guidelines (for traditional technologies) and there was no mandate for addressing housing associated issues such as amenities, services, artisanal livelihoods or indigenous knowledge.

The state government of Gujarat claimed to have rebuilt over 200,000 houses and repaired over 900,000 houses, making this the world's largest and fastest housing reconstruction program (Price & Bhatt 2009, p. 9). For this, the Gujarat state disaster management authority was awarded the prestigious UN Sasakawa award in 2003 (GSDMA, 2005) and a Commonwealth award for making a "paradigm shift from the conventional approach from response post disaster to mitigation and preparedness" (CAPAM, 2004, p. 5). Two reconstruction projects – one by a well-established network of agencies known as Abhiyan and another by a newly formed Indian agency known as SEEDS – were selected as the research case studies in Gujarat.

4.1. Gujarat case study-1: Abhiyan, Hodko settlement reconstruction in Kachchh district (near the epicentre of earthquake)

Kachchh Nav Nirman Abhiyan (hereof referred as Abhiyan) was a network of over 26 locally-based agencies working in collaboration, rather than in competition, with each other.

Fig. 2. Reconstruction in Hodko, Gujarat, in 2001 (left) (source- Hunnarshala); Houses in 2015 (right).

Abhiyan influenced the government's reconstruction policy to be ODR and to be context sensitive (Barakat, 2003; Barenstein and Iyengar, 2010).

4.1.1. Project formulation

Since Abhiyan had been working in the Kachchh region for over 10 years prior to the earthquake, they were aware of systemic challenges faced by local communities apart from physical shelter recovery (e.g., sustainable livelihoods, coping with droughts). Moreover, the Hodko community approached Abhiyan for reconstruction as due to pre-developed trust (HA-2, 2014). Abhiyan and community representatives worked collaboratively during every stage of decision-making, from settlement layout to house design (UNDP and Abhiyan, 2005, HB-1,2,3,4,7 2014)). The funding for reconstruction was entirely sourced by Abhiyan (HA-1, 2014). Abhiyan introduced technical guidelines and 'legalised' traditional earth construction technologies, with support of government's technical consultant Dr. Arya (HA-2 2014). A core-shelter was designed by Abhiyan, based residents' preferences and Abhiyan's own understanding of multi-hazard safety (earthquake, cyclone and flood), local skills, cultural preferences, local climate, and cost-effectiveness (HA-2 2014; KMVS, 2001).

4.1.2. Implementation

Local labour skills in mud construction were excellent; however, skills in rammed earth, bending reinforcement or cement mixing were missing (HA-1, 2 2014). Abhiyan trained and employed a few locals and many more non-local masons for speedy reconstruction (HA-1, 2014). Mud was locally available, whereas sand, cement, steel and water (due to drought) had to be purchased from nearby towns. Material banks were established and managed collaboratively for the distribution of quality and cost-effective materials to the residents (HA-4 2014). While Abhiyan funded and managed materials procurement, labour hiring and construction monitoring, they mandated residents to contribute at least 10% of the housing cost in order to maximise the sense of ownership.

4.1.3. Results

Abhiyan's reconstruction work in Hodko village and in the entire town of Bhuj was quoted internationally as good practice reconstruction effort (UN-Habitat, UNHCR, and IFRC, 2008, 2009). By 38 months after the earthquake, the entire Kachchh region's housing reconstruction was completed (UNDP and Abhiyan, 2005), out of which 130 houses in Hodko were first to be rebuilt (HB-3 2014) (see Fig. 2). Community satisfaction with all aspects of their rebuilt houses – disaster-safe, low-maintenance, construction quality, cultural appropriateness, and aspirations – was very high (HB-1 to 8 2014). Minor concerns were raised by the residents about the house's climatic comfort (heating up, water leakage and dust penetration from the Mangalore-tiled roofs) (HA-2, 2014).

4.1.4. Impact

Fifteen years after the earthquake, the research suggests there were mixed outcomes in terms of long-term community resilience goals. From a housing perspective, the majority of residents were content with their rebuilt houses, which they had personalised and continue to occupy. Most importantly, the houses were in good condition and required low or no maintenance. However, with time, local awareness of safety standards had started fading as evident in a majority of new houses being built using different technologies (stone/cement-block) with unknown, hazard safety (HB-4 2014). Hence the use of proposed hazard-safe technologies had discontinued.

From a system change perspective, the distinction between lower-caste (Harijan Hindus) and higher-caste (Muslims) communities in the village had vanished, thanks to a significant increase and diversification of livelihoods and upgrade in housing. Simultaneously, the research found that the local community's pride and cultural identity had also increased. After reconstruction completion, Abhiyan network agencies' continued onto other projects addressing system change. For example, the livelihood-generating Endogenous Tourism Project for building a rural eco-resort (named *Sham-e-Sarhad*, meaning sunset at the border) (Hunnarshala undated; UNDP, 2003) and revival of an age-old practice of pastoralism

Fig. 3. Reconstruction in Patanka, Gujarat, in 2001 (left) (source — SEEDS); houses in 2015 (right).

(Sahjeevan undated) (HA-4, 2014). While from a technical reconstruction perspective the project was not entirely successful in creating a culture of safe construction, however, from a systemic change perspective, there have been successes in empowering the Hodko community.

4.2. Gujarat case study 2: Patanka village reconstruction, Patan district (farther away from the same epicentre)

Sustainable Environment and Ecological Development (SEEDS) is a national non-government organisation based in New Delhi and Kobe (Asian Disaster Reduction Centre (ADRC), 2005). As SEEDS was not local to the state of Gujarat, they had to search for a village to offer reconstruction assistance. Moreover, SEEDS was a newly formed organisation with little experience in disaster reconstruction at the time.

4.2.1. Project formulation

In Patanka village, SEEDS had approached the community to offer assistance (Gupta and Shaw, 2003). With no local knowledge, SEEDS devoted significant time to learn about the local culture and processes related to construction technologies and environmental impacts. To build community trust, SEEDS conducted shake-table seismic strength tests with four construction technologies, as preferred by the community (PA-1 2014). Based on the results of these tests, SEEDS developed their own technical guidelines for stone construction (Gupta and Shaw, 2003; PA-3 2014). SEEDS mostly abided by the government beneficiary list and provided top-up of materials – including steel and cement – to existing government funding (PA-1 2014). While residents were given the freedom to design their own core shelter (PB-1,4,9 2014), half of them copied the model core shelter proposed by SEEDS (PB-3,5,7,8 2014).

4.2.2. Implementation

Local construction quality reflected poor local skills and technical know-how in stone masonry and reinforced cement concrete (RCC) (Desai, 2002). SEEDS trained all the locals interested, although very few took active part. While no technical guidelines were developed, a mason-exchange program was organised by SEEDS (PB-4,7 2014) whereby two masons, highly skilled in seismic construction from Nepal Society for Earthquake Technology, trained Patanka residents (PA-4, 2014). Materials banks were set up and managed collaboratively (for distributing SEEDS procured steel and cement). All other materials and labour were sourced by the residents themselves (PB-1,2,7,10 2014). Construction monitoring was performed collaboratively (PB-3,4,8 2014).

4.2.3. Results

SEEDS' reconstruction project in Patanka settlement was claimed best practice for enabling disaster resilience of communities (IFRC, 2004). About 300 resilient houses were rebuilt collaboratively by SEEDS and the community (see Fig. 3). The satisfaction rate with all aspects of their house was very high among all the residents interviewed (PB-1 to 10 2014) (as in Hodko). There were minor concerns regarding climate comfort (too hot in summers) and high salinity and wetness in mud floors (PB-2,7 2014).

4.2.4. Impact

Fifteen years later, there are mixed outcomes in relation to long term resilience. From a housing perspective, the impact was similar to that in Hodko in terms of high community satisfaction (PB-1 to 10 2014) and few concerns with the proposed technology due to exposure of steel in reinforced cement concrete could be detected in a few of the houses. However, most residents continued to have vivid memories of the hazard-safety features and these were reflected in new house extensions. Some cost-effective innovations were made by replacing RCC beams with stone bands; however the safety of this remains unexamined.

From a system change perspective, the housing scenario of Patanka settlement has also changed like Hodko, suggesting a culture of safe construction removing distinction between the poor and the rich. SEEDS also moved onto other projects after housing reconstruction completion, such as building a school and a communal water tank (for drought readiness); but they had to withdraw from the site prematurely. SEEDS was not successful at forging partnerships with a local organisation, such as the Self Employed Women's Association (SEWA), to allow for continuity in support to the community (PA-1 2014). However, prior to withdrawing from site, SEEDS mobilised about 40 trained masons to form 'SEEDS Mason's Association' (SMA) (PA-4, 2014), and linked it with government funding to provide further skills training and certification in seismic-safe construction in Zone V and Zone IV areas (GSDMA, 2001b). SEEDS also created employment for these masons for more than nine years (PA-2, 3, 4 2014). The masons' association has been a clear success story and many of the local masons have also managed to diversify their livelihoods, while they also spread a culture of safe construction among fellow masons in India and overseas.

5. The 2008 Bihar Kosi floods and reconstruction program

In August 2008, the northern Indian state of Bihar was devastated by a sudden surge in the Kosi River due to heavy rains and a rupture in its embankments. This caused a change in the river's natural course, inundating the so-called "protected areas", which had not experienced flooding for several decades and hence, had neither flood-proof housing (on stilts) nor boats for evacuation. Residents were totally unprepared for a disaster of this intensity or duration (GoB, 2010; UNDP, 2009). The scale of damage was exceptionally high with about 1000 villages (FMIS and GoB, 2009) and over 3 million people affected (PiC, 2010; UNDP, 2009). More than 200,000 homes were damaged and there was significant damage to cattle and crops due to protracted inundations (GoB, 2010). The severity of disaster impacts can be attributed to exogenous factors (unexpected floods), as much as endogenous factors (deep-rooted poverty, illiteracy, limited or no access to basic amenities) (BA-2 2014). Residents had experienced much less severe annual flooding and occasional cyclonic winds, which

Fig. 4. Reconstruction in Bihar, in 2008, using bamboo (left) (source — SEEDS) and in 2014 using brick (right).

added to their overall vulnerability but they had never received disaster recovery assistance before the 2008 flood disaster.

The Government of India declared the Kosi floods a national calamity. The Bihar government invited a consortium of experienced Indian agencies and international think tanks, referred to as ODR Collaborative (ODRC), for policy advocacy (GoB and ODRC, 2008). The government of Bihar had no experience itself in management of an ODR process for disaster recovery, and also had no trust in the ability of their own citizens for rebuilding houses up to hazard-safety standards (BA-2 2014). In order to build the capacity of Bihar government, ODRC proposed to implement reconstruction in two stages. Stage1 involving piloting of reconstruction processes by ODRC in order to fine-tune an ODR process to suit local conditions, described by ODRC as an 'agile' approach to policy development. For Stage1, a draft ODR strategy was formulated, which included: i) social support (setting up bank accounts and building local confidence in their ability to rebuild safe houses); ii) technical support (aimed at legalising rural construction technologies) and iii) a uniform financial package for building a core-shelter of 15sqm (BA-6 2012, NIDM 2011). Stage2 was envisaged as fine-tuning of the ODR policy by ODRC leading up to a hand-over to the state government so that the state could oversee the rebuilding of around 100,000 safe houses (Government of Bihar and ODRC, 2008). For Stage2, the state procured financial assistance from the World Bank (GoB and World Bank, 2010; World Bank, 2012). Unlike Gujarat, multiple agencies were not present, just the one large consortium worked directly with the state government. Both Ahbiyan and SEEDS were part of the ODRC coalitions.

5.1. Bihar case studies 1 and 2: Orlaha settlement (far from the ruptured embankment) and Puraini settlement (close to the same embankment)

Two settlements (or *tolas* in local language) – Orlaha in the district of Supaul and Puraini in the area of Trivenigung – were identified by ODRC for trialling the ODR process (PiC, 2010). The extent of devastation in these two settlements was different as Puraini was close to and Puraini far from the embankment that burst. While the reconstruction implementation process was similar in these two settlements, their long-term impacts of the disaster were different.

5.1.1. Project formulation

In Bihar, ODRC and the government sought to learn from the Gujarat experience by setting out to address system change needs during the reconstruction. The project scope included: constructing climate resilient houses; promoting sustainable livelihoods and environments; and empowering communities to build their own resilient houses (GoI-UNDP, 2011). As in Gujarat, beneficiaries were selected by the local government authorities and the list was displayed in public areas for the purpose of transparency and for allowing communities to raise/negotiate disputes (BA-2 2014). Two technical guidelines were drafted by ODRC to provide choice for residents: a) bamboo construction and b) brick construction (GoB, 2010). ODRC devised a mechanism by which local community members could resolve their own land rights and collaboratively design settlement layout (BOB-2-9; BPB-1-8 2014, BA-2).

5.1.2. Implementation

Technical processes – such as skills training, construction supervision, and the construction of model houses to facilitate resident choice – were similar to those followed in Gujarat (BOB-2, BOB-6 & BPB-1, BPB-7 2014). However, in Bihar, a robust social mobilisation process was developed by a multidisciplinary team (from finance, social work, technical and artisanal backgrounds), organised through shelter hubs, known locally as *Kosi Setu Kendra* (BA-1-2 2014, BNB-5 2014, BOB-1-9 & BPB-1-8 2014). The implementation process was also different to the Gujarat in that no material banks were set up, residents were provided with multiple materials and technology choices and supervision was performed by local master artisans rather than external engineers (BA-2, 2014).

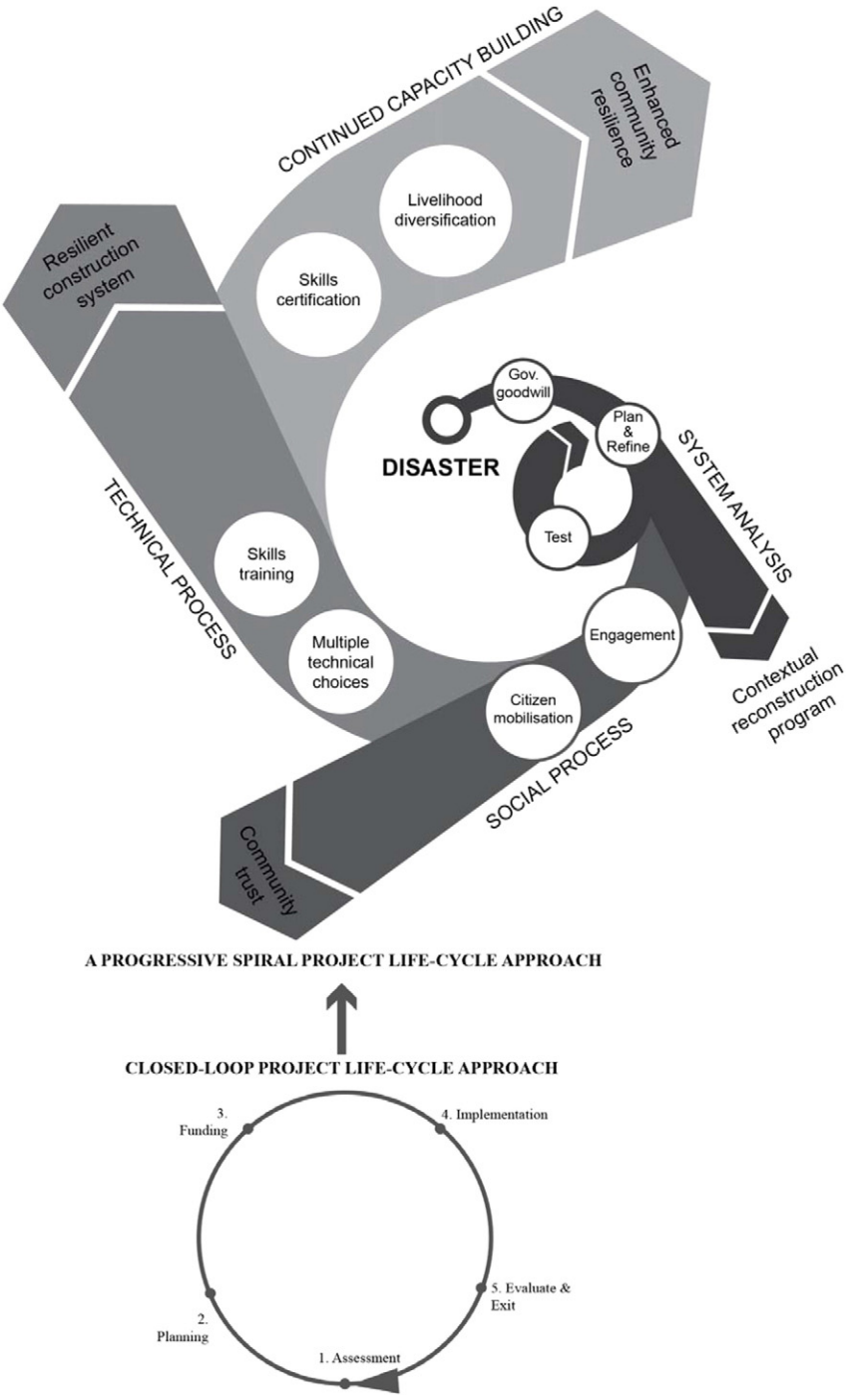


Fig. 5. A new spiral life-cycle model for effective post-disaster housing reconstruction.

Only chemicals and machinery for bamboo treatment were provided by ODRC. There were some challenges with a price spike (due to the lack of material banks) and delays in implementation for up to six months (due to land rights issues and land shortages) (BA-3 & BNB-2 2014). Top-up money for installing solar lights and toilet was given to residents in order to provide incentive for speedy construction and for overcoming construction delays (BA-3 2014). Overall satisfaction with the approach was high because 'people were hungry for development, having seen too much of poverty' (BA-2 2014).

5.1.3. Results

At the micro-level, 41 resilient houses were built in Orlaha using bamboo technology and 89 in Puraini using brick masonry walls and RCC or corrugated galvanised iron roofing (BA-1, 2014) (see Fig. 4). A majority of the residents got solar lights and water-less toilets. Almost all the residents in Orlaha and in Puraini were satisfied with the participatory process, hazard-safety, construction quality and low-maintenance of their rebuilt houses (BOB-1-9 & BPB-1-8 2014). However, most residents felt that the allocated time was insufficient

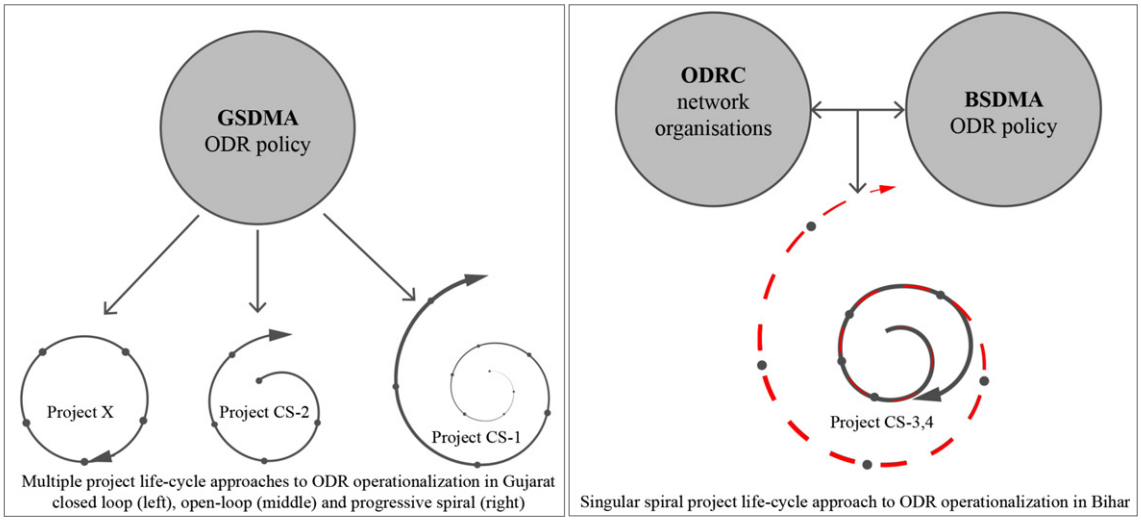


Fig. 6. Varying life-cycle models evidenced in Gujarat (left) and in Bihar (right).

(BOB-4,6,8,9 & BPB-3 2014). Most residents also appreciated the presence of ODRC and some suggested they should have stayed longer because they performed their responsibilities without bias (BNB-5 2014). By contrast, many residents expressed distrust in their own government (BA-3 2014, Vahanvati & Beza forthcoming).

5.1.4. Impact

Seven year after the 2008 floods, there were varying consequences for the communities in Orlaha and Puraini despite very similar reconstruction management processes. From a housing perspective, all the rebuilt houses survived the test of 2010 floods and cyclone (BNB-4 2014). Across the two settlements, the brick-based technology has found continuity while the bamboo technology has not (BNB-5 2014). At the time of the research, resident awareness about resilient features in housing were still fresh (BOB-1-9 & BPB 1-8 2014) and this was reflected in new housing having incorporated hazard-safety features (BOB-2,3,4,7 & BPB-2,3,6,8 2014). The residents' sense of security had increased (BOB-3-8 & BPB-2,3,6 2014) largely due to solar street lighting and more home lighting. However, many women still expressed safety concerns due to lack of operational toilets (due to dilapidated condition of proposed waterless toilets) (BOB-4-9 & BPB-3-6 2014).

From a system change perspective, in the long-term, while the housing and infrastructure seemed upgraded along with a substantial increase in livelihood of masons and bamboo artisans in Puraini settlement (BPB-1,3,7,8 2014); there were no such gains in Orlaha settlement (BOB-1, 5-8 2014). The reasons were context-specific. The flood damage to infrastructure and existing livelihoods was much more severe in Puraini settlement and this made the residents more desperate to take advantage of skills training so that they could diversify their livelihoods. Some of those who undertook skills training went on to establish their own building contractor firms and employed fellow locals (BPB-8 2014).

At a macro-scale, the withdrawal of ODRC from site after the pilot project completion (2008–2010) did not result in an effective hand-over to state government authorities and, as of 2015 only 48% of the houses had been rebuilt (World Bank, 2015). Moreover, the government discontinued the employment of highly trained artisans on the basis of their lack of formal education or inability to read or write (BA-3, 2014). It is not known whether this was mandated by the World Bank under its funding agreement although the World Bank (2015) report rated the reconstruction program in Bihar after 2011, a failure, based on traditional Project Management metrics.

6. Comparative analysis findings: conceptualisation of a progressive spiral project life-cycle for PDR

A comparison of the four case studies suggest four imperatives for ensuring that PDR projects can have long-term benefits for disaster resilience of communities:

i) need for an 'agile' or incremental strategy for addressing system change
ii) allocate ample time for gaining and maintaining community trust
iii) provide multiple materials, technologies and skilled labour choices for residents
iv) continued capacity building beyond the completion of reconstruction project

These findings echo most of the criticism of the traditional PM approach to PDR project management discussed early in this paper but this poses the need to develop a more 'agile' approach which is not limited to a single project life cycle. The research findings confirm that "closed loop" thinking cannot ensure good long-term outcomes for PDR projects. (See Fig. 5.)

6.1. Need for an 'agile' or incremental strategy

India made a big leap in disaster management from 2001 to 2008, based primarily on lessons learnt from the Gujarat experience. However the ODR model developed in Gujarat did

not address system change needs (such as drought preparedness or livelihood diversification) (Crawford et al., 2013). The ODR model developed in Bihar tried to address some system change issues and this reflected the 'agile' approach to the development of the process through a local pilot overseen by experienced disaster recovery agencies. This agile approach to policy development blurred the boundaries between policy planning and project implementation while it also laid foundations for building partnerships between state and civil society organisations needed to implement the policy. However, the Bihar process suffered as a result of delays and some unrealistic timeframes and an effective hand-over from ODRC to state government agencies due to the premature withdrawal of ODRC. The involvement of the World Bank in funding the second stage of the reconstruction made the policy less agile (with a less flexible timeframe) and less context sensitive and the overall reconstruction results were disappointing while community capacity building outcomes were patchy. While the World Bank twice extended its deadlines it used traditional PM metrics in evaluating project outcomes, concluding that the Bihar experiment had been less successful than the earlier projects in Gujarat. However, this narrow view of PDR success means that important lessons from the Bihar experience are neglected. In particular, later failings should not obscure the successes gained by the agile approach to ODR policy development in Bihar, as overseen by ODRC.

6.2. Allocate ample time for gaining and maintaining community trust

From the point of view of disaster survivors, trusting an unknown agency for rebuilding their house, when they are coping with other traumas and losses, is never easy Both Abhiyan and SEEDS had enough experience to understand the multifaceted nature of disaster impacts on the communities concerned and this enabled them to win the trust of the traumatised communities in both Gujarat and Bihar (where they both participated in ODRC). For example, in Hodko settlement, the earlier work of Abhiyan had already established trust of the local community and they set up informal shelter hubs (*Setu Kendras*) to facilitate on-going dialogue. These *Setu Kendras*, which were partly managed by local community, provided a forum for the airing of grievance as well as forum for two-way communication between the community and the government (BA-1, BA-2 2014). Due to its success in 2001 in Gujarat, *Setu Kendras* were adopted on a much larger scale and were institutionalised in 2008 in Bihar. Moreover, in Bihar, ODRC partnered with a local NGO called *Meghpain Abhiyan* in an effort to overcome cultural and language barriers for gaining community trust. In Gujarat's Patanka settlement, SEEDS experimented with model housing demonstrations to win community trust and it is clear that both Abhiyan and SEEDS understood the need to spend time gaining trust. This commitment underpinned the approach that ODRC took in the Bihar policy pilot but the premature withdrawal of ODRC weakened this commitment (Vahanvati, in press).

6.3. Provide multiple materials, technologies and skilled labour choices

While in both of Gujarat's case-studies only one construction material and technology was proposed for multi-hazard safe housing (earth in Hodko and stone in Patanka), in Bihar, multiple choices (bamboo, brick, or combination) were offered to the residents. In the long term, while Hodko community has discontinued use of the proposed construction technology, the Patanka community has retained it but with minor modifications in structural features (beams), the hazard-safety of which is unexamined. By contrast the promotion of multiple choices in Bihar meant that at least one of the technologies found continuity and helped diversify the livelihood options of local artisans. The other reason for providing multiple material and technology choices are to do with socio-cultural values. For instance, the reason for the no uptake of bamboo technology in Bihar was as much to do with a lack of trust in the technology, social stigma related to its use as to do with difficulties in accessing bamboo treatment chemicals (BOB-2,4,7 2014). Additionally, the case studies also demonstrated that when skills training of "locals" was given precedence (as in Gujarat's Patanka and in Bihar) over employing non-locals (as in Hodko) (HB-2, 6 2014), the potential for hazard-resilient technology to take roots in the local culture increased immensely.

6.4. Continued capacity building beyond the completion of reconstruction project

Some form of continuity beyond reconstruction project completion, which addresses system change imperatives, is found essential for ensuring that the knowledge bank (in terms of mason skills and resident awareness) is not lost after the spike in reconstruction activity or withdrawal of agencies from site (Shivangi Niazi, 2001, 2012). Both Abhiyan and SEEDS agencies and the government of Gujarat provided some form of continuity in capacity building projects or initiatives, the government of Bihar failed to do the same. For example, in Hodko, Abhiyan continued its projects, such as livelihood diversification and women's empowerment after housing reconstruction completion, until residents were self-sufficient (represented in Fig. 6 as CS-1). Similarly, in Patanka, SEEDS provided sustained support for masons, for over nine years, in order to link their newly acquired skills to livelihood options essential for spreading a culture of safe construction (represented in Fig. 6 as CS-2) (NDMA and IGNOU, 2011). In Gujarat, the state government linkages with educational institutions enabled SEEDS to provide further training to masons, however, a lack of Bihar government's support for promoting the bamboo technology and for helping artisans develop appropriate enterprise (BOB-2, BNB-4 & BNB-1 2014), led to the discontinuation in use of bamboo technology. Additionally, a lack of continued support to residents in terms of accessing information or technology required for altering or extending rebuilt houses also lead to a discontinuation in use of proposed hazard-safe technologies; for example, lack of access

to shuttering or brick-press machines in Hodko (HB-4,8 2014); and access to bamboo treatment chemicals in Bihar.

While a concept of self-renewing projects was embedded in World Bank's international development projects in the 1970s and 1980s (Baum, 1970; PMI, 2005), it is no longer evident in its current practice. The Hodko and Patanka case studies, in particular, demonstrate that if an on-going project development approach is adopted, a PDR project can serve as a springboard/opportunity for agencies to move on to system change projects and initiatives aimed at building wider community resilience. The open-ended project life-cycle approach (CS-1 and CS-2) that extends way beyond the traditional PM closed-loop single project approach, is captured in a spiral form in the proposed model (see Fig. 6).

Overall, the case studies presented above show that long-term disaster resilience of communities can be attained if PDR is built on the foundation of trust, flexible timeframe and context-sensitive capacity building. The case studies show the benefits of building in agility from the very beginning. However, the real challenge is to find ways to continue projects or initiatives once the reconstruction phases has completed.

7. Conclusion

The aim of this paper was to identify key processes (or success factors) that can enable PDR projects to address system change needed for long-term disaster resilience for vulnerable communities. While the alternative model for PDR project management is based on research, which was completed in India alone, it can be noted that India leads the world in the implementation and development of ODR policies and practises. The selected case studies offer insights which, taken together, have clear relevance beyond their local contexts. The research demonstrates that the long-term gains of PDR work are greatly enhanced when it is built on a strong foundation of community trust and technical support, sustained through an agile approach for on-going project development. However, the most significant finding of the research is flexibility of timeframe — allocation of more time in planning phase and thinking well beyond the completion of reconstruction phase and this is where the traditional PM approach to PDR management has been lagging behind. Thus, the research highlights a need for a new – *agile, contextual, socio-technical and time flexible* – approach. The new spiral model presented in this paper needs to be tested in practice and undoubtedly refined. However, it has the potential to build on the rich experience of highly skilled disaster recovery agencies like Abhiyan and SEEDS. A more nuanced understanding of PDR management may ensure that conditions for funding applied by major funding bodies such as the World Bank, help, rather than hinder, good practice.

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6

PARTICIPATION FOR DISASTER RESILIENCE

A life cycle approach to reconstruction projects in India

Mittul Vahanvati

Introduction

India is one of the top ten countries in the world at risk to natural disasters (NIDM, 2001). The toll of disasters on human lives and the national economy has risen substantially since 1999, with total losses of approximately 2 per cent of national GDP, annually (GoI-UNDP, 2011; Guha-Sapir *et al.*, 2012). Vulnerability of the built environment is seen as one of the major reasons for India's disaster risks (UNNATI *et al.*, 2012). However, underlying socio-cultural and financial issues are often the root cause of built environment's vulnerability. In a post-disaster context, scholars warn that addressing technical resilience without incorporating strategic issues, such as social or economic resilience may hardly empower the communities concerned (Davis, 1978; Berke *et al.*, 1993; UN-Habitat, 2012; Ahmed, 2011; Lyons *et al.*, 2010; Mulligan and Nadarajah, 2012). To this end, an international consensus has developed for participation—as a means as well as an end—for enabling disaster resilience of communities (UNDRO, 1982).

India being a federation, the states have the primary responsibility for disaster recovery management. For the first time in the history of India, reconstruction after the 2001 Gujarat earthquake saw an 'Owner Driven Reconstruction' (ODR) approach (NDMA, 2005). Since 2001, the Indian national and state governments have progressively amended their reconstruction policies in order to shift from a top down or a relief based approach to a participatory/empowering approach. An ODR approach was also adopted in 2005 following the Kashmir earthquake and in 2008 following the Kosi River flooding in Bihar (Barenstein and Iyengar, 2010). Despite clear policy commitments to maximise Owner Driven Reconstruction, its practice continues to remain patchy and sporadic, with undesirable long-term implications.

In order to determine how a participatory reconstruction project after disaster can enhance long-term disaster resilience of communities at risk, the researcher asks the following question:

- What approaches to community participation during ODR are most likely to enhance community confidence, awareness and livelihoods in order to maintain their houses and their settlement's safety and for their wider disaster resilience in the long term?

Methodology

Four good practice reconstruction projects were selected from India for case study investigation. Two projects are from the state of Gujarat following the 2001 earthquake—Hodko settlement and Patanka settlement. The other two are from the state of Bihar following the 2008 Kosi River floods—Orlaha and Puraini settlements (see Table 6.1).

The primary reason for the selection of these four case studies was that the CSOs had an upfront consideration for capacity building and going beyond rebuilding of resilient houses. Another reason was that both the CSOs were involved in Gujarat as well as Bihar. The two CSOs were:

i) Kachchh Nav Nirman Abhiyan, hereafter referred to as Abhiyan
ii) Sustainable Environment and Ecological Development Society (SEEDS).

Hence, it was expected that these two CSOs would have developed some insights on participatory approaches. They would know what worked, what did not, why and, most importantly, how the ODR approaches evolved over the last seven years (2001–2008)—the focus of this chapter?

TABLE 6.1 Criteria for the selection of case studies.

	Reconstruction programme	*Post-2001 Gujarat earthquake*		*Post-2008 Bihar Kosi River flooding*	
Key selection criteria	*Agency*	*CS-1 Abhiyaan Hodko*	*CS-2 SEEDS Patanka*	*CS-3 ODRC Orlaha*	*CS-4 ODRC Puraini*
	Owner-driven / participatory	√	√	√	√
	Resilience features explicitly incorporated in housing	√	√	√	√
	Upfront consideration for skills training and livelihood consideration	√	√	√	√

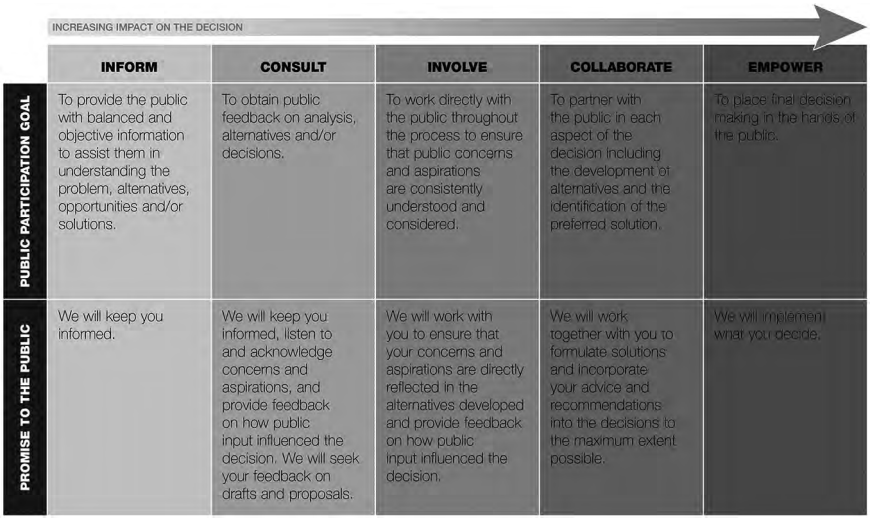


FIGURE 6.1 Public participation spectrum.
Source: International Association for Public Participation.

Case studies are divided into four phases based on project life cycle approach for logical framework analysis (LFA), as follows:

- Phase-I: Planning and design input
- Phase-II: Construction output,
- Phase-III: Project results in the short-term
- Phase-IV: Long-term impact.

Participation in each phase is rated using the Spectrum of Participation (IAP2). Within each case study, data was purposely collected from beneficiaries, non-beneficiaries and CSO members to ensure validity. Within these case studies, social profiling was used to identify beneficiaries for interviews. This allowed the author to understand the influence of caste and power hierarchies in recovery assistance. Semi-structured interviews, focus group discussions, photographs and sketches of houses and CSO publications have informed the discussion. The author conducted field study in 2012 and 2014. For ensuring the confidentiality of research participants, identity codes are used, such as HA-X 2014, where 'H' refers to the location, 'A' refers to agency member and 'X' is the number assigned to each respondent followed by the year of interview.

The 2001 Gujarat earthquake

Earthquake impact and reconstruction policy

On 26 January 2001 (also the Indian Republic Day), the western state of Gujarat was hit by a massive earthquake measuring 7.9 on the Richter scale. This

was the second largest on record and the deadliest earthquake in the Indian history (GoI-UNDP, 2011). The earthquake caused nearly 20,000 deaths (UNDP, 2009) and destroyed over 1 million houses (GoI-UNDP, 2011) (see Figure 6.2). Kachchh district of Gujarat was the epicentre of this earthquake. When the earthquake hit, Kachchh had not yet fully recovered from over three years of drought (UNDP, 2009).

Within a week of the earthquake the Government of Gujarat had set up a nodal agency to manage the disaster recovery, named as the Gujarat State Disaster Management Authority (GSDMA). Soon after, the government announced a reconstruction policy, whose key features were:

i) an Owner Driven Reconstruction (ODR) with funding assistance from the World Bank
ii) public–private partnerships for implementing reconstruction (UNDP and Abhiyan, 2005).

Case study 1

Hodko settlement in the Kachchh district was very close to the epicentre of the earthquake and suffered major destruction. The Hodko settlement is located in a hot, arid zone, with desert and grasslands (termed as *Banni* region). The traditional houses in Hodko were built using mud and grass called *bhungas)* (see Figure 6.2). Hodko continues to be known for its colourful traditional crafts (embroidery, leather work, etc.), dry farming and animal husbandry. The region faces severe droughts, moderate cyclonic winds, earthquakes and occasional flash floods.

Hodko has two predominant castes—i) *Haleputra* (the royal Muslims, originally from Sindh region of Pakistan) and ii) *Meghwal* (Harijan Hindus or the untouchables). Despite the evident political tensions between the Hindus and Muslims in other parts of India, both these communities lived harmoniously in Hodko (see Table 6.2).

TABLE 6.2 Social profile of Hodko, Kachchh district in Gujarat.

Status (high to low)	*Social profile of Hodko*	*Livelihood*
1	Muslim castes (about18 different castes)—Haleputra predominant in Hodka	Animal husbandry—they are pastoral community (also termed as Maldhari) who breed buffalos, cows, goats, camels and provide skin to the Hindus or processing.
2	Hindu castes—Meghwal and Vadha Koli (Marwada Dalits or the untouchables)	Service providers—convert skin of cattle provided by Muslims into leather products and do wood carving, whereas women do embroidery.

Planning and design

Abhiyan is a locally based network of 26 organisations (CSOs), who was working with the community prior to the earthquake. Thus, Hodko residents trusted them and opted to work with Abhiyan. Abhiyan set up informal shelter cluster hubs, which were later known as *Setu Kendra* (literally meaning bridging centres). Community were an integral part of *Setus*. This included two village motivators (*gram preraks*) worked with five professional staff from Abhiyan—social workers, information manager, accounts officer and local civil engineer (UNDP, 2001). Community were able to channel their concerns to the government via *Setu* in a collective and effective manner. Some of the victories that *Setus* had in influencing government/GSDMA were: i) re-assessment of housing damage categories; ii) amendment of policy from relocation to an *in-situ* reconstruction; iii) an agreement on a community led or an ODR approach for sustainable rehabilitation (UNDP, 2001). This initial exercise established and strengthened a relationship of trust between the Hodko community and Abhiyan.

At settlement scale, Abhiyan put together an assistance package for reconstruction. As per the package, Abhiyan would provide a core shelter design (18 square metres), all construction materials and labour; while the residents had to contribute a minimum of 10 per cent of their house's cost—either in form of labour or money (HA-1 2014). Abhiyan also legalised the mud technology (HA-2 2014; KMVS, 2001). 56 out of 97 Harijan families signed an agreement to participate in Abhiyan reconstruction (KMVS, 2001). The Muslims declined any assistance as they were more affluent (HA-2 2014). The settlement layout was done by the residents while retaining existing plots, based on traditional laws. The design, being a core shelter, did not allow for modifications by Hodko residents. Despite the generally progressive nature of Gujarat society, it was observed that women's participation was a lot less than men's. Overall, community control in various issues of initial planning and design phase is rated as "collaborative".

Construction

As a first step before construction, Abhiyan built model houses for the neediest residents in the settlement (widows, the elderly or disabled households) (Desai, 2002; Gupta and Shaw, 2003). During this process, locals were also trained in safe construction skills. Due to the scale of construction work, relatively more non-local masons were trained to build resilient shelters (HA-3 2014). While most local residents "had good friendship and skills in mud" (HA-1, 2014), they lacked skills in safe construction. Construction monitoring was entirely managed by Abhiyan, while material purchase and distribution was managed collaboratively (HA-4 2014). Thus, participation during the construction phase is rated as "involved".

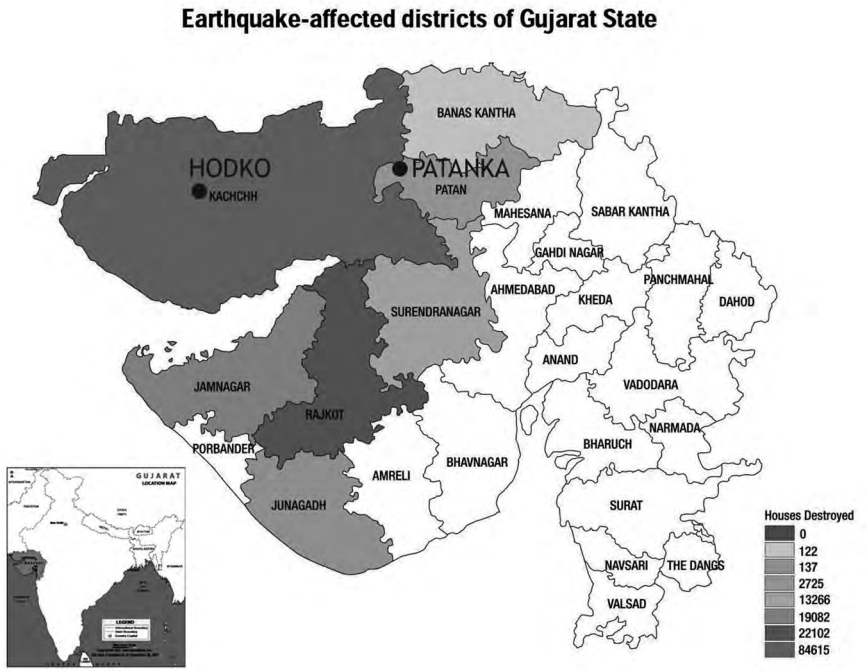


FIGURE 6.2 (A) Map of Gujarat with two case-study settlements marked in red.
Source: UNDP 2001.

FIGURE 6.2 (B) Hodko traditional village.

FIGURE 6.2 (C) Patanka earthquake damage.
Source: Photo by Rameshbhai Thakor, SEEDS.

Short-term outcomes

In fifteen months, 56 families in Hodko had completed rebuilding resilient houses (two *bhungas* per family) (see Figure 6.3). The satisfaction among all the residents interviewed was very high, in terms of participatory process and appropriateness of their house design, construction quality, disaster safety, cost effectiveness and low maintenance. However, there was a bit of discontent among some residents regarding the climate comfort of the house and among some artisans regarding fewer locals trained (HA-7 2014). Abhiyan work was recognised as best-practice in reconstruction (UN-Habitat *et al.*, 2008; UN-Habitat *et al.*, 2009).

Abhiyan did not stop there. They took the momentum from housing reconstruction further by moving onto other livelihood enhancement and community empowerment projects (HA-2 2014).

Long-term impact

Fifteen years later, almost all the residents in Hodko have personalised their rebuilt houses, and continue to reside in them as they feel confident in their robustness. However, the resident's memory of the resilient features in house design was fading. Additionally, it was not easy to access the resources (shuttering or brick press machines or skilled masons) required to build seismic safe house extensions. This was evident in the new houses or extensions built that are incrementally discontinuing the use of proposed materials and technologies essential for housing resilience.

(A)

(B)

(C)

FIGURES 6.3 (A–C) Rebuilt houses (past and present) in Hodko settlement.

On the other hand, *Sham-e-Sarhad* eco-resort project was highly successful. This project has increased the financial capacity, cultural pride and social well-being of Hodko residents, who no more identify themselves as poor or backward anymore (HA-2 2014). Moreover, the resort directs some of the profit towards village infrastructure and amenity improvements. Despite an increase in livelihood, the residents of Hodko are not currently investing in resilient housing.

(D)

(E)

(F)

FIGURES 6.3 (D–F) Rebuilt houses (past and present) in Patanka settlement.

Case study 2

Patanka settlement in Patan district was located further away from the epicentre of the earthquake, but it also suffered high damage after the earthquake. The climate of Patanka is similar to that in Hodko. But traditional houses were built from yellow sandstone with mud plaster (see Figure 6.2). It is well known for its cumin farming. Contrary to Hodko, Patanka settlement had only one predominant caste—*Aahir* (Brahmins or highest Hindu caste) with small representation of others (see Table 6.3) (GoB and ODRC, 2008).

TABLE 6.3 Social profile of Patanka, Patan district in Gujarat.

Status (high to low)	*Social profile of Patanka, Patan, Gujarat*	*Livelihood*
1	Aahirs (70%) (Brahmins)	Farming, animal husbandry (well educated)
2	Koli Thakurs (16%) (Rajputs)	Farming, animal husbandry (moderately educated)
3	Rabaris (10%)	Pastoralism and labour (not educated)
4	Harijans (4%), few Suthars (carpenters), Bawajis (monks) and a Nai (hairdresser)	Farming labour, animal husbandry

Planning and design

Five months after the earthquake, the community of Patanka were approached by SEEDS to offer assistance. Unlike Abhiyan, SEEDS was neither a local Non-Government Organisation (NGO) and nor did they have a relationship with this particular community. SEEDS' efforts at forming a partnership with a local NGO—Self Employed Women's Association (SEWA)—proved futile. SEEDS organised 'shake-table' tests to showcase seismic safe technologies to the local residents (Gupta and Shaw, 2003). This exercise earned SEEDS trust of local residents. With mutual consent, a tripartite agreement was made between GSDMA, SEEDS and the Patanka village *Panchayat* (local elected members). As part of this agreement, the residents of Patanka would receive GSDMA funding with a top-up from SEEDS (in form of steel and cement for construction). All the 225 families in Patanka decided to take SEEDS assistance (PA-1 2014). SEEDS gave Patanka residents the freedom to design their own house core of about 12 square metres. The only constraint was to abide by the multi-hazard safety features in housing. Overall, community participation during initial planning and design phase is rated as 'involved'.

Construction

Like Abhiyan, SEEDS also constructed model house for a widow, trained local masons in safe construction skills as their construction quality was very poor (PA-4 2014) (Vahanvati and Beza, 2016). Additionally, two highly skilled masons were invited by SEEDS from the National Society for Earthquake Technology in Nepal to live in Patanka for three months and train the locals (PA-4 2014). The residents procured all their construction materials (except for steel and cement), employed labour and monitored the construction quality, collaboratively (PA-2 2014). The community participation during construction phase is rated as "collaborative".

Short-term outcomes

Three hundred families managed to build resilient houses with support from SEEDS (see Figure 6.3). The satisfaction among Patanka residents was as high as in Hodko. SEEDS also continued onto other projects, such as building a school and a water tank to cope with future droughts. Most importantly, SEEDS mobilised a guild of about 15–20 trained masons from Patanka to form a 'SEEDS Mason's Association' (SMA) (PA-4, 2014). SEEDS' work in Patanka was recognised as best practice in going beyond rebuilding of houses in order to enhance 'community resilience' (IFRC, 2004).

Long-term impact

Fifteen years later, satisfaction and confidence is as high in Patanka as in Hodko, however, the memory of the resilient features is much better. Livelihood of only the trained masons, who joined SMA, had increased. The reason was that SMA masons were supported by SEEDS for over nine years with further training, government certification in safe construction skills and employment (PA-2, PA-4, 2014). In the long term, despite high awareness and an ease of access to skilled masons, only half of the residents are investing in their house's continuing safety.

The 2008 Bihar Kosi floods

Flood impact and reconstruction policy

In August 2008, the north Indian state of Bihar was devastated by a rupture in the embankment of the Kosi River. There was a sudden surge and a change in the natural course of the Kosi River, inundating the so called "protected areas" that had not experienced flooding for several decades (GoB, 2010; UNDP, 2009). The scale of damage was exceptionally high. Over 3 million people were affected (PiC, 2010; UNDP, 2009), more than 200,000 homes were damaged and large number of cattle and crops were impacted due to protracted inundations (FMIS and GoB, 2009).

Within four months of the disaster (in December 2008), the Government of Bihar announced an owner driven reconstruction (ODR) policy. The government invited a network of institutions and agencies from all over Asia, termed as Owner Driven Reconstruction Collaborative (ODRC) (GoB and ODRC, 2008). The ODRC comprised UNDP, Indian national and Gujarat government authorities, Abhiyan, Asian Coalition for Housing Rights (ACHR), SEEDS and World Habitat Centre, among others (GoB and ODRC, 2008). The role of ODRC was to assist the government in policy formation and implementation. Some unprecedented aspects of this reconstruction programme were:

i) piloting before ODR policy announcement, for contextualising the policy
ii) involvement of ODRC from the initial policy formation stages
iii) the State taking responsibility of ODR implementation.

The two ODR pilot settlements of Orlaha and Puraini are selected as case studies.

Case study 3

Orlaha settlement was situated far from the burst Kosi River embankment (see Figure 6.4). Both these settlements have humid sub-tropical climates and are located in the far north of Bihar, also known as the Kosi River basin. This region is characterised by a network of rivers, land shortages, poverty, and illiteracy with limited access to electricity. The region has an abundance of bamboo, grass and mud-based items such as bricks, roofing tiles. Kosi River basin is prone to annual flooding, earthquakes and cyclonic winds.

In Bihar's Kosi region, residents identify their community based on their religion, caste or lineage. There are four communities, who despite the social hierarchy of castes coexist harmoniously and practice barter for sustenance (see Table 6.4). ODRC chose pilot villages to demonstrate an ODR process and to build the government's capacity in managing disaster recovery. Since ODRC was a non-local consortium of national and international organisation, it partnered with a local CSO, *Gramsheel*.

Planning and design

Four months after the floods, an agreement was made between residents of Orlaha and Puraini, ODRC and government of Bihar participate in an ODR pilot project. As per the agreement, the government identified the beneficiaries and ODRC

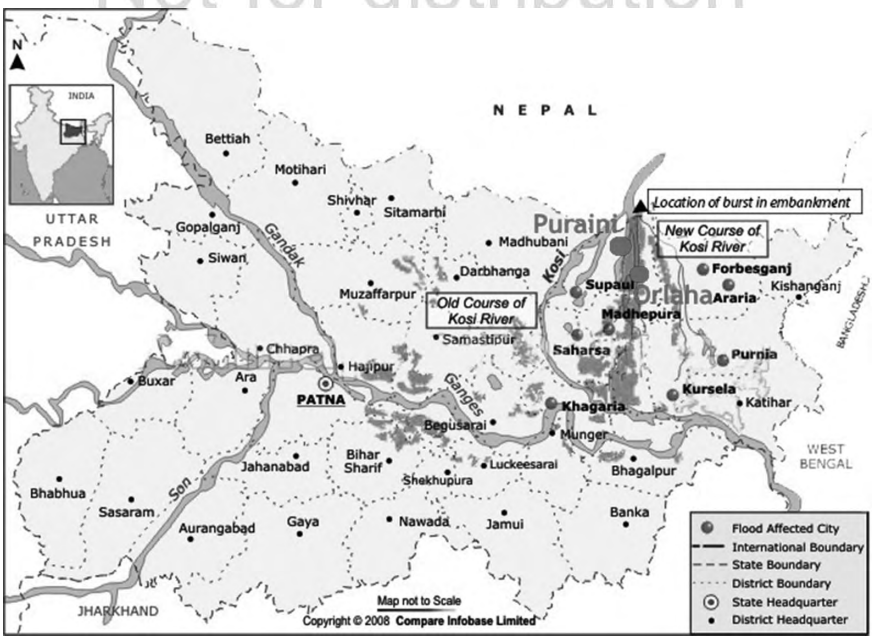


FIGURE 6.4 (A) Left Map of Bihar with two case-study settlements marked in red.
Source: Compare Infobase 2008.

FIGURE 6.4 (B) Flood devastation
Source: www.gfdrr.org.indiapdna2008).

FIGURE 6.4 (C) Traditional house in Bihar Kosi river basin.

TABLE 6.4 Social profile of Orlaha and Puraini settlements in Bihar.

Social profile of Orlaha	*Status (high to low)*	*Social profile of Puraini*
Mandal (agricultural land owners, contractors)	1	Mandal (agricultural land owners / Master masons) (90%)
Patwa (labourer—agricultural / construction)	2	Rajput (driver, migrant labourer)
Muslim (labourer—cotton quilt makers)	3	Mehta (land owners)
Sardar (labourer—masons / bamboo artisans)	4	Harijan / Musahars (labourers)

implemented the project. To maintain transparency in communication, *Kosi Setu Kendras* (KSKs) were set up, as in Gujarat. ODRC aimed at instilling faith in the local residents to be able to rebuild their resilient houses (GoB, 2010). To do so, ODRC provided socio-technical support, legalised traditional bamboo technology and published a handbook with few core shelter designs and the non-negotiable resilience features, all in the local language (Hindi) (BIPARD and The Shelter Group, 2008).

With ODRC's support, the local residents resolved land issues of the landless, planned their settlement layout and designed their own houses. ODRC facilitated the opening of a bank account for each family (in name of male and female). In a region where there is high illiteracy and poverty, gaining community trust in opening a bank account was the most challenging task. Overall, community participation in this initial phase, both in Orlaha and Puraini is rated as "empowering".

Construction

Similar to Gujarat, ODRC built model houses to demonstrate a palette of technology options. They trained residents in safe construction skills. Most residents had good construction skills but lacked finesse and awareness in safe construction (BA-4 2014). Engineers were hard to find in the villages, therefore, few trained masons and *Dabia mistry* (bamboo artisan) were employed as *Rajmistry* (master mason) in place of engineers, to be part of the ODRC technical team (BA-1 2014). The KSK configuration was similar to that in Hodko; one *Rajmistry,* one engineer, one manager and two social workers. This KSK team was responsible for providing day-to-day handholding support to the residents of one village or approximately 200 houses.

When compared to Gujarat, key differences with regards to community participation in Bihar, are as follows:

i) residents were enabled to make decisions for technology selection, material procurement and labour selection
ii) a palette of contextually appropriate construction technologies was offered
iii) training in safe construction was provided to the local residents

iv) funding was allocated for basic amenities, landscaping, infrastructure, and loss of livelihood due to engagement in construction, apart from housing reconstruction
v) time-based incentive was offered for speedy construction (six months).

Community participation during construction in Orlaha and Puraini is rated as "empowering".

Short-term outcomes

In six months, 41 families had rebuilt resilient houses in Orlaha settlement using bamboo construction technology (see Figure 6.5). Almost all the residents interviewed were highly satisfied with the participatory process and the housing outcome (its quality, disaster safety, cost effectiveness and low maintenance). There

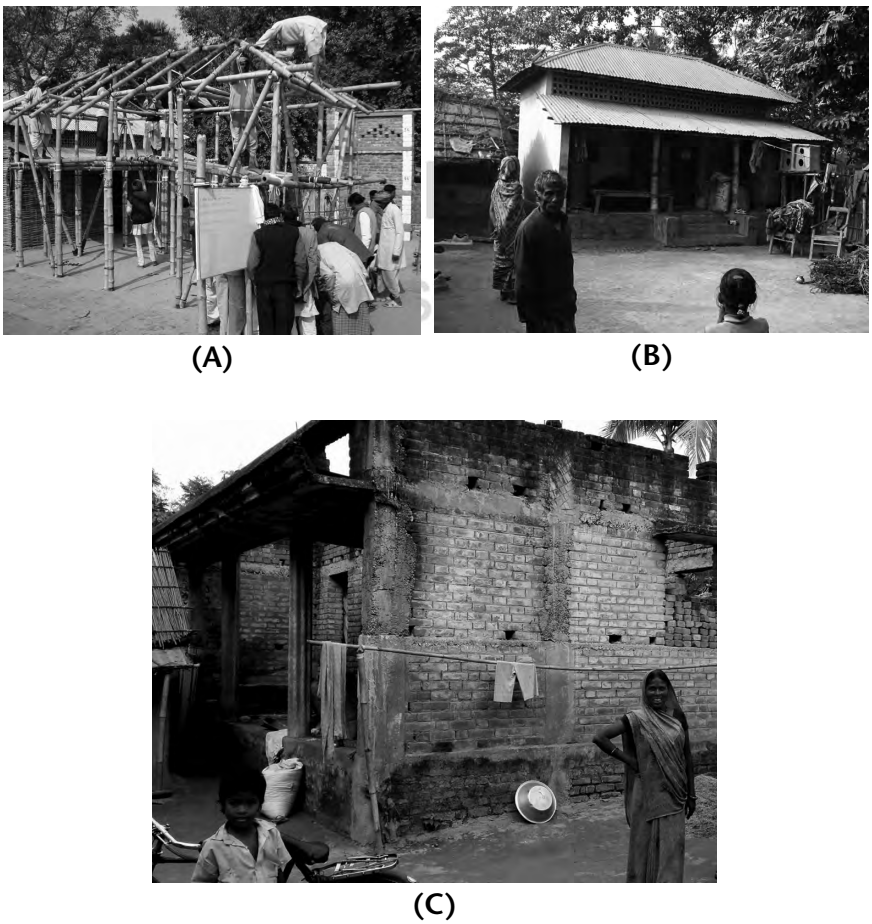
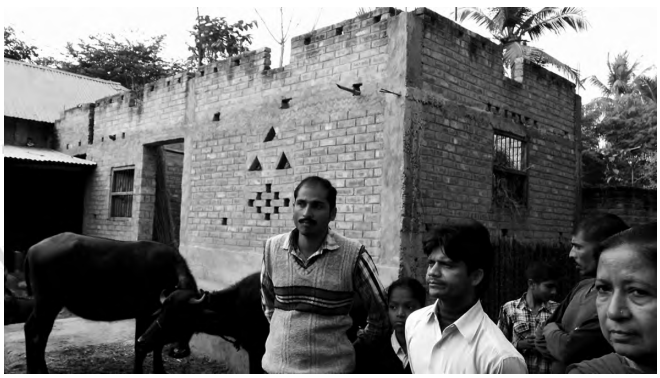


FIGURE 6.5 (A–C) Rebuilt houses (past and present) in Orlaha settlement.
Source: Hunnarshala.

(D)

(E)



(F)

FIGURE 6.5 (D–F) Rebuilt houses (past and present) in Puraini settlement.
Source: Hunnarshala.

was bit of dissatisfaction among residents in both villages regarding beneficiary selections, which was done by the government. One social worker stated that "the assistance did not reach those who were in real need of a house at that time" (BA-3 2014). Despite ODRC's efforts to maintain transparency and negotiate a resolution with government, no amendments were made to the beneficiary list (BA-2 2014). In both settlements, residents stressed that without the presence of ODRC—a non-local, non-corrupt CSO, they could not have achieved speedy and quality housing recovery, at least not with the assistance of the government alone.

Long-term impact

Eight years after the floods, the housing reconstruction programme is still ongoing. Currently (2015), it is entirely managed by the state government and the World Bank. ODRC withdrew their support to the government after the pilot village

construction. In the pilot settlements, almost all the residents had personalised their houses and continued to reside in them. Some of the residents in Orlaha were questioning the longevity of their bamboo houses as the structural bamboo poles were infected by borers. A majority of new houses, or extensions, were made using brick and RCC technology (not bamboo), which incorporated resilient features. Hence, at least one construction technology has found continuity.

Sadly, a majority of the waterless toilets constructed using bamboo technology were in a dilapidated condition and not in use. These waterless toilets were being replaced by regular flush toilets as resident finances permitted. Most men and a few women had vivid memories of the disaster resilience features in their houses. There was no evidence of livelihood improvement in Orlaha resulting from the safe construction training. In Orlaha, there was resentment among some trained *Dabia mistry* regarding a lack of continued support in term of certification in safe construction skills (BNB-1, 2014).

Case study 4

Except for the fact that Puraini settlement was very close to the burst embankment, nothing was different in regards to the ODR implementation, when compared to Orlaha settlement (see Figure 6.4). This section only explains key issues that were different in Puraini.

In the short-term, as opposed to Orlaha, almost all the 89 houses in Puraini were rebuilt using brick and RCC (see Figure 6.5).

In the long term, contrary to Orlaha, livelihood had evidently improved in Puraini due to training in safe construction skills. Some residents had become entrepreneurs and started their own building contracting company, which employed other locals as labourers (BPB-8 2014). After floods, Puraini residents had lost their main source of livelihood—agriculture, due to over three metres of sand deposition on land. They had no choice but to diversify their livelihoods. These residents organised and mobilised themselves, without any continued support from CSOs, to turn adversity into livelihood opportunity. Increase in livelihood has also increased residents' confidence.

Overall, communities in both the settlements, Orlaha and Puraini, have emerged more resilient than before—with robust houses, basic amenities, increased awareness and confidence. Livelihood has increased more so in Puraini than in Orlaha. Almost all the residents are investing in their family's development, for instance, children's education and resilient housing.

Key factors for success of ODR in the long-term

Three lessons have emerged from the examination of four good-practice ODR case study projects in India:

1) gaining community trust and local partnership—a foundation for ODR
2) artisanal skills training or capacity building—during ODR
3) continued support for enhanced community self-sufficiency—post-ODR.

Based on the findings from empirical research, a new framework for operationalising community participation during reconstruction is derived (see Figure 6.6). The framework considers strategic issues that go beyond one project life cycle understanding; to transition from the enhancement of trust and shared aims (social resilience), to housing reconstruction (technical/physical resilience), to capacity building and the diversification of livelihoods (financial resilience). The framework is for use by CSOs/implementers to enhance community engagement and disaster resilience in the long term.

Gaining community trust and local partnerships—a foundation for ODR

For the survivors of a disaster, trusting an unknown CSO for housing assistance seems like a big ask, especially when they are still recovering from the trauma and

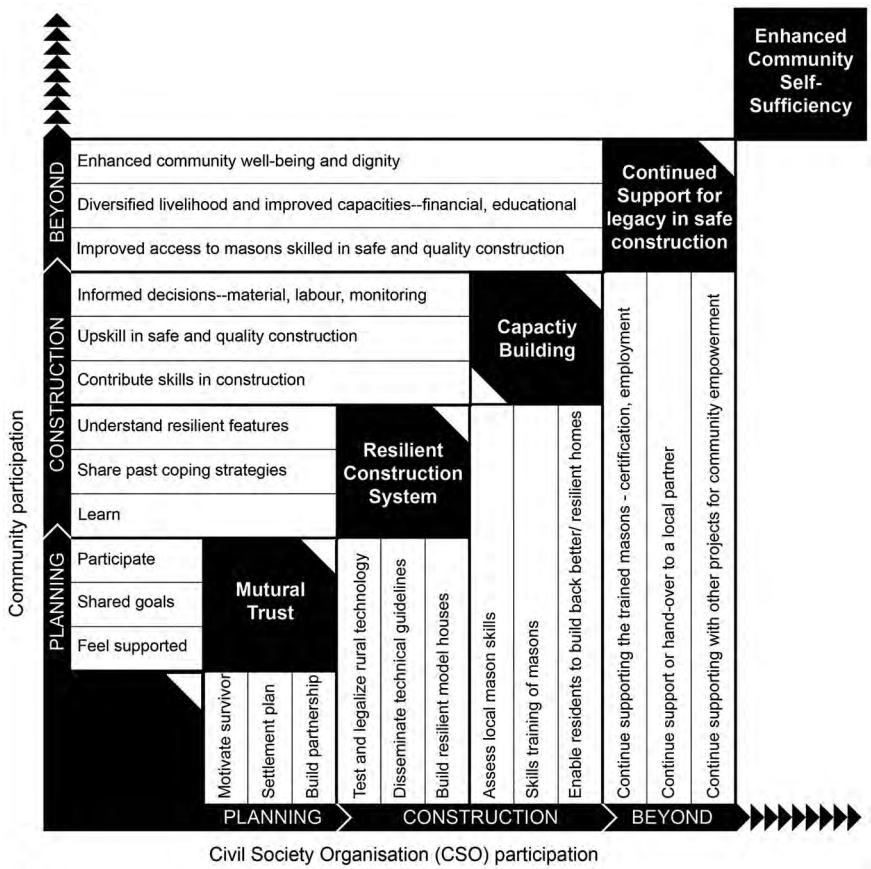


FIGURE 6.6 A new framework for operationalising community participation for disaster-resilience during post-disaster reconstruction.

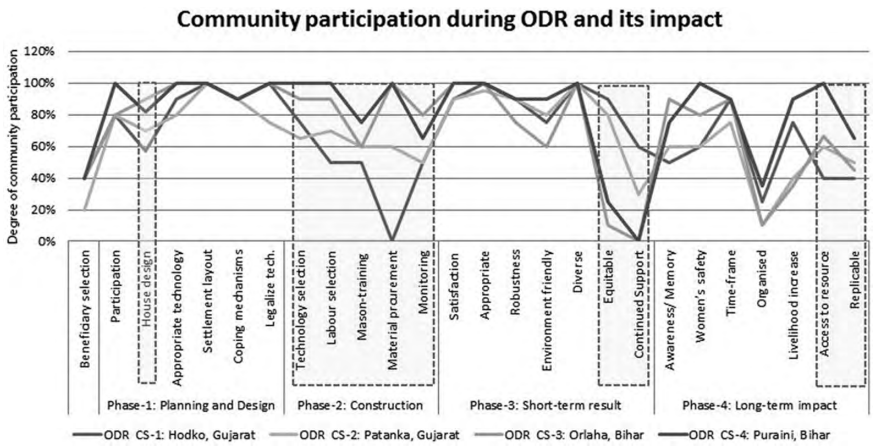


FIGURE 6.7 Degree of community participation during and after housing reconstruction process, based on quantitative data analysis (highlighted areas show major differences between all the four case studies).

TABLE 6.5 Community participation rating and its long-term impact.

		Participation rating			
Case study ODR project settlements		*Planning Phase-I*	*Construction Phase-II*	*Continued support Phase-III*	*Long-term Impact Phase-IV*
CS-1	Hodko, Gujarat	• • • •	• • •	✓	Increase in livelihood
CS-2	Patanka, Gujarat	• • •	• • • •	✓	Moderate increase in livelihood and legacy of resilient housing
CS-3	Orlaha, Bihar	• • • • •	• • • • •	X	Legacy of resilient housing and disaster risk reduction
CS-4	Puraini, Bihar	• • • • •	• • • • •	X	Increase in livelihood; legacy of resilent housing and disaster risk reduction

(• • • = Involve; • • • • = Collaborate; • • • • • = Empower on IAP2 Community participation spectrum)

loss of livelihood. The *Setu Kendras* in Hodko was one such effort to address this issue. Due to its success in Gujarat, *Setus* were adopted in Bihar, but with modifications, as:

- from an informal grassroots setup to a formalised setup
- from small-scale in Kachchh district to a large-scale setup affecting the entire Kosi region
- assisted in coordination and partnerships between stakeholders; for example, ODRC's partnership with the local CSO *Gramsheel,* whose knowledge of local language and cultural norms played a crucial role in gaining community trust.

On comparing Gujarat and Bihar's *Setu* setup, the formal setup seems to be a shift in the right direction, that is, towards decentralisation.

Though the *Setu* approach in India is unique, it is comparable to the Shelter Cluster, which assists in faster and better recovery (Shelter Cluster, 2015). *Setus* have proven successful mechanism at multiple levels—gaining community trust and establishing partnerships, which has laid foundations for a successful ODR project.

Artisanal skills training or capacity building, during ODR

The case studies demonstrate that when skills training, employment and capacity building of 'locals' was given precedence over construction speed, the long-term impacts are positive. This is evident in the changes made by Abhiyan and SEEDS from 2001 to 2008 ODR (as described in the "Construction" section on p. 000). Results of community engagement during initial planning and construction activity phases, and their direct or indirect long-term impacts, are highlighted in Figure 6.7 and represented in Table 6.1. For instance, compared to Hodko (CS-1), more locals were trained during construction phase and employed longer term in Patanka (CS-2), resulting in resilient technology being embedded in the local culture. Moreover, increase in choices provided to local residents—in terms of design, material procurement and technology selection (in CS-3, and CS-4, unlike CS-1), can be linked to an increase in residents' awareness and access to resources in the longer-term. Overall, high community engagement in Bihar through all phases has shown positive long-term impacts—in increased livelihood (despite lack of continued support) and regaining lost faith in residents' own ability to rebuild and maintain the resilient house.

Continued support to masons and community until autonomous, post-ODR

Only the communities in Gujarat's Hodko and Patanka settlements received continued support from CSOs, long after the reconstruction was completed (see Table 6.5). On the contrary, the communities in Bihar's Puraini and Orlaha did not receive any extended support after the reconstruction completion. The following lessons can be learnt from Gujarat and Bihar.

Long-term thinking, beyond one project life cycle

This was evident in the approach of Abhiyan and SEEDs during reconstruction in Gujarat. Both CSOs spring-boarded onto other developmental projects to address underlying issues, such as livelihood and drought. For example, Abhiyan livelihood projects were successful at increasing and diversifying the local livelihood, but not successful at cultivating a culture of safe construction for future disaster risk reduction (DRR). There was a missing link, the answer for which was found in Patanka. In Patanka, SEEDS provided continued support to trained masons by linking their safe construction skills to income earning opportunities. These trained masons have ensured the uptake of proposed technology and are leaving a legacy of resilient construction.

Context specific time-frame for participation

In Bihar, neither the trained masons nor the residents were provided with extended support for livelihood or certification of skills. Despite this, some entrepreneurial residents in Puraini have managed to find livelihoods from their newly acquired skills. These residents are having a catalyst effect on the livelihood of entire Puraini community. Though a similar effect is not witnessed in Orlaha, it is worth nothing that what has happened in Puraini is very context-specific. First, since the residents of Bihar had never witnessed developmental assistance from CSOs they were very receptive (HA-2 2014) and, second, the residents had a sense of urgency to diversify their livelihoods with all the existing options being lost.

The four case studies signify that not only participation but trust building, capacity building/skills training and some extended support to trained masons plays a significant role for the uptake of proposed technology and future disaster resilience of communities. Additionally, Puraini exemplifies that the one-size-fits-all approach to the time-frame for reconstruction and continued support varies according to the particular context.

Conclusion

The focus of this chapter was to identify approaches to community participation during reconstruction projects that are most likely to enhance the disaster resilience of housing and its residents in the long-term. Four "good practice" case study reconstruction projects from the Indian states of Gujarat and Bihar were compared to identify the long-term impact of varying participatory approaches. Three key lessons were discussed and proposed in form of a new operational framework to operationalise community participation. The first finding was the significance of social process, such as grassroots motivation of survivors during the initial planning phase, even before the beginning of construction. The second finding, about building the capacity of local community, is nothing new for the practitioner in disaster recovery, yet it is often compromised. The third finding was about planning

beyond one project life cycle, that is, beyond rebuilding of houses, so as to ensure self-reliance of community in terms of livelihood, awareness and safe construction skills. Based on these findings, a new framework for operationalising community participation during recovery projects is proposed. This chapter contributes a new framework, which can potentially help CSOs, donors and government authorities to understand context specificities of communities, participation, project life cycle and associated time-frame.

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A NOVEL FRAMEWORK FOR OWNER-DRIVEN RECONSTRUCTION PROJECTS TO ENHANCE DISASTER RESILIENCE IN THE LONG TERM

1. INTRODUCTION – WHAT WE ALREADY KNOW!

Over recent decades, our knowledge and understanding of disasters, risk, resilience and an owner-driven approach to reconstruction has grown dramatically. However, losses associated with natural hazards have risen at a seemingly exponential rate. In context of growing disaster risk, increasing intensity, frequency and complexity of hazards (Guha-Sapir et al. 2012) and dwindling resources (human and financial), it is imperative for post-disaster reconstruction (PDR) interventions to "pay for itself many times over in the form of disaster avoided and lives safeguarded" (Clinton 2006, p. 22).

While post-disaster reconstruction (PDR) interventions fit squarely in built environment and development fields of study, it has been influenced by an array of other fields. Since the 1970s, pioneers from the built environment (e.g. Cuny 1978; Davis 1978a, 1978b; Turner 1976) have suggested that while addressing physical or technical vulnerabilities (hard assets) in house is important, even more important is addressing the underlying social and/or economic vulnerabilities (soft assets). They have urged for beneficiary participation from an early stage, proposed 'minor technical modifications' to prevailing construction technology and emphasised process over product (Davis 1978a, 1978b; Davis, Thompson & Krimgold 2015). Human geographers and sociologies, however, have challenged built environment practitioners' shallow understanding of the terms: community, participation or engagement. For example, scholars have suggested that communities need to be "produced" before they can be mobilised (Bulley 2013, p. 276; Delanty 2003) and the term participation has been used in varying scales as differentiated in the ladder of participation proposed by Sherry Arnstein (1969) for developed countries. Later this ladder was modified for use in developing countries by Marisa Choguill (1996), and then adopted for use in PDR work by Davidson et al. (2007). Scholars have also warned that the narrow or uncritical use of the term community

participation (e.g. unknowingly favouring one caste over the other for housing assistance) can weaken the sense of community or at worst, exacerbate social division (e.g. Mulligan 2013; Mulligan & Nadarajah 2012). For these reasons, 'social mobilisation' is used in this paper, as it aligns with enabling environment for active engagement. Scholars from development studies (not economic studies) have established a cause and effect relationship between house and their resident's livelihoods (Chambers 1995; Chambers & Conway 1992; Development Alternatives 2004; Niazi 2001). They have argued that livelihood (or a lack of it) may be the root cause of why the house was vulnerable in the first place. Since the 1990s, there was a shift from 'development' narrowly focussed on economics to 'post-development age' with a desire for human development and well-being (e.g. Sen 1998). Through the concept of capabilities (freedom to choose), Amartya Sen (1985) argued that the freedoms enjoyed by people are a greater determinant of human development than capital possession. In line with post-development era, an owner-driven housing reconstruction (ODHR) approach re-emerged. An ODHR has become a default mode in disaster recovery management, internationally (Jha et al. 2010), evident in the development of guidelines for ODHR (IFRC 2010). The approach emphasises enabling mechanisms or providing disaster survivors with support (social, financial and technical) to make informed decisions during reconstruction. Such emphasis explains that ODHR combines concepts from multiple fields of study (built environment, human geography, development and ecology).

The introduction of the concepts such as risk (Blaikie et al. 1994) and socio-ecological systems (SES) resilience (Holling 1973; Resilience Alliance 1999) highlighted scholarly research that was cross-disciplinary. The concept of risk shattered the myth of disasters being natural or neutral; rather, it being created by society's interaction with hazard (i.e. disaster risk = hazard x exposure x vulnerability/ capacities). At the same time, the influential concept of resilience encouraged an integrated or systems perspective because human environments and natural environments are inevitably interconnected (Holling 1973). While the concept of resilience has gained traction, it has also come under a lot of scruity, with some arguing resilience thinking lacks a normative dimension or promotes a "negative anti-community individualism" (Mulligan et al. 2016, p. 1). Despite such

criticisms, the concept's long-standing use and increasing recognition means that its use will most likely continue in disaster management work. Hence, a number of scholars (e.g. Cascio 2009; Seville 2008; Smit & Wandel 2006) have proposed to narrow down the concept if it is to be of practical use, by providing answers to questions such as resilience – of what, to what, why, when and for whom. Some of these answers can be found in its definition by UNISDR (2009, p. 24) as:

> *The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazards in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.*

This definition provides answers to resilience – to what: natural hazards and of what: a system, community or society. Table 1 provides answers to remaining questions. Due to the aligned focus of resilience concept and ODHR on 'adaptive capacities' of people (Gunderson et al. 2002; Holling 1973; Twigg 2009), disaster resilience is touted as an ultimate objective of ODHR (Jha et al. 2010). Such linkages between resilience and reconstruction are also evident in the Sendai Framework for Disaster Risk Reduction (SFDRR) (UNISDR 2015).

Table 1: Characteristics of SES resilience and positioning it in context of reconstruction projects

Resilience	**Answer/ Characteristics**	**Positioning in context of post-disaster reconstruction (focus of this research)**
To what	Natural hazards	Understanding multiple interacting stressors, causing disaster
Of what	Socio-ecological system (SES) i.e. system, community or society (UNISDR 2009) 'human action and social structures are integral to nature and hence any distinction between social and natural systems is arbitrary' (Adger, 2006, p.268)	**Human system and assets** - **Physical/ Technical component** – housing and settlements (IFRC, 2012; Bevc et al., 2013) - **Human/ social component** – knowledge of past experiences (Twigg, 2009); health, well-being (IFRC, 2012); strategic foresight, social memory (Folke, 2006); kinship or networks (Smit & Wandel, 2006) - **Financial component** – livelihood (Twigg, 2009)
Why	- For "building a culture of safety and resilience" (UNISDR, 2005, p. 57-75) - to emphasis strengths (Gunderson et al., 2002)	- **Robust** houses and construction - **Adaptive capacity and resourcefulness** of communities - **Rapidity,** timeliness and efficiency of projects
When	Resilience is a continuous and on-going activity, but, its most evident (Kapuca et al. 2013, p.xiv), either: - prior to (anticipatory resilience) - during (responsive resilience) - long time after (adaptive resilience) disaster	**Long time (>10 years) after a disaster** as people are more open to change or new ways of thinking and hence enhancing resilience can become a conscious task (Folke, 2006)
For whom	Disaster affected or at-risk communities	Community
How	- owner driven approach - skills training - capacity building	Limited research linking how post-disaster reconstruction can enhance resilience of communities at-risk in the long-term, hence the focus of this research

In PDR context, enhanced SES resilience would equate to the following five characteristics (informed by Bevc 2013; Folke 2006; Gunderson et al. 2002; Holling & Walker 2003; IFRC 2012; Twigg 2009):

- Robust yet diverse
- Redundancy
- Resourceful yet equitable
- Rapid yet time-flexible, contextual and strategic
- Adaptive and transformative capacity

These characteristics are discussed in section 5. Table 1 also highlights that resilience is typically evident in communities long time (>10 years) after a disaster. However, there is limited research on the long-term impacts of reconstruction interventions.

The author of this paper acknowledges that there have been some notable examples of research on long-term impacts of PDR projects. These include, research on post-2004 tsunami in Sri Lanka by O'Brien and Ahmed (2012) and a compendium of case-studies on the Asia and Latin America by Schilderman and Parker (2014) including those investigated 36 years after 1976 Guatemala earthquake by Kurt Rhyner (2014) and 12 years since El Salvador earthquake by Claudia Blanco et al. (2014) and 12 years since 2001 Gujarat earthquake by Jennifer Barenstein et al. (2014). Despite trickling progress in research on long term impacts of reconstruction, there is lack of ONE accepted framework, from an inter-disciplinary or systems perspective, for practitioners to provide guidance on 'how' to carve pathways for disaster resilience and development, through PDR. While attempts have been made to propose resilience framework, these have bene either fairly conceptual (e.g. community resilience framework by Berkes and Ross (2013) and the IFRC (2012)), or designed for macro-scale program evaluations (e.g. city resilience by Arup, Jo da Silva 2014) or highly detailed program evaluations with emphasis on one or two of the system components (e.g. cost-benefit analysis of DRR, by IFRC 2008a). Further discussion on various resilience frameworks and their pros and cons are discussed by Bond (2017, pp. 5-19). There has been no accepted framework for micro-scale, ODHR project scale. A conceptual framework is developed as Venn diagram for the purpose of this investigation (figure 1).

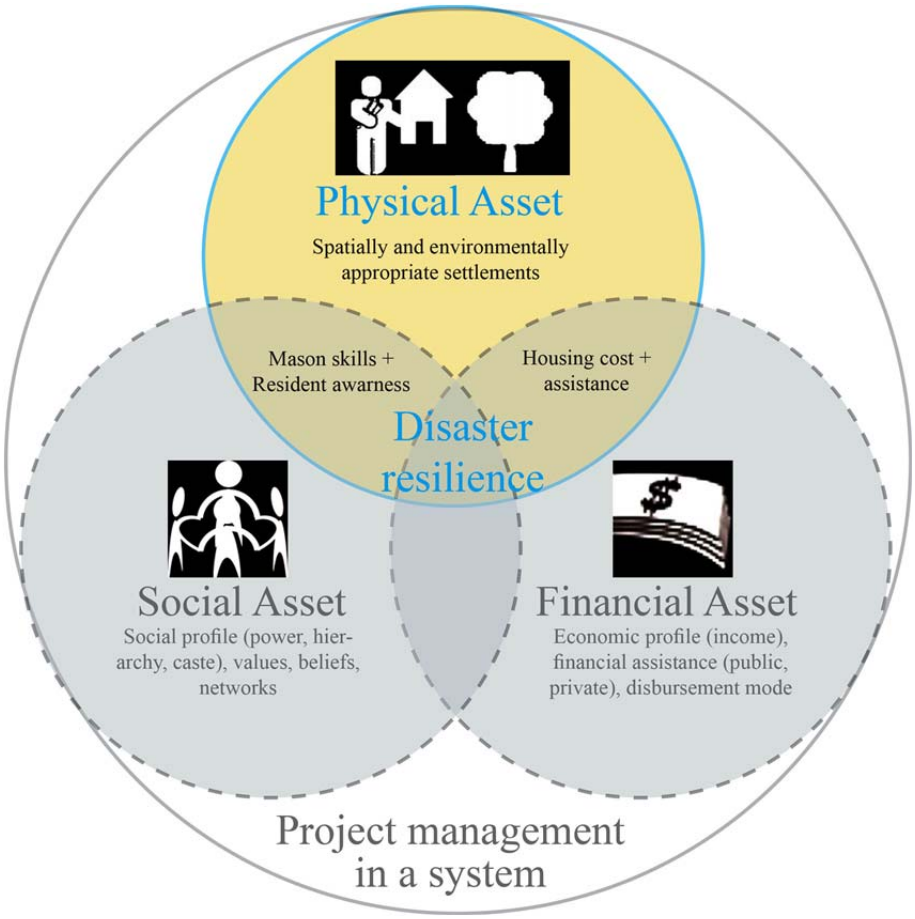

Figure 1: Conceptual framework as a Venn diagram (source: author)

This empirical paper aims to address the identified research gap by long term investigation of good practice ODHR projects and assimilating findings – contingent and generalizable – into one framework, to inform practitioners in a field where lessons from the past have often been narrowly documented and long-term project outcomes have largely remained unexamined.

2. RESEARCH DESIGN

This paper deployed a comparative case study and mixed methods methodology (predominantly qualitative). In order integrate issues from different fields of study (i.e. technical, social, financial), the research is designed as a multi-disciplinary case study (Yin 2009). Consequently, empirical data collection relied on a mix of social sciences methods including semi-structured interviews, and architectural research methods including the visual analysis of photographs and sketches. Due to the intent of this research to identify long-term 'project impacts' (Blessing & Chakrabarti 2009), one of the criteria for the selection of ODHR project (as a case) was to be atleast 6 years old.

Case studies were selected from India because it has been at the forefront of ODHR policy and practice, since the 1990s (NDMA 2005). Two case studies were chosen from Gujarat (13 years after the 2001 earthquake) where ODHR policy was adopted for the first time in India. The other two case studies were selected from Bihar, (6 years after the 2008 Kosi River floods), when an innovative ODHR program was put into place (figure 2). Two developmentally oriented civil society organisations (CSOs) – Kutch Nav Nirman Abhiyan (a Gujarat-based consortium of about 26 CSOs, hereon referred to as Abhiyan) and Sustainable Environment and Ecological Development (SEEDS), had adopted Hodko and Patanka settlements in Gujarat for reconstruction, respectively (ADRC 2005; Gupta & Shaw 2003). Since the work of these two Indian CSOs has received high acclaimed, their practice is followed from 2001 to 2008, to learn from. For example, the work of Abhiyan has been cited internationally (UN-Habitat, UNHCR & IFRC 2008, 2009) and similarly, SEEDS' work has also been commended by IFRC (2004).

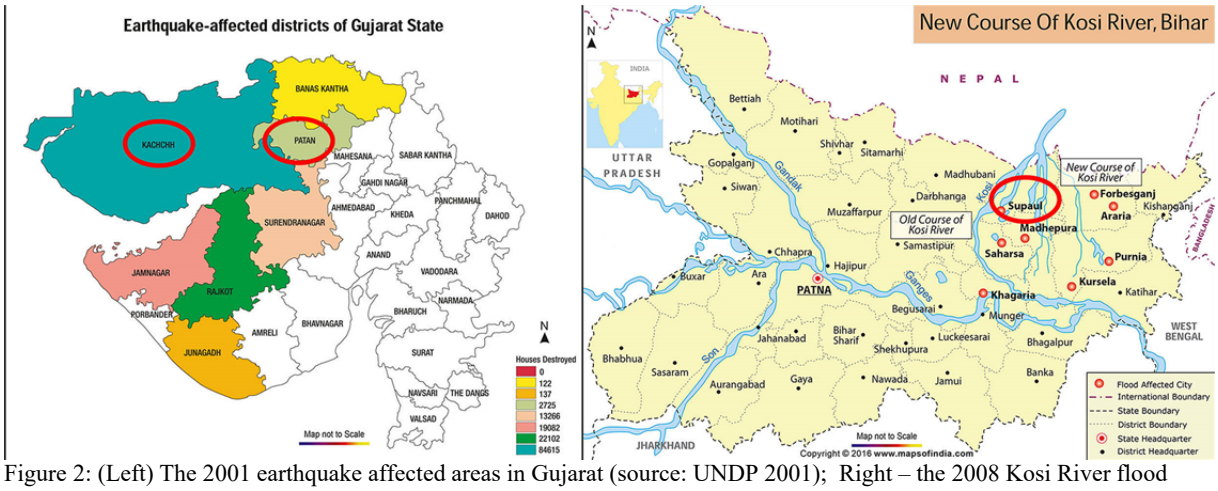

Figure 2: (Left) The 2001 earthquake affected areas in Gujarat (source: UNDP 2001); Right – the 2008 Kosi River flood affected areas in Bihar (source: Compare Infobase Limited 2008) with red ovals showing selected case-study locations

For data collection and analysis, a modified version of the Logical Framework Approach (LFA) was used, as informed by several scholars (Ahmed & Charlesworth 2015; Bornstein et al. 2012; Lizarralde 2002; UNDP & Hunnarshala 2006). Despite the weakness of LFA being typically used for designing, monitoring and evaluation of on-going projects, and availability of other evaluative tools such as the development assistance committee (DAC) criteria (ALNAP 2006), this research adopted LFA for two

reasons. One, it allowed for conducting mixed-methods research and two, it allowed for establishing causal linkage between project life-cycle phases as: i) Input, ii) Output iii) Results/Outcomes and iv) Impact (unintended outcomes) (Baum 1970; Steinfort 2017) (for details on LFA based analytical framework, see Vahanvati & Mulligan 2017). The research was conducted in two stages. A total of 80 in-depth interviews (15-18 per site) were conducted, including three sample groups: 1) 34 CSO members, professionals and government official; 2) 37 beneficiaries and 3) 9 non-beneficiaries. These three sample groups were identified purposively (based on gender, socio-economic variations and housing condition) to be inclusive and for triangulation. Non-beneficiaries were interviewed for comparative analysis and to draw causal linkage between project inputs and long-term impacts (intended and unintended). Thematic content analysis was used for the analysis of qualitative data.

3. CASE STUDY DESCRIPTION

3.1. THE 2001 GUJARAT EARTHQUAKE AND RECONSTRUCTION PROGRAM

On 26th January, the Indian Republic national holiday, the Western state of Gujarat was hit by an earthquake of 7.9 magnitude, claiming nearly 20,000 lives (UNDP 2001) and destroying over one millon homes (GoI & UNDP 2011). The earthquake was declared to be the second-largest recorded in the Indian history (UNDP 2009). In response, the state government set up a nodal agency – the Gujarat State Disaster Management Authority (GSDMA 2001a), announced an owner-driven reconstruction (ODR) policy and allowed public-private partnerships, creating space for the civil society organisations (CSOs) to operate freely during reconstruction (Barenstein & Iyengar 2010). Despite an ODHR policy, the government maintained a top-down institutional structure for disaster management.

3.2. CASE STUDIES 1 AND 2

3.2.1 Pre-disaster context

Hodko settlement is located in Kutch district of Western India, which is an arid and desert region. The region is prone to earthquakes, sand storms, and droughts. Kutch is also of high ecological significance due to its arid grasslands – including Asia's second largest grassland in the world and

marshy salt desert (Sahjeevan n.d.). Though it is one of the poorer regions, it is renowned for its crafts sector (e.g. colourful embroidery). Main livelihood of people is cattle breeding and secondary livelihood is service provision (making leather items or dairy products). Traditional houses were cylindrical in shape with high conical roof (termed as *bhungas)* and were built from mud, grass and wood (Desai 2002; Vahanvati & Beza 2016) (figure 3). While 90 percent of people in Hodko comprised of muslims (who were rich) and Harijans (who were poor and considered untouchables), there was harmony between these caste-based communities.

Figure 3: Photos of traditional mud houses in Hodko, Gujarat, prior to the 2001 earthquake (left) and after reconstruction (right) (source: author)

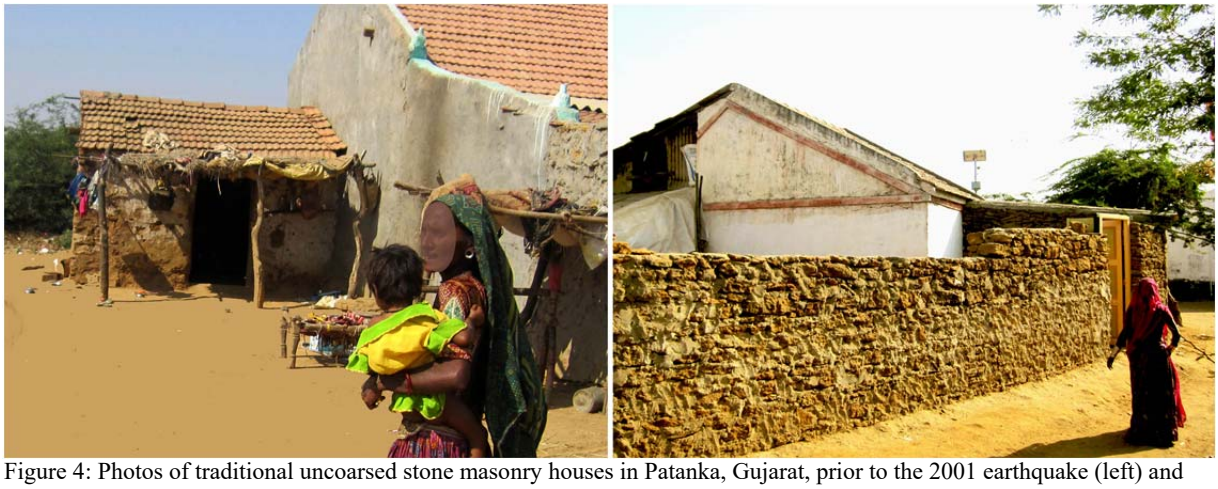

Figure 4: Photos of traditional uncoarsed stone masonry houses in Patanka, Gujarat, prior to the 2001 earthquake (left) and after the reconstruction (right) (source: author)

Patanka, like Hodko, is also located in an arid region. Main livelihood of the people in Patanka is farming – the region known for its cumin produce. Traditional houses were rectangular in shape with pitched roof and were built from stone or unburnt brick (with mud plaster) and thatch roof (figure 4). By 2001, affluent households were building houses from burnt brick, concrete mortar and reinforced

cement concrete (RCC) flat roof. Generally, the quality of construction was very poor. 70 percent of people in Patanka were Hindu Brahmins and other of different castes.

3.2.2 Post-disaster reconstruction

Post-disaster, Hodko settlement, being in close proximity to the epicentre of this earthquake suffered massive devastation of approximately 85 percent of all asset loss in the state (UNDP 2009), while Patanka settlement had approximately 60 percent houses collapsed (Gupta & Shaw 2003). Hodko village comprised of 12 caste-based hamlets with a total of about 450 houses (UNDP & Abhiyan 2005); while Patanka was a smaller village of 250 houses.

Since Abhiyan was a local group of over 26 CSOs who were working in Kutch for over a decade prior to the earthquake, they were approached by people for help with reconstruction because people trusted them. Abhiyan established informal shelter hubs – termed as *Setu Kendras* (literally meaning bridging centres), whereby local community members could work collaboratively with professionals, social workers, among others. *Setu Kendras* acted as a two-way conduit for communities to raise their concerns to the government and visa versa. SEEDS on the other hand was a newly formed non-government organisation (NGO) based in New Delhi. They had to find settlements and communities to offer assistance. In Patanka, SEEDS' efforts to partner with a local CSO (named SEWA) who had thorough understanding of the local culture and community trust, was in vain. Hence, SEEDS had to invest ample time in building community trust. They did so by understanding the local meaning of community, their diverse needs, aspirations and their previous coping capacities and demonstrate their own abilities to help.

Financial assistance was to be provided by GSDMA directly to the disaster survivors into their bank account (in joint name of man and women). However, CSOs and citizens were encouraged to top up government funding by atleast 50 percent (GSDMA 2001a). While Abhiyan brought in all of the money for assistance, SEEDS topped up government funding by providing materials – steel and cement (Gupta & Shaw 2003). As seen in the tables 2 and 3, funding by GSDMA was mainly allocated for housing recovery, not for addressing systemic issues such as water shortage.

Table 2: Uniform financial package for construction of one *bhunga* by Abhiyan in Hodko, Gujarat (KMVS 2001a)

Abhiyan CSO contribution towards core-house construction (uniform package – only materials)	Rs. 43,500/-
Abhiyan CSO contribution towards administrative cost	Rs. 1,500/-
Beneficiary contribution (money or equivalent labour)	Rs. 9,000/-
Total	Rs. **54,000/-**

Table 3: Non-uniform financial package for the construction of housing per household in Patanka, Gujarat (source: author, adapted from PNY Report, Gupta and Shaw, 2003)

Gujarat government contribution towards core-house construction (non-uniform package)	Rs. 40,000 to 90,000/-
SEEDS CSO top-up (construction materials = cement + steel)	Rs. 10,000/-
Beneficiary contribution (only if households wish to construct bigger house)	Variable
Total	**Rs. 50,000 to 100,000/-**

One improvised construction technology (minor modification to the traditional system) and core house design was proposed by both Abhiyan and SEEDs. For example, Abhiyan proposed a core house design of 18 sq.m. that continued traditional cylindrical form of *bhungas* with minor modification to technology – cement-stabilised mud walls and reinforced cement concrete (RCC) columns and beams (Jagadish 2009). On the other hand, SEEDS had not proposed any design solution but communicated to residents that the funding would allow for construction of a core-unit of 12 sq.m. Like Abhiyan, they had also proposed minor modifications – cement mortar and RCC bands in traditional stone masonry. These modifications were based on shake table tests performed on model houses by SEEDS in partnership with UNCRD (2003). Skills training in newly proposed technology was conducted by both CSOs. While Abhiyan employed few masons from neighbouring state and few locals (UNDP & Abhiyan 2005); SEEDS trained and employed only locals. SEEDS also facilitated a mason exchange program whereby two masons, highly skilled in seismic construction were invited from Nepal's National Society for Earthquake Technology (NSET) to train the residents of Patanka. Despite language barrier, the language of hands proved successful in skills transfer (Arai 2002).

With financial, technical, material and social support from Abhiyan, 56 households of Hodko led their own housing recovery, and finished reconstruction in a rapid timeframe of 15 months, for Rs. 45,000 (approx. $700) per household (figure 3). Its must be noted that while the Hodko rehabilitation may seem very small scale, the overall scale of reconstruction supported by Abhiyan was massive. Similarly, with support from SEEDS, 300 households of Patanka led their own housing reconstruction, which finished in less than 24 months (Gupta & Shaw 2003) (figure 4).

3.3. THE 2008 BIHAR KOSI RIVER FLOODS AND RECONSTRUCTION PROGRAM

In August 2008, the North Indian state of Bihar was severly flooded due to sudden surge in the Kosi River. Massive devastation happened due to a rupture in its embankment and a subsequent change in river's natural course. The scale of damage was exceptionally high, affecting over 3 million people (PiC 2010), damaging more than 200,000 homes (GoB & ODRC 2008a) and destroying crops. The government of India declared the flood as a national calamity (GoB & ODRC 2008b). The Government of Bihar (GoB) invited Owner Driven Reconstruction Collaborative (ODRC) – a consortium of researchers, think-tanks, governments and CSOs from the Asia-Pacific region, to develop policy collaboratively (GoB & ODRC 2008b). For the first time in Bihar's history, the GoB proposed a reconstruction strategy following floods (not just an aid package), adopted an ODHR policy and setup for decentralised governance. However, GoB lacked any prior experience in disaster management. Thus, ODRC agreed to build the capacity of GoB through pilot project implementation; following which, GoB was meant to upscale the reconstruction. It must be noted that since Orlaha and Puraini were demonstration projects, they got higher inputs from ODRC and GoB.

3.4. CASE STUDIES 3 AND 4

3.4.1 Pre-disaster context

Orlaha and Puraini settlements are in a sub-tropical zone, which gets heavy rains and are frequented by floods, earthquakes and storm surges. The region is covered with a network of over eight rivers including the Kosi and Ganges, which rejuvinate the soil with rich alluvial deposits, annually. These rivers and the great Himalayan Ranges significantly influence Bihar's landform, climate, hydrology and culture. Main modes of livelihoods of people in this region are agriculture (with three crops per year), mud-based industry (bricks, tiles) and mining. The traditional houses were rectangular with pitched roof and were built using mud, grass and bamboo (Census of India 2011b). Generally, the quality of construction was poor. Nonetheless, skills in bamboo technology were excellent (with an exception of few issues such as lack of bamboo treatment). Hindus formed a majority with Muslims as a minority in this region, however, they lived harmoniously.

Historically, Bihar had witnessed a golden period (during 240-500AD when India was termed as the Golden Bird), had been a seat of power (giving the world its first democracy) (UNDP 2014), learning centre (e.g. Nalanda and Vikramshila Universities, 5th and 8th Century), as well as cultural and spiritual centre (Government of Bihar undated). However, since the 18th Century, Bihar's condition (e.g. law and order, infrastructure, education and political system) has constantly deteriorated (NIOS n.d.). Such deteriorated condition combined with annual disasters have gripped the people of Bihar in eternal poverty (India 2004).

3.4.2 Post-disaster reconstruction

Post disaster, Puraini being close to the dam was entirely washed out and hence almost all the households (89 out of 102) received assistance. In contrast, Orlaha being further away from the same dam, less than half households (41 out of 110) received assistance. A transparent and robust social mobilisation process was established in Bihar by ODRC. Once again, *Kosi Setu Kendras* were setup after being institutionalised and formalised. ODRC partnered with a local organisation named Meghpain Abhiyan who knew local language and had pre-established community trust. The staff of Kosi Setu Kendra communicated beneficiary list with villagers, addressed discrepancies, enabled communities (who were illiterate) with setting up of bank accounts and provided hand-holding support throughout their housing reconstruction (PiC 2010).

Based on people's previous coping mechanisms (e.g. an attic for refuge during floods) and people's aspirations, five model houses were built to showcase two technologies – 1) improvised traditional bamboo-based construction and 2) aspired brick and cement construction. Along with providing multiple technological choices, residents were also given freedom to make informed choices for their house design and labour selection. The financial support was uniform for all the beneficiaries. However, the funding was for housing as well as for addressing deep-rooted poverty, land shortage and lack of basic amenities (e.g. energy, clean drinking water, toilets, sustainable energy) (GoB & ODRC 2008a) (table 4).

Table 4: Uniform financial package per household by Government of Bihar (source: author)

Core-house construction (uniform package, distributed in 3 instalments)	Rs. 48,000/-
Daily sustenance of residents who loose time in providing labour	Rs. 4,000/-
Solar lighting - one bulb (incentive for timely completion of housing in 6 months)	Rs. 3,000/-
Landscaping or beautification	Rs. 10,000/-
Toilet building	Rs. 8,000/-
Landless to have land-titles	Variable
Beneficiary contribution (only if households wish to construct bigger house)	Variable
Total	**Rs. 75,000/-**

In a little less than two years, 41 households in Orlaha and 89 households in Puraini had managed to rebuild their houses at a nominal cost of Rs.55,000. Most of the Orlaha residents built their houses using bamboo technology, while all the Puraini residents used brick masonry and reinforced cement concrete (RCC) (figure 5).

Figure 5: Top left - Photos of traditional bamboo and thatch house in Bihar; Top right – Improvised bamboo houses in Orlaha and Bottom left – improvised brick houses in Puraini settlements after the 2008 Kosi River floods (source: author)

4. FINDINGS: SHORT-, MID- AND LONG TERM IMPACTS

4.1. CASE STUDIES 1 AND 2: POST 2001 GUJARAT EARTHQUAKE

4.1.1 Short-term outcomes

As discussed by Vahanvati and Mulligan (2017, p. 8), “community satisfaction with all aspects of their rebuilt houses – disaster-safety, low-maintenance, construction quality, cultural appropriateness, and

aspirations – was very high" immediately after housing reconstruction completion.

Post-completion, both the CSOs in Gujarat continued to built on the momentum of reconstruction because they had longer term vision. For example, Abhiyan had envisioned sustainable development of the Kutch region (Kutch Nav Nirman Abhiyan 2013) while SEEDS had envisioned developing a model village – Patanka Navjivan Yogna (Gupta & Shaw 2003). Despite lack of funding for additional projects, SEEDS in Gujarat's Patanka settlement mobilized approximately 40-trained masons to form a SEEDS Mason Association (SMA), prior to their withdrawal from site (Gupta & Shaw 2003). SEEDS linked these masons with government funding for certificate training at affiliated institutions in seismic-safe construction (GSDMA 2001b). Likewise, Abhiyan facilitated the process of developing guidelines for mud construction in partnership with a technical research centre (ASTRA 2008) and the national seismic engineer – Dr. Arya (GSDMA & UNDP 2005). Later on, this mud-based earthquake safe construction guidelines were legalised by GSDMA. Abhiyan also continued onto other projects with an objective of sustainable development of Kutch region. The Gujarat State Disaster Management Authority (GSDMA), thus played an important role in partnering with training institutions and legalising so-called un-engineered construction technologies (GSDMA 2001a, 2001b).

4.1.2 Long-term impacts

13 years since the Gujarat earthquake, empirical evidence demonstrated mixed outcomes in terms of disaster resilience at different scales, in Hodko and Patanka.

From a technical perspective, visual analysis demonstrated high occupany rate and the good condition of all rebuilt houses in Gujarat's Hodko and Patanka. Furthermore, interview respondants claimed that their houses required limited maintenance (figures 3 and 4). In Hodko, the houses had also survived the test of another earthquake measuring 5.6 on Richter scale in 2006 (Price & Bhatt 2009). However, over time, Hodko residents have incrementally discontinued use of the proposed technology (stabilised mud-brick) and the safety feature. In contrast, in Patanka, at least half of the research respondents continued using the proposed technology. By 2011, the SMA had grown to become "an 800-member organisation, of which 200 have been certified by the Government of Gujarat for having reached

internationally accepted standards in construction skills" (NDMA & IGNOU 2011, p. 81). At settlement scale, both the settlements had improved quality of roads and access to electricity, but access to water and toilets continued to be a challenge.

From a wider social and economic perspective, interview data suggests that most of the residents, who benefitted from a house in Hodko had improved and diversified their livelihoods. The beneficiaries felt that their housing and living standard was an upgrade from their pre-disaster shelter, in which non-beneficiaries continued to live. Such improved housing, which was as good or even better than the houses of affluent people, had also led to a dilution in caste-based hierarchies and enhanced a sense of dignity among residents of Hodko. In Patanka, such socio-economic gains were not evident among all residents, rather, only among the trained masons evident from their kids being able to get eduction in school and Universities (Vahanvati & Mulligan 2017).

4.2. CASE STUDIES 3 AND 4: POST 2008 BIHAR KOSI RIVER FLOODS

4.2.1 Short-term outcomes

Immediately after the completion of housing reconstruction, all the respondents in both the settlements were highly satisfied with every aspect of reconstruction process – participatory process, construction quality, flood-earthquake-cyclone resistant of their rebuilt houses, access to solar lights, water pumps, toilets and lighted and paved streets.

While there were plans by ODRC to build sewage and drainage, to raise awareness by using different folk forms (PiC 2010), ODRC had to withdraw prematurely, soon after the completion of pilot projects (in 2010), without effective hand-over to the state. At local level, no concerted efforts were put in to link trained masons or local residents to livelihood diversification, post 2008 floods.

4.2.2 Mid-term outcomes

Six years since the 2008 floods, it was still a bit early for identifying long-term impacts and hence only mid-term outcomes in relation to disaster resilience are discussed.

From housing perspective, all the rebuilt houses were robust, required minimal maintenance and were occupied. These houses had also withstood the test of 2010 floods and cyclone. Compared to the non-beneficiaries who continued to live in fragile shelters (which needed rebuilding every year after flooding), the beneficiaries felt that their houses were an upgrade. Consequently, better housing had increased their sense of security (e.g. protection against snakes) and had enabled their kids to study after dark (due to solar lighting). A high level of awareness and incorporation of disaster safety features in housing was evident in almost all the extensions or new house construction. However, over time, across both the settlements, only brick-based construction technology had found continuity, bamboo-based had not. Furthermore, almost all the toilets were out of use due to stigma of using waterless toilets. At the settlement scale, majority of solar street lights were non-operational due to problem with batteries, which the residents neither had ability to repair nor incur the high cost of replacement (about Rs. 600 per battery).

From a broader social and economic perspective, there were many positives. The livelihood of trained masons in Puraini settlement had increased with some having setup their own building consultancy, providing employment to other local residents. In contrast, Orlaha residents did not have such gain in their livelihoods since most of them were trained in bamboo construction, which has got discontinued. Nevertheless, beneficiaries in both the settlements estimated a savings of approximately Rs. 10,000 ($155) annually from not having to repair their house post-floods.

4.2.3 Long-term impacts

Bihar's transdisciplinary, collaborative and decentralised governance setup for ODHR was fairly comprehensive compared to Gujarat's. Besides, *Setu Kendras* were institutionalised for community mobilisation. However, given with a background of political instability and lack of government experience (capacity) in disaster management, the long-term impact of these projects would have to be assessed at a later date.

5. HOW SHORT- AND LONG-TERM OUTCOMES DIFFER?

In Gujarat, an ODHR policy was adopted for the first time and hence varying shades of CSOs' understanding and implementation of owner-driven were evident. In the short-term, residents of all the four settlements – Hodko and Patanka in Gujarat and, Orlaha and Puraini in Bihar – were satisfied with their in-situ rebuilt houses, participatory processes and assistance package. However, the outcomes in the mid- and the longer-term were different.

- Robust yet diverse: All the rebuilt houses in all the four settlements were diversified (or personalised), were robust and had survived the test of other hazards. However, replicability over time was a challenge. For example, in Gujarat's Hodko stabilised mud brick had incrementally been discontinued and bamboo-based technology in Bihar's Orlaha settlement met similar fate. Two reasons can be associated to the discontinuity of technology, as 1) a lack of access to resources (e.g. mud brick press machine in Hodko) and 2) growing aspirations for so-called modern houses (Unnati, Peope In Action & Cordaid 2012). Three reasons can be claimed for the relative technical success, to: 1) resident's easy access to resources (e.g. skills training to mainly locals), 2) link skills of trained masons with livelihoods (e.g. SEEDS'Mason Association) and 3) Provide multiple technological choices to residents (e.g. in Bihar's settlements).

- Redundancy: While no such failsafe mechanism was inbuilt in Gujarat, it was incorporated in house design in Bihar. The houses were built on pile foundation (which went deep in ground), and were lifted on stilts. The walls on ground floor between the columns (of pile foundation) were built to give away in the event of floods, in order to ensure the house's safety wasn't compromised.

- Resourceful yet equitable: Ample care was taken by both CSOs to provide financial and social resources to disaster survivors in an equitable manner, without favouring any caste or status; however, there were some resentments in the short-term in all the four settlements (Vahanvati

2017; Vahanvati & Beza 2016). In the longer-term, substantial livelihood improvement and diversification were evident, especially among residents of Hodko settlement in Gujarat. Such gains can be attributed to the proliferation of projects by Abhiyan, such as building of a rural eco-tourism resort of international standard (entirely owned and managed by community) (UNDP 2003), linking of women artisans with contemporary markets (thatch roofing, mud plastering or embroidery) and supporting pastoralism (Sahjeevan, Banni Breeders' Association & Natural Justice South Africa n.d.). Similar livelihood gains were evident among trained masons in Patanka settlement, which can be attributed to SEEDS' sustained employment (in India and internationally) to SMA masons for over 9 years, past reconstruction completion. Such sustained capacity building has led to an increase in resources, which is allowing residents to invest in their kids' education, in livelihood progression and in the safety and resilience of their own house.

- Rapid yet time-flexible, contextual and strategic: While almost all house reconstruction in Gujarat got completed within 24 months after the earthquake; only 130 houses (in pilot settlement) out of a total of 100,000 destroyed houses, got assistance and got built in similar timeframe. Secondary data reveals that the state government of Bihar has not been able to complete rebuilding even nine years since the floods (World Bank 2015). The author of this paper questions. At this stage the author is unsure of whether such such time-consuming, incremental and system analysis based pilotting approach to formulating an ODHR program, will have better longer-term outcomes compared to Gujarat's rapid program design and implementation (Vahanvati & Mulligan 2017).

- Adaptive and transformative capacity: All the above characteristics combined enhanced people's ability to imagine the future they want, forward plan, self-organise and develop. To some degree such transformative capacity was evident among residents of all settlements, however, projects where systemic issues (such as access to toilets or drinking water) were not addressed, it compromised people's ability to adapt and transform.

6. PRACTICAL AND SCHOLARLY IMPLICATIONS

Few similar patterns have emerged based on empirical long term investigation of four ODHR projects in India, in terms of what practices influenced disaster resilience outcomes. These practical implications relate to the way in which practitioners formulate, implement and monitor ODHR projects. These findings (as 9 value deliverables), are assimilated into four project components as:

1. Systems analysis
2. Social mobilization
3. technical modifications
4. capacity building

This section discusses the change needed in reconstruction practice as well as how these findings further our current scientific scholarship on linking ODHR and resilience outcomes.

6.1. SYSTEMS ANALYSIS

As Walker and Salt (2006, p. 1) explains, "system might be a home, a company, or a nation" or a farm, or a region. Since this paper focuses on resilience at community scale, it is interested in a system of people, their social network, relationship to environment, livelihoods, houses and settlements. While systems analysis at community scale may seem similar to context analysis, it is more than that. Systems analysis is not a passive account of pre-existing conditions, rather, it is a dynamic understanding of inter-relationships. Both the Indian CSOs performed systemic analysis (e.g. understanding traditional housing typology, people's needs and aspirations, meaning of community, the particulars of context, among others, and their interconnectedness). Their thorough understanding of systemic issues facing local residents helped them determine resource allocation (financial, human and organisational), technical choices, approaches to social mobilization and timeframes for housing reconstruction. To address deep-rooted systemic issues beyond housing, two different strategies that were effective in the long-term in Gujarat and Bihar, respectively (Vahanvati & Mulligan 2017) were (figure 6):

(i) Scoping a program of projects (not just one project) with long-term goals (e.g. Gujarat's Hodko where Abhiyan proceeded with a series of projects)

(ii) Adopting an 'agile' strategy (if appropriate) to formulate a context-specific project which addresses systemic issues and adjusts as the project/ program unfolds (e.g. Bihar)

For long, scholars from the built environment studies have emphasised importance of the early decision making, as they can determine "the future form of the new settlement and even the long-term economic development of a community" (Davis 1978a, p. 91). Furthermore, the scholars from human ecology have suggested that such early decisions need to be informed by a socio-ecological systems (SES) perspective (Smit & Wandel 2006). In order for ODHR to carve pathway for human development, systems analysis is recommended prior to a disaster, especially in disaster-prone areas, as part of continual disaster management practice. This paper showcases good practice examples of how early stage systems analysis can be done (e.g. pilotting, partnering with local CSO) and can influence establishing a strategic vision.

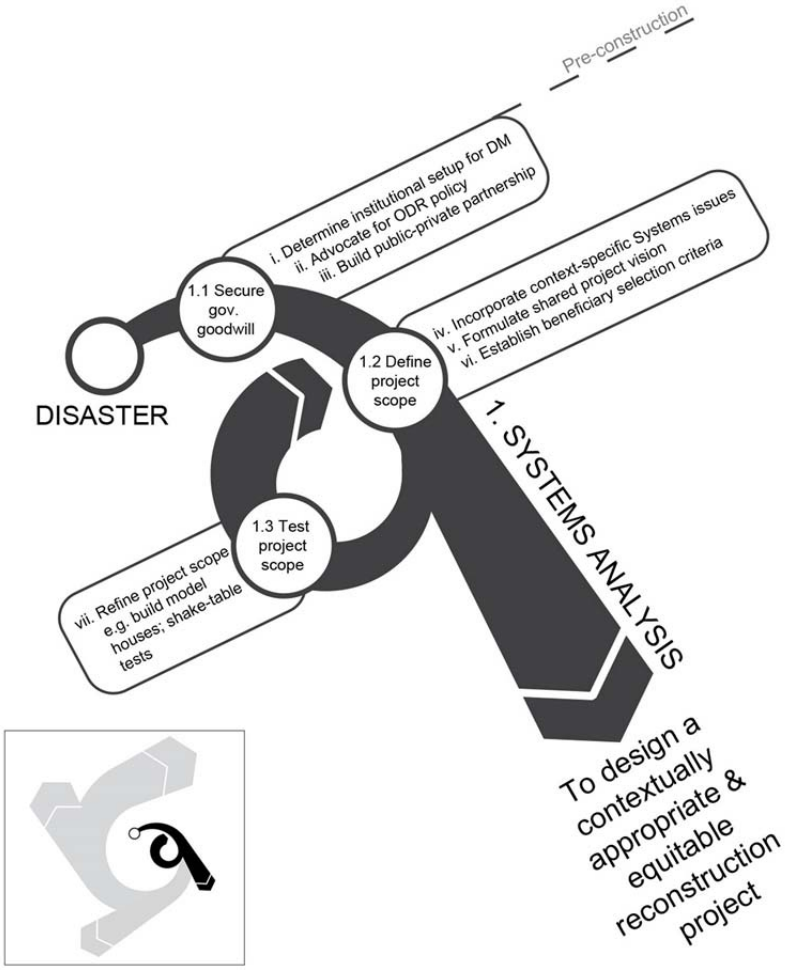

Figure 6: ODHR framework project component 1 – Systems Analysis and its sub-components/ deliverables (source: author)

6.2. SOCIAL MOBILISATION

Community engagement has been identified by scholars and CSOs alike as a foundation on which the success of ODHR projects relies. The case studies in India demonstrated that the following strategies worked for mobilising community for engagement (figure 7):

(iii) *Gaining community trust*

(iv) *Mobilising the community*

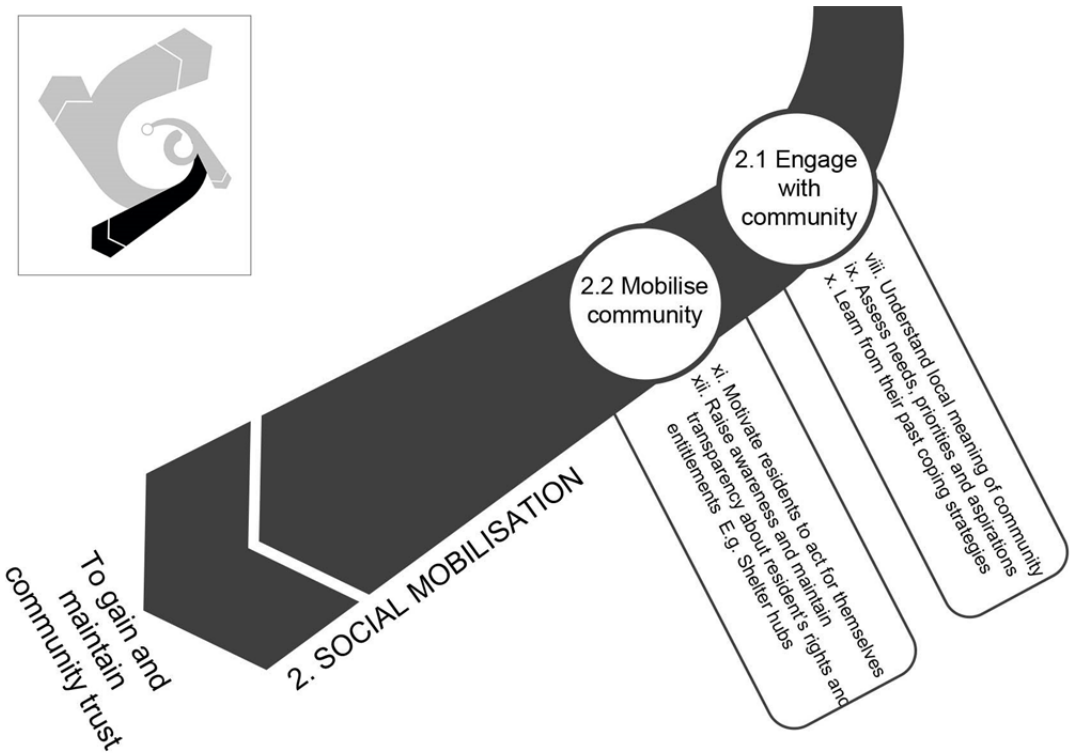

Figure 7: ODHR framework project component 2 – Social Mobilisation and its sub-components/ deliverables (source: author)

Scholars have highlighted the significance of community participation (e.g. Davis 1978a), have deconstructed participation (Ganapati & Ganapati 2009), proposed varying degrees of participation (Arnstein 1969; Choguill 1996), argued for producing community in order to mobilise them (Bulley 2013; Delanty 2003) and advocated for reconstruction to create positive social change (e.g. Mulligan 2012; Oliver-Smith 1990). While existing literature highlights how crucial community mobilisation and participation is for their connection and happiness, very few discuss about particular mechanisms for operationalizing such concepts (Vahanvati 2017). This paper showcases empirical evidence of how some of these concepts can be operationalised. For example, as discussed by Vahanvati (2017), *Setu kendras* proved to be an efficient mechanism for mobilising and empowering communities (UNDP

2001). Community mobilisation ensured that people owned the process (and product - house) and changed their perceptions (about vulnerable practices). However, communities could be mobilised only on a solid foundation of mutual trust, which hinges on paradigm shift from top-down to owner-driven process.

6.3. TECHNICAL MODIFICATIONS

Technical modifications were minor changes proposed to prevailing construction technologies, necessary to ensure the rebuilt houses to be multi-hazard safe, rooted in the local skills and aligned with people's aspirations. Empirical evidence suggest that the following two strategies were effective at embedding safe construction technology in the local culture, in the longer term (figure 8):

(v) Providing multiple technological choices

(vi) Upskilling local artisans

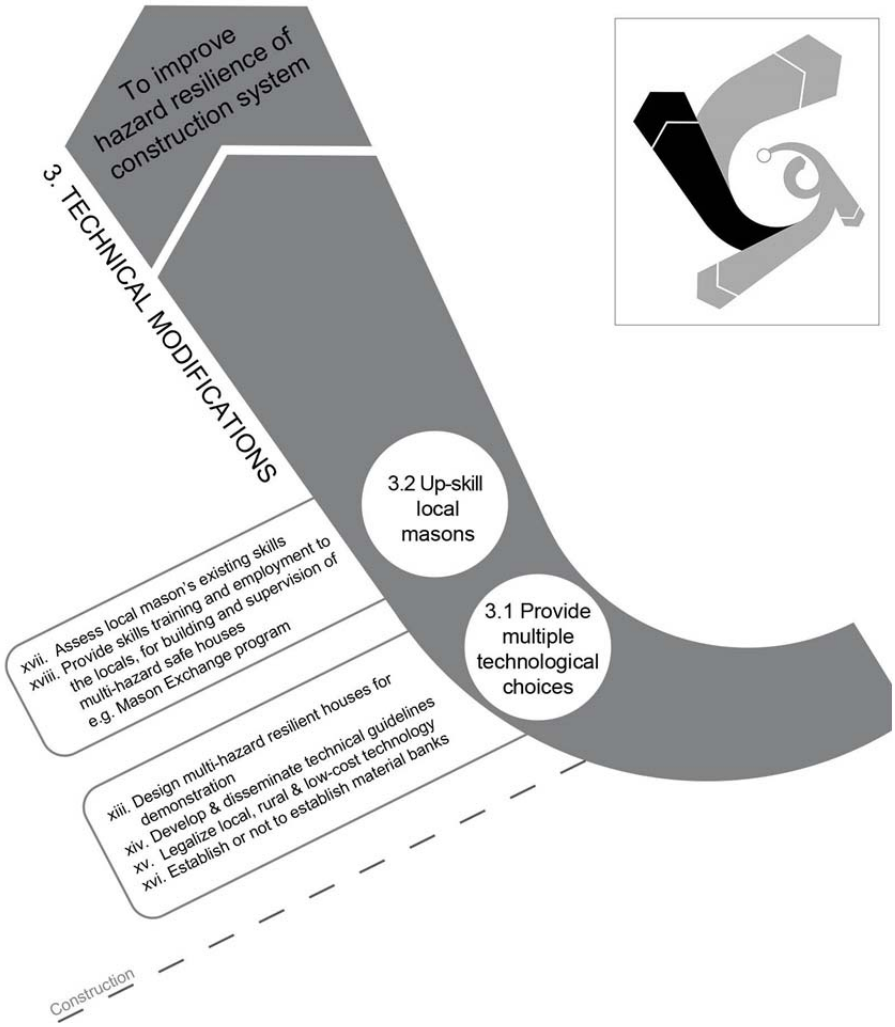

Figure 8: ODHR framework project component 3 – Technical Modifications and its sub-components/ deliverables (source: author)

The findings presented in this paper align partly with the minor technical modifications that have been promoted by pioneers (such as Cuny 1978; Davis 1978a; Turner 1976) since the 1970s. However, the findings further scientific understanding by claiming that a very important dimension of owner-driven has been overlooked – people's need for freedom of choices for their own house – irrespective of people's income group. Mere continuity of traditional technology with minor modifications has not been sufficient at enhancing resilience. While the concept of freedom of choices has already been emphasised by scholars in development studies (e.g. Sen 1997), it has never been discussed in the context of built enviornment studies.

6.4. CAPACITY BUILDING

Capacity building and development relates to "all aspects of creating and sustaining capacity growth over time" (UN-Habitat n.d.b; UNDP 2001; UNISDR 2009, p. 6). CSOs in India have managed to sustain capacity building efforts beyond housing completion by following two mechanisms (figure 9):

(vii) *Improving resident's access to resources (technology, information and/or skilled labour for quality construction) and*

(viii) *Initiating other projects for improved quality of life*

As one CSO member said:

> *housing [reconstruction] process in itself does not lend to many recoveries. What does is the social mobilization. You have lost something – you restore it and you do it well – and therefore shift the bar of the quality and well-being of the community – that much happens through the housing. However, housing is also a medium of mobilizing community […] But, continued Civil Society presence [or a local organization is essential] to use the elevated stage and to reorient the community to achieve their own aspired dreams (interview respondent).*

This description suggests that continnum from housing reconstruction to long-term recovery or enhanced disaster resilience is possible, if these activities are performed in a continuous spiral (figure 10). The knowledge transfer between these components and between projects, ensured projects' and its stakeholders' efficiency (Steinfort 2017). These findings imply practitioners need to sustain capacity building efforts beyond skills training and beyond completion of ODHR projects because this is what will provide a crucial, yet missing link to enhanced resilience.

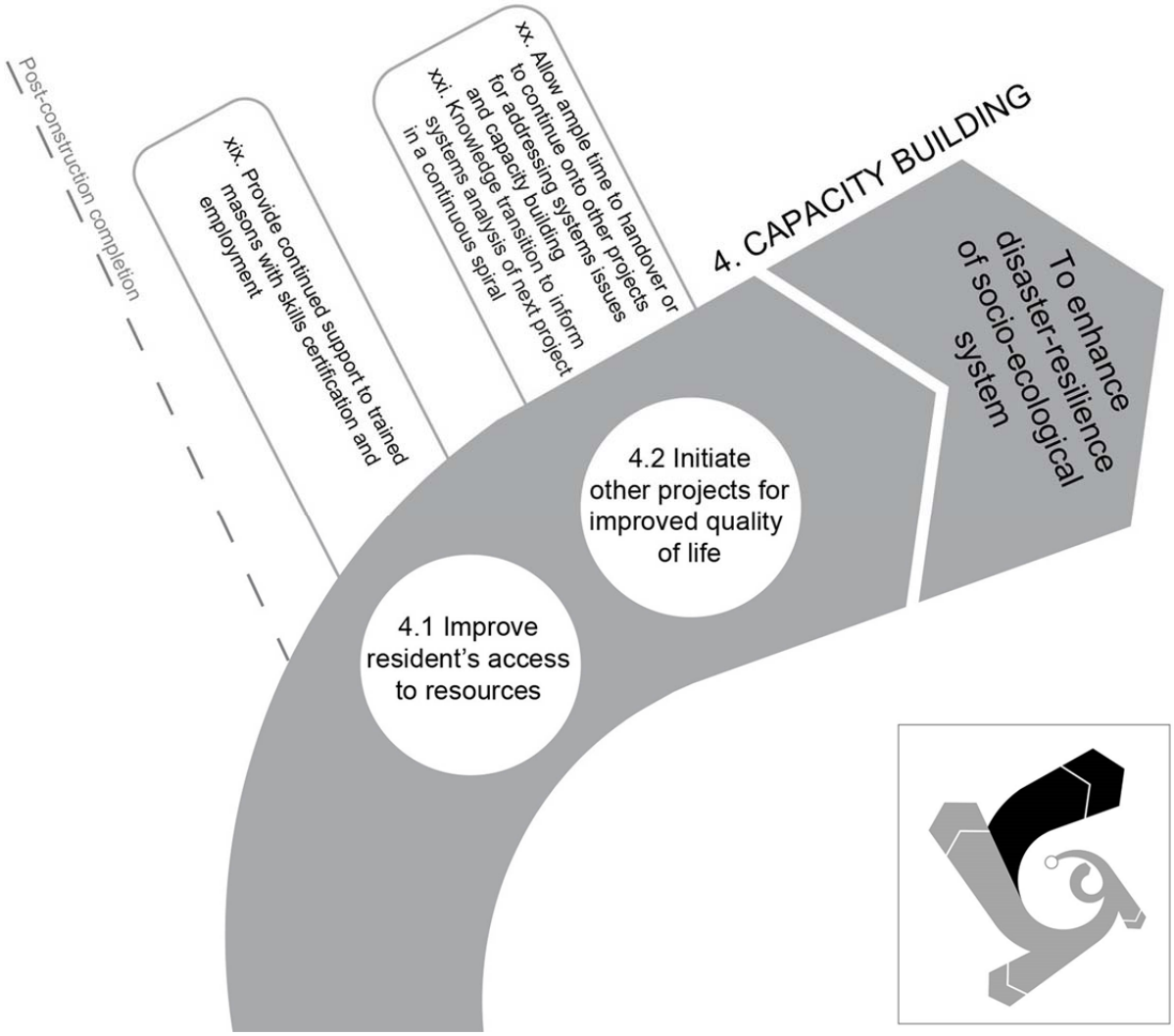

Figure 9: ODHR framework project component 4 – Capacity Building and its sub-components/deliverables (source: author)

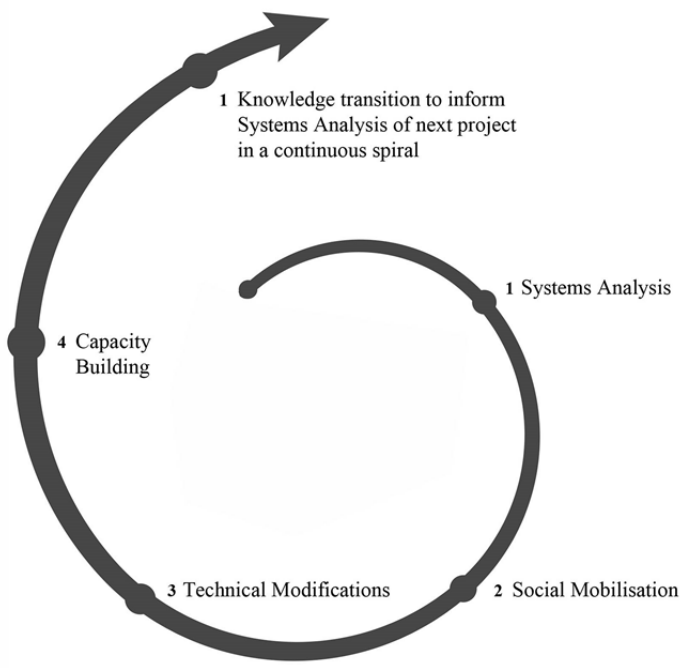

Figure 10: ODHR framework as continuous spiral (source: author)

Since prevailing models or frameworks neither incorporate multidisciplinary approach (demanded by socio-ecological systems resilience concept), nor represent project scale from a long-term perspective, a novel framework for ODHR has been proposed (figure 11).

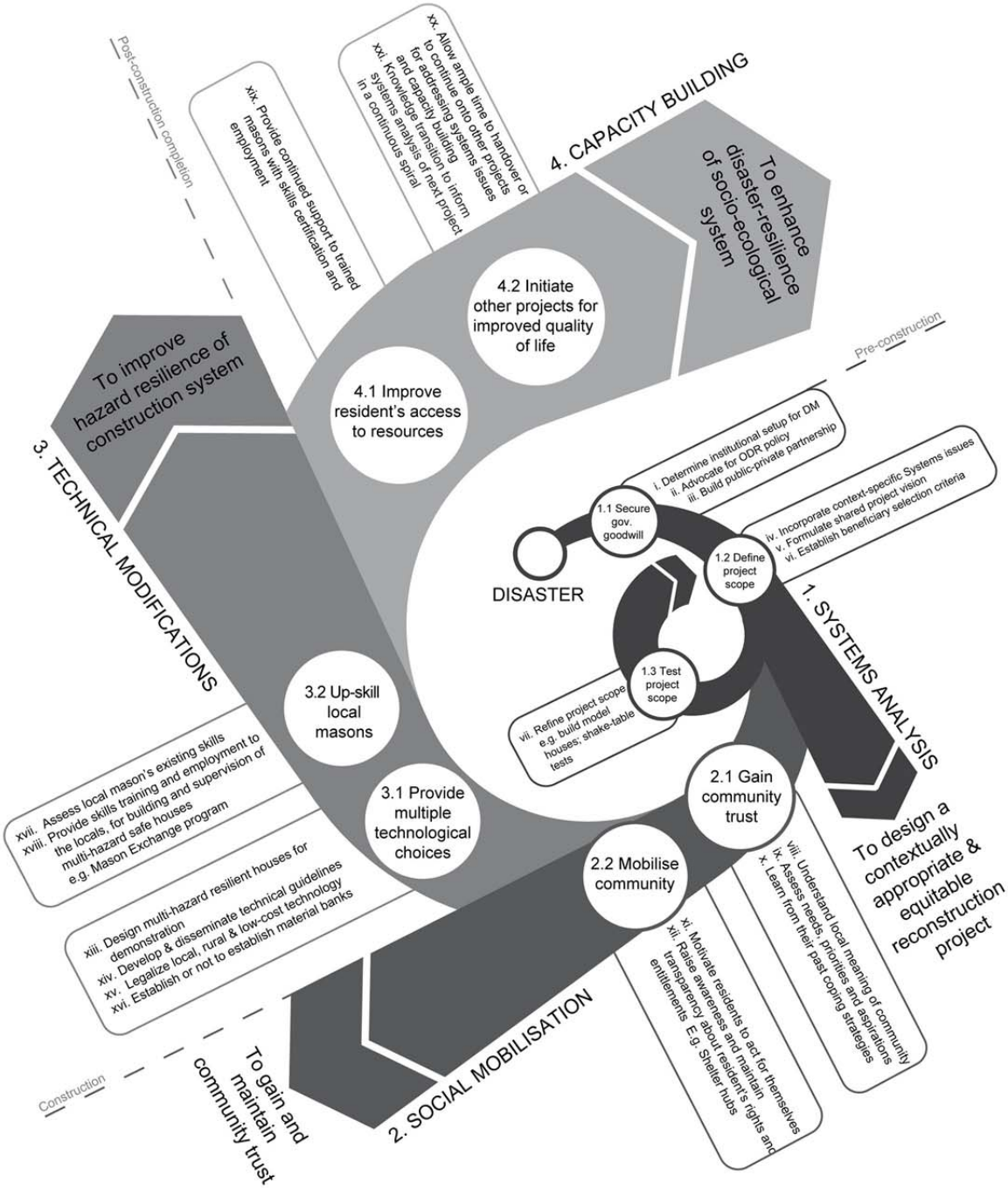

Figure 11: A novel framework for ODHR projects to enhance disaster resilience of communities in the long-term (source: author)

7. CONCLUSIONS

This pupose of this empirical paper was to assimilate findings – contingent and generalizable – from long term investigation of good practice ODHR projects which influenced project's strategic success at enhancing disaster resilience of communities, into one framework. The research was imperative in context of increasing disaster risk, and to inform practitioners and further scientific knowledge in the field of risk reduction and resilience, where lessons from the past have often been narrowly documented and long-term project outcomes have largely remained unexamined. Comparative case study investigations were conducted for four ODHR projects in India's Gujarat and Bihar states. The findings confirm that the civil society organisations (CSOs) and the state acted as 'enablers' at four stages: 1) envisioning strategically based on systemic understanding 2) building soft assets including community trust and capabilities for social mobilization, 3) proposing minor modifications to the conventional construction technology for its multi-hazard safety as well as cultural relevance, and 4) sustaining capacity building efforts beyond reconstruction completion or beyond one project life cycle. These findings were assimilated in a novel ODHR framework and illustrated in spiral form for use by practitioners, globally. The most significant finding that further current scholarship on OHDR and resilience is a need for enhancing people's capabilities – their freedom to choose – to maintain their own disaster resilience. The research concludes that only a systems based, flexible, patient/dignified and capabilities-based ODHR process can have better long-term outcomes in terms of enhanced disaster resilience of communities.

8. RECOMMENDATIONS

The framework discussed in this paper is built on and refined from an earlier publication (Vahanvati & Mulligan 2017). While the four components are illustrated seperately in the ODHR framework, they need to be viewed as interconnected or working in tandem, as they would in practice. The framework has been illustrated in spiral as well as tabular forms (table 5). Having said that, the author of this paper cautions that the spiral framework needs further development to make it flexibility and customisable to suit the specifics of a particular context.

Table 5: A novel framework (in table format) for ODHR projects to enhance disaster resilience of communities in the long-term (source: author)

PROJECT COMPONENT	PROJECT COMPONENT GOAL (IMPACT)	VALUE DELIVERABLES	ACTIVITIES (INPUTS) BASED ON BEST-PRACTICE CASE-STUDIES & THE KNOWLEDGE GAINED BY TWO INDIAN AGENCIES OVER SEVEN YEARS
1. SYSTEMS DESIGN	To design a contextually appropriate & equitable reconstruction project/ program of projects for reconstruction to have impact beyond robust housing	1.1 Secure government goodwill	i. Determine institutional setup for Disaster Management & governance ii. Advocate for ODR policy where possible iii. Build public-private partnership
		1.2 Define project scope	iv. Incorporate context-specific socio-ecological systems issues (risks and capacities) v. Formulate shared project vision vi. Establish beneficiary selection criteria
		1.3 Test project scope	vii. Refine project scope, technological modifications, financial package and facilitation mode e.g. build model houses; shake-table tests
2. SOCIAL MOBILISATION	To gain and maintain community trust for equitability and enhanced ownership – a foundation for ODHR	2.1 Gain community trust for effective engagement	viii. Understand local meaning of community ix. Assess community needs, priorities and aspirations for housing and settlement x. Learn from communities past coping strategies
		2.2 Mobilise community	xi. Motivate residents to act for themselves and make informed decisions to build back better xii. Raise awareness amnd maintain transparency about resident's rights and entitlements
3. TECHNICAL MODIFICATION	To improve multi-hazard resilience of construction system for ensuring pertinence, effectiveness and quality of construction in rebuilt houses	3.1 Provide multiple technological choices	xiii. Design multi-hazard resilient housing for demonstration xiv. Develop and disseminate technical guidelines in locally appropriate manner xv. Legalize local, rural and low-cost technology xvi. Establish or not to establish material banks
		3.2 Up-skill local artisans to rebuilt robust houses	xvii. Assess local mason's existing skills xviii. Provide skills training and employment to locals (masons, labourers, engineers) for building and supervision
4. CAPACITY BUILDING	To enhance disaster resilience of system for sustaining robustness, redundancy, rapidity resourcefulness and adaptive capacities	4.1 Improve residents' access to resources	xix. Provide continued support to trained masons after completion of reconstruction e.g. skills certification and employment
		4.2 Initiate other projects for improved quality of life	xx. Allow ample time to hand-over (to local partner or government); or to continue onto other projects for addressing systems issues and capacity building xxi. Knowledge transition to inform systems analysis of next project in a continuous spiral

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APPENDIX B

B.1. EVIDENCE OF PEER-REVIEW PROCESS FOR EACH PUBLICATION

B.1.1 Publication-1

Reviewer: 1
Comments:
A very well written account of the study. The article can be accepted without further revisions.

Additional Questions:
1. Originality: Does the paper contain new and significant information adequate to justify publication?: This is an account of a study into key or critical processes during an owner-driven reconstruction process. The originality emerges from the empirical data collected from villages in India, and discussion of their implications on long-term disaster resilience within a community. While the owner driven reconstruction has been the subject of many studies in recent years, the findings and discussion are sufficiently insightful to make a useful contribution to the knowledgebase and will be of interest to the journal readership.

2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: A reasonable review of the literature is provided, which covers both the grey and scientific literature. While there are many significant works in this area, the limited word count would make it unrealistic to be exhaustive. As such, the coverage is adequate. The review also covers some background to the Indian situation, which provides useful context for the study.

3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: The methodology is appropriately described and justified. The detailed data collection and analysis techniques are also suitably documented. Overall this section provides confidence that the study has been well designed.

4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: The results are presented under a small number of themes and sub themes. It is well structured and appropriate direct reference is made to individual respondents. A concluding discussion addresses the original aim of the study and provides appropriate insights that are drawn from the empirical results.

5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: The study could be replicated in other contexts which would increase the generalisability of the findings. However, this study alone can also contribute to informing future practice in ODR schemes.

6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: The article is very well written, appropriately technical but also accessible.

Reviewer: 2

Recommendation: Accept
Comments:
The authors have directly addressed the manuscript formatting guidelines for IJDRBE. As a selected paper from the BR conference series, the article will make a useful contribution to the journal.

Additional Questions:
1. Originality: Does the paper contain new and significant information adequate to justify publication?: The paper has been selected from the ICBR submission, emphasising its contribution to the field.

2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: The literature review is brief but sufficient to provide an adequate base for the study. There is a lot of material available in this area but some key studies / reports have been cited.

3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: The methodology is rigorous and well described.

4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: The results are well structured and appropriately detailed, with direct links to specific respondents. The conclusion adequately brings together other aspects of the paper and addresses the original aim of the paper.

5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: The study contributes to the broader work on ODR and can also inform future practice, although further studies would be required to provide greater confidence.

6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: Well written and in accordance with the journal requirements.

B.1.2 Publication-2

First Review Process

Date: 01 Jul 2016
Subject: Decision on your submission JPMAD1600282

Reviewer #1: This is an interesting paper, but the presentation and organisation of the article is rather disappointing. The article could've had the potential to offer some theoretical and practical implications for project management profession. The current state of the paper, however, as it stands, fails to meet the required standards of the special issue.

The abstract is poorly written, 'to conceive project 'handover'…, at leaving a legacy of disaster resilience' what does this mean? This sentence does not make any sense. Also in the Abstract, it was claimed that the paper argues some limitations in applying the closedloop project life cycle approach to postdisaster Housing reconstruction projects. But in reality, the article only briefly touched on the limitations in using closedloop project life cycle approach, no detailed arguments have ever been made in the literature.
The entire article is not well written, with many grammatical and punctuation errors, 'a' or 'the' are missing in many places.

At the start of the introduction, there are multiple concepts mentioned resilience, vulnerabilities and build back better. What is the purpose of citing different paradigms without explaining properly the relationships of these concepts?

Figure 2 is of low resolution, also it seems it was cut and copy and paste directly into the paper. Event with the source referenced, there is a concern that authors may have breached the copy right by directly copy and paste the published work without third party permission.

What is the purpose of Table 1 which includes quite a significant amount of information, but little was mentioned in the text?

On page 6, two research questions mentioned, however, it was surprisingly not aligned with the title of this article. By reading the title and abstract, it seems that the paper's focus was on proposing a new life cycle model to addressing issues in housing reconstruction projects. However, the two research questions were only concerned about

disaster resilience the role of project management/reconstruction projects in ensuring disaster resilience. Also the rest of the paper seemed to also have had way too much emphasis on resilience, other than project management itself. By keeping reading, it looks like authors tried to include multiple strands 1) project life cycle, 2) disaster reconstruction as a whole and 3) resilience in one single paper, and also have not done well by pulling them together. There are too many different focuses in one paper, which makes it difficult to understand the key messages the paper tries to deliver.

Section 3.3, page 17, triangulation is needed. It is commonly understood as a method of combining both qualitative and quantitative methods. There is no such quantitative data in the paper, how can it be triangulation? Also can authors justify the sample of interviews, why only households, aid agency representatives and beneficiaries? What is the difference between household and beneficiaries? Are they not the same people? Why other types of stakeholders such as local govt were excluded from the sample?
Where is Table 4 analytical framework from? If you have an analytical framework, it should be based on the literature review. However there is no such information in your literature review.

If the section 4 is the case study results section, what does section 5 do? Where do the three themes 5.1, 5.2 and 5.3 come from? Are these the comparative analysis results? It is very confusing.

Also the final conclusion part is way too brief. The paper failed to close the loop. If the article is about PM life cycle approach to housing reconstruction projects, the literature review should only focus on PM life cycle approach and housing reconstruction projects, and conclude the research gap. The results of case study should also only focus on life cycle of the case studies. By analysing the case studies commonalities and differences in terms of good practice then propose the new model that can achieve better/improved outcomes (time, cost and quality, etc) for housing reconstruction projects. If authors can follow this logic and always keep it focused, the article can offer some value to the special issue. But currently, too much nonrelevant information such as Indian policy in disaster management and its evolution, etc. and literature in disaster resilience and reconstruction fill in the paper, made it less relevant to the special issue and lack of focus is a critical issue of this article.

Reviewer #2: This paper is evidently based on an indepth knowledge of postdisaster housing reconstruction projects in India, and it appears to draw on a rich set of data on the case studies used. Nonetheless the following should be taken on board in order to address the quality and value of the work:

- The paper would benefit from more literature based evidence and supporting references in places where specific claims are made. In particular there is a reference to what "many researchers" have noted in relation to 'build back better' these should be identified; other examples include claims that PDHRR is seen as preferred by donors and that there are weaknesses in 'one size fits all' PM approach and/or PDHRR in relation to the social, cultural & political context.
- there is a wide range of literature on postdisaster housing reconstruction that has not been referenced. People like Cassidy Johnson have written a lot on it; Ophiyandri et al (2013) look at CSFs for community based PDHR in Indonesia and addresses some governance issues; etc. The paper should position the research in relation to this breadth of work that exists. The contexts for much of this work is different but a lot of literature acknowledges PDHR as a social and political process. There are also PM perspectives like Ismail et al (2014).
- The supporting evidence for Table 2 (commonalities in core processes of PM and PDRR projects) is weak just 2 sources cited and one of them isn't even in the References. This is a weakness in the paper as the 4 phases provide the framework for analysis. Table also looks incomplete.

- The structure of the paper, in terms of the overview of the phases, is a little confusing. Phases I and II are presented before the methodology/case study selection is described; while the research is focusing on phases III and IV, taking a project perspective means that the entire lifecycle should be presented for each case study, and not done in part before the case studies are described. Having said that, if the content of Section 2 is presented as an outline of the policies and practices that informed PDHRR in the regions then it is ok to structure the paper as it is.
- The reader needs to know more about the analytical framework used to help direct the research, and how it was developed. As it stands there is no rationale given for the four themes (text refers in one place to three themes) or for the key questions presented for phases 3 and 4.
- There seems to be no differentiating factors between case studies 3 and 4. Justify and clarify why both are included.
- The conclusions drawn in section 5 are unconvincing, particularly in relation to the need to shift to an agile approach to PDHRR projects. An agile project approach is incremental, iterative, and works on requirements in priority order to deliver the highest value features as early as possible. There is little in the evidence presented, or indeed the in conceptualised spiral model, to support this approach. In general, agile is seen as more applicable to the execution portion of a construction project; if you are going to propose agile for PDHRR projects you need to do more assessment of what this means.
- The graphical abstract indicates that the paper is about effective project handover, long term impact (in terms of disaster resilience) and a project management approach that supports these. However there are gaps in the logical progression from the case studies to the conceptualised spiral model; while the model looks interesting and of value it is not clear that it emerges from lessons learned on the 4 case studies.
- There are a number of typographical errors which should be fixed (eg: "because it assumed")
- On Case study2 in 4.2 it says "Hence, there was handover by SEEDS ...". Should it not be "Hence, there was no handover by SEEDS ..."??
- Check table numbering and referencing ... there's an incorrect reference to table 2 in the text figure 6 is unclear did you add the "missing link"?
- There are a lot of acronyms used (some like CSO not defined on first usage in Table 1, but defined twice afterwards), and while there is a list of abbreviations at the end this is incomplete. Need complete list, ideally at start.

Second Review Process

22 Nov 2016
Subject: Decision on your submission JPMAD1600282R1

Reviewer #2: The structure and organisation of the paper is improved significantly. However there is still some work to be done on the aim and objectives. After outlining inadequacies of the traditional project management lifecycle approaches, you aim to build in a "much wider array of success factors" for PDR projects. You say later on that there has been limited research on the longterm effectiveness of PDR projects in relation to the disaster resilience of the communities concerned. This would suggest that the first step should be to gain a better understanding of their effectiveness, and to identify the success factors (in order to achieve the systemic change you refer to). Consider if and how your paper can contribute to achieving this.

You also say that the paper build a new model of PDR project management. And in the conclusion you say that the aim was to identify a new project management lifecycle approach for planning and implementing PDR projects. This was achieved, but the approach (figure 5) looks more like a staged approach than an incremental or agile one. It shows (a) systems analysis, followed by (b)m social process, (c) technical process and (b) continued capacity building. The case studies indicate that there was collaboration, and

residents were involved in the designing, procuring of material and building of their own housing. However there is insufficient evidence to support the recommendation of an incremental/agile/active approach for addressing systemic issues at the planning stage of PDR projects. And there is also insufficient indication of how the approach can be considered agile.

On the methodology, you say that data collection primarily relied on the social research methods of semistructured interviews and focus group discussions. However the only referne to interviewees is in the first of the case studies. It would appear that no interviews were done for the other three.

Finally the tone and style of the abstract can be improved for example the first sentence, and describing the case studies as emergent. Also saying that you've organised your findings graphically gives a different impression to the reader than saying you are proposing a new project management approach. Remember the abstract needs to 'sell' the paper; to convince the reader that there is something interesting and novel in it.

B.1.3 Publication-3

Editor 1: S.B

Dear Mittul Vahanvati This is a most interesting chapter allowing comparison regarding approaches. I was not aware of the moves towards bottom up approaches in India and you have well-articulated this. I also find the study 15 years later and lasting impacts or otherwise very informative.
I am not an academic reader - and I feel many of our audience may be operational and so my thoughts are around making this an easier read. Some sentences are quite long - 30 words plus, and the many academic references clutter the text.
In the case studies I found myself going backwards and forwards trying to understand what happened at each location. I wonder if it might be possible to split the locations and discuss each one in a consistent thematic flow.
I also see that you need to lose about 1000 words and so this may present an opportunity to simplify and streamline.
Using a few more bullet points rather than itemised points within a sentence might also assist.
All in all it's not only a strong chapter but a reflection on your depth of research and understanding.

Editor 2: G.M

This is generally a well written chapter making important points; however I agree with Steve that it would be even better and more succinct if it is reduced in the way he suggests.

B.1.4 Publication-4

9-Apr-2018

Dear Mrs. Vahanvati,

Manuscript ID DPM-11-2017-0285.R1 entitled "A novel framework for owner driven reconstruction projects to enhance **disaster** resilience in the long term" which you submitted

to **Disaster Prevention** and Management, has been reviewed. The comments of the reviewers are included at the bottom of this letter.

The reviewers have recommended some revisions for your manuscript to be considered for publication. Therefore, I invite you to respond to the reviewers' comments and revise your manuscript. Note that we do not necessarily require that you do additional fieldwork but please make sure that your revised manuscript stay within 7000 words.

Reviewers' Comments to Author:

Reviewer: 1

Comments:
The efforts made since the previous version paid off (clearer structure, presentation of the case studies, some bibliographical references and more) but it is still not a scientific article strictly speaking.

Additional Questions:
1. Originality: Does the paper contain new and significant information adequate to justify publication?: As was said during the first review, the subject of the article is original and very interesting, in connection with the fact that the post-**disaster** period being treated less than those of **prevention** or that of crisis management for example.

2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: The literature is studied more than in the first version of the article, but it remains too incomplete. References to the works of Davis, Oliver, Alexander, Quarantelli, Aysan, Gaillard, on the post-**disaster**, or those of Wisner, Cannon, Blaikie on the question of the root causes of vulnerability of societies is absent whereas they are key references. In general, the reader still can not locate the field in which this study is written (geography, sociology, etc.). Regarding the work done to clarify the definitions of resilience, the effort is important, however, the most recent reference dates from 2013 ... Some texts / writers seem poorly understood: the framework of action of Hyogo and Sendai do not speak not implicitly in **disaster** resilience, they impose it as an injunction (by the way, the build back better principle is evoked but never defined, as well as system analysis). This work seems to fit into the field of action research, yet completely absent in the references used. The classification of bibliographic sources in parentheses in the text must be from the most recent reference to the oldest. In general, the bibliography is still too incomplete and is poorly cited. For example, when you say in the introduction that there is not much work on reconstruction but there is a lot of work on resilience: prove it, cite

sources and not just one. This conceptual weakness is felt very strongly in clumsy attempts to rise in generality. It is true that the field of the post-**disaster** is less studied than others but it has been the subject of several works since the 70s: there is material on which you support to enrich your analyzes and sit conceptually your results.

3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: The methodology is described more precisely than in the previous version. The presentation of the case studies is much better achieved than in the previous version and in general the article is better constructed and responds more formally to what is expected of a scientific publication. However, several elements are problematic. In addition to the fact that the map on the left still does not include either north or scale, there is a lack of detail in many places in the text. You say that OHDR absorbed many field of study, specify which, give some names of authors who have worked on the question, explain why OHDR groups all these fields ... In the "research design" you talk a lot about system and functioning systemic, that you never define or quote the leading authors in this area. You talk about the specifics of post-**disaster** but you do not detail them or compare them to other periods to clearly explain the differences (these questions have also been the subject of scientific and operational publications). In general, you advance many elements presented as truths without questioning or justifying them by studies of other people or by the results of your own investigations (see review on results).
In addition to the fact that little work has been done on OHDR, no other justification is offered on the interest of this work. Some elements also need to be clarified: what is the difference between the different castes, what does it imply for the reconstruction, how do the investigators have positioned themselves in relation to these castes (besides you never formulate reflexive feedback on your method or the limits it contains), why are you talking about it and what does it bring to your analysis? ... In general, the work presented seems to be a good fieldwork (although there is very little evidence to judge) in a relatively undeveloped territory and with an interesting approach, but the restitution presented here looks more like a mission report or possibly a synthesis of reconstruction project evaluation only to scientific research that meets standards, particularly with regard to the construction of sound scientific reasoning.

4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: The case of a reconstruction partially financed by the State and partly by the relocated populations exists elsewhere in the world, and an abundant gray and scientific literature exists in particular on the case of Indonesia, Nepal, Bangladesh, Haiti ... All this literature is ignored by this article and thus loses in quality. You say that the financing of this type of project is problematic (which is right) but you never say what problems, did other territories meet them

too, how do you get out of it, why did you have these problems, etc. In a scientific work (unlike an operational work), you can not stop there, you must detail, justify, compare with other works of authors, other cases to support your reasoning, prove that your analysis is good since it is found in other territories, situations ... especially as you claim to offer a universal framework, you can not ignore the international openness and implementation look at other case studies. You say on page 28 that access to water and toilets is a challenge, you also say that many people have diversified their livelihoods, why do not you justify this with the results of your surveys (that we does not see anywhere ...)? You speak in the introduction and in the methods of people surveyed but no figures can illustrate your words: concretely we never see the result of the field work.

5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: The interest of this work is much more marked for the stakeholders and practitioners than for the scientific world. Given the lack of bibliographic work and the poor results presented (no doubt about the fact that you have made the field, but we never see your statistics and there is only one interview verbatim. ..) and the lack of discussion (including criticism) of your methods and results, considering also the lack of scientific rigor in the presentation of the results and in the preparatory work (lack of bibliography especially and of precisions and justifications), this article does not answer to what is expected (in the background) of a scientific publication. For example, page 26, part 3.4.2 you talk about robust and transparent social mobilization: what does it mean, compared to what, why is it transparent and robust and what does it bring in positive / negative for OHDR? This finding is supported by your own comments throughout Part 5 and 7 which speak only of interest to stakeholder but never to the scientific community: "The findings were assimilated in a novel ODHR framework and illustrated in spiral form for use by practitioners, globally "... This approach can be similar to action research but you never mention it, so this paper is more of a kind of synthesis of evaluation of a specific reconstruction program, by a particular method rather than a scientific article.

6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: The syntactic style is a little heavy and does not correspond to the scientific standards: "please note", "go see this author" ... this is a more journalistic than scientific style. On the other hand, there are other elements that are problematic from the point of view of scientific rigor, especially on page 22 you speak of Muslims who are the descendants of the Sindh royal family: it is necessary to specify, explain,

historically, ethnologically, anthropologically and above all link this to your topic, that we understand what the implications are for OHDR. Regarding the form, the acronyms must ALL be defined at the FIRST occurrence! The titles are still not problematized ...

Reviewer: 2

Comments:
The paper has improved in structure and style. The author took into consideration the specific comments. However, the need to expand fieldwork findings to balance more reliance on secondary data and academic arguements is not addressed. Fundamentally it is the same paper. I do not think more comments will achieve a different balance. It is possible that the author does not have eough field experience to make more of the fieldwork.

The two paragraphs that are in italics that start by stating "the case studies demonstrate that the following strategies worked..." then lists the strategies while relevant and also a part of the author's graphical framework they are not adequately examplified in the case studies. In this sense still not so clear how the step by step framework links with the case studies.

My feeling at this stage is that t author tried his/her best to imrpove the paper. Further comments will not achieve a significant change. The paper does not throw much new evidence on the case studies but it is written in an acceptable standard, except for the conclusions and recommendations that are weak. If there are no other papers on the subject you may want to consider publishing it so as to have something on the topic.

p.s. some paras lie the one on Bihar' history starting from colonialism are uncessary. One line on powery etc would suffice. I guess there can be deleted in editing the paper.

Additional Questions:
1. Originality: Does the paper contain new and significant information adequate to justify publication?: See above

2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: See above

3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well

designed? Are the methods employed appropriate?: See above

4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: See above

5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: See above

6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: See above

DEADLINE: 09-Jun-2018