Developing Design Options for Housing in Disaster-prone Areas of Central Vietnam

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

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DECLARATION

I certify that, except where due acknowledgement has been made, the work is that of the researcher 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; and, any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Signed

Tran Tuan Anh
10 May 2017
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<tbody>
<tr>
<td>ADPC</td>
<td>Asian Disaster Preparedness Center</td>
</tr>
<tr>
<td>BEPs</td>
<td>Built-Environment Professionals</td>
</tr>
<tr>
<td>CBO</td>
<td>Community-Based Organisation</td>
</tr>
<tr>
<td>CCA</td>
<td>Climate Change Adaptation</td>
</tr>
<tr>
<td>CCFSC</td>
<td>Central Committee for Flood and Storm Control</td>
</tr>
<tr>
<td>CFSC</td>
<td>Committee for Flood and Storm Control</td>
</tr>
<tr>
<td>DRH</td>
<td>Disaster Resilient Housing</td>
</tr>
<tr>
<td>CRRD</td>
<td>Center for Social Research and Development</td>
</tr>
<tr>
<td>DRR</td>
<td>Disaster Risk Reduction</td>
</tr>
<tr>
<td>DWF</td>
<td>Development Workshop France</td>
</tr>
<tr>
<td>EM-DAT</td>
<td>The International Disaster Database</td>
</tr>
<tr>
<td>ESCAP</td>
<td>The Economic and Social Commission for Asia and the Pacific</td>
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<tr>
<td>FGD</td>
<td>Focus Group Discussion</td>
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<tr>
<td>GSO</td>
<td>General Statistic Office</td>
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<tr>
<td>HFH</td>
<td>Habitat for Humanity</td>
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<tr>
<td>HHB</td>
<td>Hoa Hiep Bac Ward (one of the case-study sites of this research)</td>
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<tr>
<td>HI</td>
<td>Household Interview</td>
</tr>
<tr>
<td>IAB</td>
<td>Ia Broai Commune (one of the case-study sites of this research)</td>
</tr>
<tr>
<td>IFRC</td>
<td>International Federation of Red Cross and Red Crescent Societies</td>
</tr>
<tr>
<td>ISET</td>
<td>Institute of Social and Environmental Transition</td>
</tr>
<tr>
<td>KII</td>
<td>Key Informant Interview</td>
</tr>
<tr>
<td>LT</td>
<td>Loc Tri Commune (one of the case-study sites of this research)</td>
</tr>
<tr>
<td>MONRE</td>
<td>Ministry of Natural Resource and Environment</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
</tr>
<tr>
<td>PDHR</td>
<td>Post-Disaster Housing Reconstruction</td>
</tr>
<tr>
<td>SC</td>
<td>Save The Children</td>
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<tr>
<td>SKAT</td>
<td>Swiss Resource Centre and Consultancies for Development</td>
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<tr>
<td>TN</td>
<td>Tan Ninh Commune (one of the case-study sites of this research)</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Program</td>
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<td>UNISDR</td>
<td>The United Nations Office for Disaster Risk Reduction</td>
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<td>United Nations Framework Convention on Climate Change</td>
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<td>UNDP</td>
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Abstract

Building community resilience against climate hazards is one of the most important goals for socio-economic development in Central Vietnam, due to the high exposure of this region to climate change and the increasingly unpredictable occurrence of the future climate. Housing is one of the key sectors in community development planning and also in building resilience of provinces and cities in this region. However, how to enable and develop disaster-resilient housing is still problematic, and becomes a real challenge to governments, housing providers, donors, planners, implementers, and local actors. Within this sense, the present study is an effort to bridge this gap through providing a comprehensive analysis of design-related issues in developing disaster-resilient housing and identifying practical ways of achieving resilient housing outcomes in the context of Central Vietnam.

Floods and storms are considered to be the biggest natural hazards to local housing in this region. Post-disaster houses provided by stakeholders show a strong link to the resilience of the involved households and communities. Housing reconstruction not only helps rebuild damaged or destroyed houses but also opens up opportunities for gaining long-term stability and development of the community involved. The present study examines three key themes of post-disaster housing reconstruction, primarily identified from the literature review: (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience; in order to seek core issues for building a resilient housing system in Central Vietnam.

Since this study adopted a qualitative research, the interpretive model was applied to investigate the research problems above. This study used the Case Study method, a common way for carrying out qualitative research, to guide the research process. Four disaster-affected communities in four vulnerable provinces of Central Vietnam were selected as the case studies. These communities comprise Hoa Hiep Bac, Loc Tri, Ia Broai and Tan Ninh, where housing of local people, especially those on a low income, is seriously affected by annual storms and floods. The comparison between these case studies and the three key themes above (i, ii and iii) enables the identification of the core issues associated with
housing resilience enhancement, and of how to achieve this through housing design-related solutions.

In terms of the first theme, community consultation, the study found two appropriate forms of consultation, community meetings and separate household interviews, for information and knowledge sharing at the local grassroots level to bring disaster-resilient housing outcomes. Vulnerable households, local construction workers, built-environment professionals and local committees for flood and storm control are found to be the key actors in this consultation process, whose contributions and inputs are useful for the desired outcome of disaster-resilient housing. In addition, the study indicates the necessity of incorporating the process in three supportive mechanisms - technical, financial and legal - to enable effective communication and consultation between vulnerable groups and technical parties (e.g. local architecture offices, local construction firms) for safe and resilient housing development.

In relation to the second theme, the role of built-environment professionals (BEPs), the study identifies three core issues associated with the involvement of BEPs. These are (1) the economic constraints of vulnerable households, (2) limited understanding of local actors on safe housing, and (3) lack of incentive schemes to sustain innovative or resilient ideas, as the three major obstacles to the involvement of BEPs. The study also shows a potential role of architects in developing disaster-resilient housing and delivering resilient housing design options for the low-income population in Central Vietnam.

Regarding the third theme, design principles for resilience, the study found that safety-related considerations need to go along with the cost efficiency and cultural appropriateness of disaster-resilient housing. This demand needs to be addressed in the design process of residential housing. To provide affordable houses for vulnerable households, who usually belong to the low-income group, the study emphasises the necessity of identifying an acceptable level of safety for the designed house(s), to maximize the use of local resources in construction, and to ensure cost efficiency of future housing extensions or renovations. In addition, the spatial design of the house needs to address the cultural and social characteristics of the occupants or householders to ensure their satisfaction and adoption.
Based on the findings within each of the three themes above, this study develops a framework for disaster-resilient low-income housing within the context of Central Vietnam. This framework is a useful, practical reference guide for architects and building designers responsible for or involved in the design and construction of disaster-resilient housing in this region. This study also generates some important policy implications for low-income housing development in Central Vietnam, such as: (1) applying building permits or similar forms of permission to control unsafe construction practices in vulnerable areas; (2) improving consultative/communicative mechanisms for better information exchange and knowledge sharing between stakeholders at multiple levels; and (3) intensifying bottom-up approaches alongside the top-down ones to fully capture the local situations, community feedback, and local needs and capacities.
Personal Preface

This research was initially generated from the personal background in architecture and the working experience of the researcher in the field of post-disaster housing reconstruction. His background as a Vietnamese architect and his practical experiences as the designer of more than 200 post-disaster houses in Central Vietnam helped establish the key assumption of this research, that the design of post-disaster housing has a high potential to bring long-term disaster resilience for local communities living in hazard-prone areas. As disaster is also the result of defects and restrictions in human settings and interventions (e.g. improper settlement patterns or unsafe construction practices), post-disaster housing reconstruction helps to improve such pre-disaster fragilities and sustain the development of at-risk or vulnerable communities, as concisely stated by Archer and Boonyabancha (2011):

Disasters always bring tragedy, but they also open up an opportunity for change in the affected communities.

Based on what was observed in the practical situation of local housing in Central Vietnam and what was experienced through the researcher’s engagement in practical design and construction practices of safe housing, the issue of disaster resilience rather than disaster resistance has emerged as the overall target of post-disaster housing reconstruction efforts. This perception is particularly meaningful to the current and future times, where climate change is contributing to the unpredictable or unprecedented occurrence of natural disasters (UNISDR, 2008). Within this sense, there is a demand for post-disaster housing reconstruction to improve and build responsive and adaptive capacities of local housing and settlements in anticipation of future disasters, rather than focusing on building preventive and resistant capabilities.

In mid-2010, the researcher joined the non-governmental organization (NGO), Development Workshop France (DWF) in Central Vietnam, in the role of architect for one post-disaster housing reconstruction project funded by the International Federation of Red Cross and Red Crescent Societies (IFRC) after Typhoon Ketsana in 2009. The main task of the researcher at that time was to propose design solutions for 200 safe houses for two provinces in this region, Kon
Tum and Gia Lai. Design approaches applied were mainly adopted from the DWF’s work plan, which involved several site visits, and talks and meetings with local communities and authorities to understand local needs and capacities before finalizing housing designs and initiating construction activities. Six housing design options were then proposed based on the series of field visits and local discussions, and the construction of 200 houses was completed by the expected time.

In addition, the work at DWF also gave the researcher a good opportunity to visit post-disaster houses provided by other agencies in Central Vietnam, such as those provided by local enterprises in the Gia Lai and Kon Tum Provinces. In most cases, those houses (built by other agencies or donors) were not used as the main house for living, whereas the old houses nearby were fully occupied even if in unsafe conditions. Through local talks and on-site observations of how people used their houses, the researcher found out that there was a significant gap between perceptions of the outsiders (donors, agencies, implementers) on post-disaster housing and the actual needs and expectations of local people towards their homes. Physical improvements for safety purposes to build stronger houses seemed to be preferred by the outsiders when providing post-disaster houses, while socio-economic and cultural responsiveness to local contexts were less considered or even neglected.

In late 2012, the researcher was involved in another safe housing project, funded by the Rockefeller Foundation, in Central Vietnam. This project included two main parts: financial assistance through a conditional micro-credit program; and technical support for storm risk reduction. The researcher and his team were responsible for providing technical support, for which they organized a resilient housing design competition in early 2013. This competition was launched to capture current perceptions, experiences, and suggestions of local architects and engineers towards climate-resilient housing under the urbanized contexts of Central Vietnam. This competition was completed in May 2013 and the first prize was given to the design team that had addressed a harmonious combination of local and innovative (new) knowledge in their design solutions. As said by the first-prize winner:
Before, we thought we needed to do something innovative for this competition. However, after our site visits, we decided to develop what local people are currently doing because their experiences seem to be adequate for disaster reduction and their economic constraints may undermine innovative ideas. Our work was to slightly modify local techniques with the support of some new construction elements to maintain the building safety. (Thang et al., 2013)

The above statement of the 1st prize-winning architect depicts the real housing situation in Central Vietnam, where local experiences are still valuable but inadequate for building long-term resilience to future disasters. The design competition provided the researcher with a clearer vision of housing vulnerability and underlying driving forces within the context of Central Vietnam, and a better understanding of the role of improved design solutions in achieving resilience performance. The outcome of this design competition also showed that current understandings of local architects on disaster resilience remain limited, since they have often viewed resilience as ‘safer’ or ‘stronger’. This may explain the lack of success of some recent housing reconstruction projects where technical issues were more focused on than were social and institutional issues. It also showed the necessity to conduct the present research, to find out what disaster-resilient housing actually means within the context of Central Vietnam and how to achieve this in practice.
Chapter 1: Introduction

1.1 Introduction

Housing and climate change have a close link in Central Vietnam, the most hazard-prone region of the country. In this region, housing is considered as the most valuable but also the most vulnerable asset for residents. It is among the sectors that show the highest exposure to climate risks (MONRE, 2008). Recent debates and discussions (Johnson & Lizarralde, 2012; Barenstein, 2012; Wardak et al., 2013) have raised concern about the influence of post-disaster housing for the long-term resilience of local communities. In the design of residential housing, particularly low-income housing, there remains a large distance between vulnerable households and built-environment professionals (e.g. architects, engineers), as well as an absence of technical instructions understandable and usable for local actors (i.e. local builders, household families). Therefore, the present research aims to investigate the causes and drivers of this problem, and how to tackle it through housing design-related solutions.

As climate change is an ongoing process associated with the increasingly unpredictable occurrence of climate events, withstanding ongoing disturbances has more implications than just recovering from individual events (Morecroft et al., 2012). In this sense, post-disaster housing provides one of the best opportunities to improve pre-disaster fragile conditions and achieve long-term community resilience, rather than just rebuilding the destroyed or damaged parts (Archer & Boonyabancha, 2011; Schilderman & Lyons, 2010). In the flood- and storm-affected areas of Central Vietnam, the limitations of local construction practices, local stakeholders’ awareness and capacity, and the economic and social constraints of at-risk households, have hindered efforts at building a resilient housing system. The literature review and the fieldwork findings presented in Chapters 2, 4, 5, 6 and 7 in this study indicate that the limited communication and consultation between local and external actors, the lack of technical input from built-environment professionals in developing housing designs, and the absence of resilient housing designs for low-income people, act as the key drivers of such problems. The study identifies three major aspects related to the development of disaster-resilient housing, namely (i) Community Consultation, (ii) The Role of
Built-Environment Professionals, and (iii) Design Principles for Resilience. This research, therefore, examines and analyses the actual situation of low-income housing in Central Vietnam, drivers of housing vulnerability, and how to shape resilient housing alternatives or designs based on examining these three aspects.

As widely realized by researchers and practitioners, economic constraints have a close relation to housing vulnerability (Wisner et al., 2004; DWF, 2010; Phong et al., 2013). Financial difficulties are often the major obstacles to low-income households in selecting safer residential plots, employing professional design services, and using higher-quality materials for their houses. In Central Vietnam, low-income groups frequently live in hazard-prone areas (i.e. flood- and storm-affected locations) and construct their houses on their own without technical assistance from professional designers (e.g. architects, engineers) for DRR. These groups are among the most vulnerable populations, whose houses are seriously affected by annual windstorms. Recent typhoons such as Xangsane in 2006, Ketsana in 2009 or Nari in 2013, have resulted in huge damage to low-income housing in this region. This research, therefore, focuses on the low-income population, namely the poor and near-poor, to examine their housing situation, its vulnerable conditions and the underlying drivers of vulnerability, and the opportunities to build disaster-resilient housing.

In Central Vietnam, low-income families usually spend a considerable amount of their income on annual housing repair or reconstruction after annual typhoons. Sometimes, they fall into debt after disasters because they borrow too much money from others (commonly friends, relatives or neighbours). Without technical guidance, they often follow previous but frequently unsafe practices, and unknowingly, produce new risks to future storms. This is the main barrier for poor and near poor households to escaping from the poverty cycle and reaching a more stable life.

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1 Low-income as addressed in this research refers to poor and near poor households ranked by the national poverty line, applied for 2011-2015, under the Decision No. 09/2011/QĐ-TTg of the Prime Minister, namely:

- Rural poor = 400,000 VND (= 19 USD) per capita per month; rural near poor = 520,000 VND (= 25 USD).
- Urban poor = 500,000 VND (= 24 USD); urban near poor = 650,000 VND (= 32 USD).
In Central Vietnam, there are commonly two housing reconstruction approaches:

- **The donor-built housing reconstruction**, where agencies provide post-disaster houses (with external support);
- **The self-built housing reconstruction**, where people rebuild houses on their own (without external support).

Donor-built post-disaster housing has usually been the main focus of recent debates and discussions in the DRR literature; whereas the self-built approach gains little attention from the research community, and therefore has not been adequately analysed in recent publications. For example, post-disaster housing provided by NGOs after Typhoon Xangsane (2006) or Ketsana (2009) were extensively examined in the project reports or news\(^2\), while many self-built houses after those events were not sufficiently discussed and analysed\(^3\).

Hence, the present research focuses on both these reconstruction approaches, *donor-built* and *self-built*, to deepen understanding of the real housing situations in Central Vietnam, what are grassroots vulnerable conditions and underlying drivers, and core issues and opportunities for developing disaster-resilient housing afterwards. Specifically, this research examines the three key themes mentioned earlier through the lens of post-disaster housing, via four case studies based in Central Vietnam, to identify which forms and mechanisms of *community consultation* are locally appropriate, how *built-environment professionals* are involved in these, and which *design principles* are useful for improving the resilience of low-income housing. A *framework for disaster-resilient low-income housing* is provided as one of the key outputs of this research, to assist and guide the design and construction practices of safe housing in Central Vietnam in particular, and in other similar regions of Southeast Asia in general.

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\(^2\) For examples:


\(^3\) The local staff supposed the number of self-built houses was equal or possibly higher than donor-built ones, when being interviewed during the fieldwork in 2013.
1.2 Problem Statement

There is a critical gap in the current housing literature related to disaster-resilient housing and its link to the stability and development of vulnerable or at-risk communities. The concept of *disaster resilience* has been recently used in the field of disaster management, but in Central Vietnam it appears to be a new notion and is frequently understood in different ways by different local players (i.e. local authorities, housing providers, technical agencies, designers, builders, households). They often view this term as ‘disaster resistance’ or ‘disaster prevention’, where addressing safety-related measures has been the most important consideration, while lacking consideration of socio-cultural aspects. In addition, the link between post-disaster housing reconstruction and development of a resilient housing system has not been analysed adequately in the housing literature. Recent publications (e.g. Davis, 2011; Ahmed, 2011; Chhotray & Few, 2012; Ophiyandri et al., 2013) have emphasised the importance of post-disaster housing reconstruction for building long-term resilience for at-risk groups and communities, but have still lacked specific instructions on how to link reconstruction efforts to resilience enhancement, especially for the situation of Central Vietnam.

Moreover, in safe housing construction practices in this region, particularly within the *donor-built* segment, physical improvements are still preferred by implementers, whereas other important aspects such as socio-economic and cultural appropriateness are considered less. Consequently, many *donor-built* houses are technically safe but socially inappropriate to local needs and people’s ways of living. This narrows the possibility for replicating or scaling-up safe housing designs to a larger scale. The literature review, presented in Chapter 2, identifies three themes that are closely related to this problem. These are (i) *community consultation*, (ii) *the role of built-environment professionals*, and (iii) *design principles for resilience*. The literature review asserts that the improvement of these three themes, both individually and collectively, has a high likelihood of building a resilient housing system in Central Vietnam.

The three themes above are also issues that have not been adequately analysed in recent housing literature, especially in terms of their linkage and interdependence, even though each of them has been extensively discussed in separate publications.
(e.g. Ganapati & Ganapati, 2009; Lawther, 2009; UNEP & SKAT, 2012; Jha et al., 2010; DWF, 2011). The interaction and mutual influence between these three themes has received limited attention from the DRR research community in recent safe-housing studies. Therefore, the present research aims to bridge this gap, to further investigate these themes and their interactions in the real context of Central Vietnam, in order to better understand their roles, meanings, and contributions to the development of disaster-resilient housing in this region.

1.3 Research Questions

As generated from the in-field experiences of the researcher mentioned above and the literature review presented in Chapter 2, this research was designed to seek answers to the following question:

➢ **What are the appropriate forms of disaster-resilient housing (DRH) in hazard-prone areas of Central Vietnam?**

To answer this question, three sub-questions need to be answered:

- What are the appropriate forms of community consultation for DRH?
- How can built-environment professionals assist the development of DRH?
- What are appropriate design principles for DRH?

1.4 Research Objectives

Since housing is context-specific, there is no ‘perfect’ housing model in all cases. Therefore, the aim of this research is to investigate the core issues relating to the above sub-questions and how to achieve DRH within the context of Central Vietnam. Four case studies based in this region (Hoa Hiep Bac, Loc Tri, Ia Broai, and Tan Ninh) were, then, selected for the study. To enable the conduct of this study, four main objectives were identified, as follows:

➢ **To assess housing vulnerability to natural hazards intensified by climate change:** This objective aims to determine current housing situations in Central Vietnam in an era of climate change, where climate extremes and events are increasingly unforeseeable. Vulnerable conditions of residential housing and underlying driving forces are examined, to investigate key factors influencing post-disaster housing outcomes and the possibilities for building a resilient housing system.
➢ To establish the research themes and ground them in the case studies of post-disaster housing reconstruction in Central Vietnam: This objective is to investigate the core themes for the development of DRH in Central Vietnam, based on the literature review, the field investigation of the case studies, and the practical experience of the researcher. Three key themes of this research are then identified: (i) Community Consultation, (ii) the Role of Built-Environment Professionals, and (iii) Design Principles for Resilience. These three themes are subsequently grounded in four case studies in Central Vietnam to examine their appropriateness and responsiveness to this region. A cross-case analysis is then undertaken to further understand the importance of these themes to the real situation of Central Vietnam, and how to operationalise them in resilience planning and implementation.

➢ To develop a framework for DRH in the light of key lessons learnt from the case studies: Based on the cross-case analysis and key lessons learnt from the case studies, a framework for DRH was established to form the theoretical foundation and operational guidance for the provision of safe and resilient housing in Central Vietnam, especially within the low-income population. This framework is the main outcome of this research, to assist future housing design and construction practices for better response to natural disasters, particularly storms and floods.

➢ To offer practical recommendations and guidelines for the development of disaster-resilient housing in Central Vietnam: Along with the main outcome, of the framework for disaster-resilient housing, important recommendations and guidelines derived from the real-world case studies are also provided to assist local and external actors, particularly at-risk communities and built-environment professionals, in finding the best design options for safe and resilient housing.

1.5 Methodology

This research follows the interpretive methodology and case study method to address the above research questions. Investigating the issues relating to the
development of disaster-resilient housing in Central Vietnam is, in fact, the examination of underlying drivers beyond the use or non-use of disaster-resilient measures in low-income housing construction practices. This relates to social phenomena, and human perceptions and behaviours that chiefly involve dealing with qualitative data.

Specifically, the qualitative data on housing situations and disaster risk reduction were collected at four case study sites in Central Vietnam, through household interviews, focus group discussions, and in-depth key informant interviews. These data are then processed by categorization, tabulation, and visualisation, for the cross-case comparison, analysis, and interpretation. To support the qualitative data analysis and the generation of research outcomes, some measurable variables relating to physical conditions of the surveyed houses and the socio-economic status of the interviewed households are also captured alongside qualitative interviews and discussions. This enables a full understanding of household vulnerability and resilience to climate hazards within the context of Central Vietnam, and how housing resilience can be enhanced in development planning and implementation.

1.6 Significance of the Study

This research provides in-depth insights on the development of disaster-resilient housing in relation to three key themes: community consultation, the role of built-environment professionals, and design principles for resilience. The field investigation of these three themes within the real situation of Central Vietnam provides practical instructions and guidelines to strengthen the resilience of low-income housing to future disasters. In addition, this study also contributes to filling a gap in the housing literature to the extent that it helps clarify the significant role of post-disaster housing reconstruction in building safer and more resilient communities through housing interventions.

The first group that benefits from this research is the built-environment professionals who are involved in the field of disaster risk reduction and safe housing provision. In recent resilient housing projects implemented by donors (donor-built), architects and engineers have played an important role in delivering suitable housing design options. The outcome of the framework for DRH will be a
useful, practical reference guide for architects and building designers who are responsible for or directly involved in the design and construction of safe housing, particularly for the low-income population in Central Vietnam.

The second group benefiting from the study is local stakeholders, particularly vulnerable households, local builders, community-based organizations, local authorities, and local NGOs, who are commonly the first responders to natural disasters on site, and the main actors during the recovery and reconstruction process following disasters. The findings of the research are likely to improve their understanding of resilient housing concepts, common local drivers of housing vulnerability, and available and externally mobilised resources and capacity for better response to natural disasters. The research also offers this group implementable ways of achieving the desired disaster-resilient housing outcomes in practice.

In addition, this research generates important policy implications for decision and policy makers in low-income housing development in Central Vietnam. Driving forces of housing vulnerability, such as limited awareness of local people, socio-economic constraints of vulnerable households, and institutional limitations of the governance and operation systems, have demonstrated the need for: incorporating national and local policy mechanisms in raising public awareness at local levels; supporting local economic development; improving current administration systems for better DRR; building local capacity for disaster preparedness; and supporting sustainable low-income housing development. The findings of this research in terms of social and institutional dimensions of disaster-resilient housing, such as the need to apply building permits or safe-construction requirements for disaster-prone areas, will also assist planners, and decision and policy makers, in releasing proper legal documents and frameworks for effective disaster risk management in the future.

1.7 Scope of the Study

1.7.1 Focus on Post-Disaster Housing

This study examines drivers of housing vulnerability and possibilities of resilience enhancement through the lens of post-disaster housing. It has been said that the reconstruction of residential houses after natural disasters opens new opportunities
to build a resilient housing system, since pre-disaster shortcomings or weaknesses can be identified and improved in post-disaster reconstruction; of which housing reconstruction is one of the major interventions.

1.7.2 Targeted Housing Sector: Low Income
As mentioned before, economic constraints of vulnerable households have a critical impact on their disaster vulnerability, especially their housing. According to the project reports of the NGO Development Workshop France, Save the Children, and Vietnam Red Cross, and from the researcher’s experience in the field, people living in the flood- and storm-affected areas of Central Vietnam mostly belong to low-income groups. Their houses are usually not reinforced, and hence, are unsafe for storms and floods, compared to their middle- and high-income counterparts.

Economic constraints of low-income households often make them select cheap residential plots in places far from the city centre and commonly located in hazard-prone areas (e.g. cyclone-affected places or flood zones). In addition, financial shortages hinder low-income households from employing built-environment professionals (e.g. architects, engineers) in designing their houses. This makes their houses technically unsafe, due to lacking the incorporation of safety-related measures in the house structure. Within this sense, the study focuses on low-income housing to examine its vulnerable conditions and associated driving forces. This helps identify opportunities for reducing housing vulnerability and shaping resilient housing design options that are appropriate to the low-income population in Central Vietnam.

1.8 Thesis Outline
This thesis is divided into nine chapters. Chapter 1 discusses the necessity of developing disaster-resilient housing for the region of Central Vietnam. Post-disaster housing reconstruction implemented in this region is briefly examined in this chapter to show its link to the development of disaster-resilient housing and the achievement of community resilience. In this sense, this chapter focuses on identifying the research problems, the motivation of the researcher to pursue this study, the key research questions and objectives, and the significance of this research to the wider public.
Chapter 2 identifies the research questions through an extensive literature review. This chapter identifies the knowledge gaps in the current housing literature, particularly the absence of an overall vision for building disaster-resilient housing and settlements in vulnerable developing countries such as Vietnam. Expressions of housing vulnerability and the main drawbacks commonly seen in Central Vietnam are carefully examined in this chapter, through a review of recent housing publications, DRR project documents and reports, and up-to-date theories and practices for safe and resilient housing. This helps reinforce the necessity of post-disaster housing reconstruction for building the resilience of local housing and settlements. The main part of this chapter is the three last sections, where the three key themes of this thesis emerge and are critically examined: (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience.

Chapter 3 justifies the research design, where methodological approaches, strategies, and techniques to conduct this research are presented. Firstly, the interpretive approach is justified as the principal methodology to conduct the study; followed by a discussion of the research methods, where the case study method was selected to collect and analyse the data. Next, this chapter justifies the techniques used for data collection and analysis, where qualitative discussions and interviews (for data collection), as well as the cross-case comparisons (for data analysis), were chosen.

Chapter 4, 5, 6 and 7 discusses the fieldwork implementation and the findings from the fieldwork. The selected fieldwork methods and the background of the four case-study sites in Central Vietnam are discussed in Chapter 4. The three key themes of this research, (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience, are discussed and analysed in Chapter 5, 6 and 7, respectively, based on the fieldwork findings for each theme. The cross-case analysis and interpretation are also provided in each chapter (5, 6 and 7), to bring new knowledge and insights on disaster-resilient housing in relation to each theme, and to assist the establishment of a framework for disaster-resilient housing in the next chapter (Chapter 8).

Chapter 8 presents the key output of this research, where a framework for disaster-resilient housing is developed, and specific considerations and guidelines for the
design of safe and resilient housing within Central Vietnam are given. Practical design guidelines for disaster-resilient housing are also provided in the last section of this chapter, to further explain and guide architects and building designers in finding the best design options for disaster-resilient housing.

Chapter 9 provides the conclusion to the whole thesis, where the key concluding remarks, considerations, and recommendations for future disaster-resilient housing development within Central Vietnam are presented. This chapter also discusses some important policy implications derived from this research, which may assist decision and policy makers in strengthening governance and policy environments for a resilient housing system against natural disasters.
Chapter 2: A Review of Contemporary Literature in the Field of Disaster-Resilient Housing

2.1 Introduction

The previous chapter presented the background of this research, the research questions and objectives, the scope of this research, and its expected outcomes and significance. This chapter undertakes a review of relevant literature, to identify the research questions and to develop a conceptual framework for DRH development in Central Vietnam. The literature review identifies five core issues for developing DRH in this region, as follows:

1. Housing vulnerability to natural disasters in an era of climate change.
2. The importance of safe housing construction in building community resilience.
3. Community consultation as an essential element of the design process of safe housing.
4. The role of built-environment professionals in safe housing development.
5. Design principles for disaster-resilient housing.

These issues are discussed in the next sections, to identify the core subjects for each issue and how relevant they are in the context of Central Vietnam. This enables the provision of comprehensive and in-depth understandings of DRH, and the role of post-disaster housing reconstruction in building community resilience and in promoting DRH solutions for the region of Central Vietnam. The issues and themes discussed in this literature review are summarized in Table 2.1.
Table 2.1: Key ISSUES that emerged from the Literature Review *(References are given throughout the text)*

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<td><strong>Housing vulnerability to natural disasters in an era of climate change</strong> <em>(Refer to Section 2.2 of this chapter)</em></td>
<td><strong>The importance of safe housing construction to building community resilience</strong> <em>(Section 2.3)</em></td>
<td><strong>Community consultation as an essential element of the design process of safe housing</strong> <em>(Section 2.4)</em></td>
<td><strong>The role of built-environment professionals in safe housing development</strong> <em>(Section 2.5)</em></td>
<td><strong>Design principles for disaster-resilient housing</strong> <em>(Section 2.6)</em></td>
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**Physical:**
- ✓ Location of human settlements
- ✓ Design-related problems
- ✓ Construction-related problems

**Social:**
- ✓ Economic constraints
- ✓ Fashion-driven rather than safety-oriented construction
- ✓ Over-dependency on external supports
- ✓ Lack of communication and consultation
- ✓ Limited governance

**Importance:**
- ✓ As part of the process of creating housing in pre- and post-disaster periods
- ✓ To improve pre-disaster fragilities
- ✓ To meet short- and long-term needs of disaster-prone communities
- ✓ A good opportunity to build long-term resilience of disaster-prone communities

**Significances:**
- ✓ To improve mutual understanding between stakeholders
- ✓ To share experiences and knowledge on safe and resilient housing
- ✓ To provide housing options sensitive and appropriate to local contexts
- ✓ To ensure user satisfaction
- ✓ To integrate local and innovative (new) knowledge for risk reduction

**Challenges:**
- ✓ Narrow definition of community
- ✓ Limited capacity of facilitators
- ✓ Limited use of community feedback on design and construction implementation
- ✓ Potentially creating meetings where politically conflicting opinions of different groups are given
- ✓ Lack of studies deepening the meaning and application of community consultation
- ✓ Addressed on a limited basis in the research and practice community in Vietnam

**Roles of Built-Environment Professionals:**
- ✓ To interpret local needs and capacities into spatial, functional, and technical solutions
- ✓ To improve local awareness and unsafe practices
- ✓ To facilitate community consultation and manage design- and construction-related activities

**Role of Architects:**
- ✓ Capacity Building
- ✓ Representation
- ✓ Vision

**Physical:**
- ✓ Technical principles for risk reduction, human comfort provision, and climatic appropriateness

**Economic responses for cost efficiency**

**Social responses for cultural appropriateness**
Firstly, housing vulnerability is examined within the international and local contexts in relation to physical, social and institutional dimensions, to understand the main drivers beyond housing vulnerability in developing countries such as Vietnam. Secondly, the literature review clarifies the role and contribution of post-disaster housing reconstruction in the stability and development of vulnerable communities, especially the emergence of the three key themes of this research: (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience. The last three sections of this chapter discuss each of these three themes in association with the current housing literature, to understand how important these themes are to the context of Central Vietnam, and in what ways disaster-resilient housing options can be developed.

2.2 Housing Vulnerability to Natural Disaster in an era of Climate Change

2.2.1 Introduction

To understand the importance of disaster-resilient housing in building community resilience, it is essential to fully capture the expression and causes of housing vulnerability as well as its impacts on the socio-economic stability of communities and households. Tyler and Moench (2012) and ISET (2012) agree that an in-depth understanding of vulnerable conditions, socially and physically, is the key to building resilience to natural disaster and climate change. Thus, an analysis of housing vulnerability and associated root causes is undertaken in this section, with a focus on Central Vietnam.

There has been an increasing trend for natural disasters to occur in recent times (Bozkurt & Duran, 2012) (Figure 2.1). Housing often represents one of the most affected sectors, because levels of disaster preparedness for residential houses, prepared by local communities, are frequently limited (McEntire, 2011). In developing countries such as Vietnam, socio-economic constraints of at-risk communities and lack of technical assistance from professionals (e.g. architects, engineers) also hinder efforts to reduce housing risks and strengthen community resilience. This section discusses this matter within the Asia Pacific Region, one of the most disaster-prone regions in the world (Hay & Mimura, 2006), with a focus on Central Vietnam afterwards.
The context of climate change and natural disasters in the Asia Pacific Region, where Vietnam is geographically situated, is briefly described in the first part of this chapter. Secondly, climate-related disasters such as floods and cyclones and their destructive effects on Vietnam, one of the top five countries exposed to climate change (IPCC, 2007), are discussed in relation to the commonly unsafe housing conditions and underlying drivers. Attention is subsequently paid to Central Vietnam, the most disaster-prone region of this country (Tinh et al., 2010; Anh et al., 2014), to examine low-income housing conditions and how people build or renovate their houses in the face of climate change.

2.2.2 Climate-related Disasters in the Asia Pacific Region

To understand the relationship between housing and disasters in Vietnam, it is essential to have an overview of how local communities in Asia-Pacific countries cope with and respond to natural disasters.

The Asia Pacific is known as an extremely vulnerable region, with the occurrence of many types of natural disaster such as typhoons, floods, earthquakes and drought (Hay & Mimura, 2006). Despite the significant efforts of national governments and aid agencies in DRR, damage and losses triggered by disasters have still exhibited an escalation in number (UNISDR, 2012) (Figure 2.2). Huge losses of human life and property, as seen in Typhoon Xangsane in Vietnam in 2006, Typhoon Sidr in Bangladesh in 2007, Typhoon Nargis in Myanmar in 2008, a large flood in Thailand in 2011, and Typhoon Haiyan in 2013 in the Philippines, have proved the environmental severity and geographical disadvantage of this
region. In 2012, about 80% of the global economic loss associated with natural disaster belonged to this region (CRED, 2012). Intensified by climate change, hydro-meteorological hazards such as floods and typhoons are considered to bring the greatest damage to this region in comparison with other hazards (ESCAP & UNISDR, 2012).

Figure 2.2: Rising trend of economic loss due to disasters in the Asia Pacific Region from 1970 to 2010 (UNISDR, 2012)

In addition, risks posed by smaller-scale but higher-frequency disasters, such as annual floods and cyclones, receive more attention, as they have a high potential to trigger much more damage than larger-scale, but lower-frequency disasters such as the Indian earthquake and tsunami in 2004 (ESCAP & UNISDR, 2012). Annual storms and typhoons followed by long-lasting rains, inundations and storm surge have become the most dangerous hazards for Asia-Pacific developing countries, where levels of disaster preparedness are limited and levels of exposure to climate hazards are not reduced.

Exemplary instances of the disaster proneness of this region can be seen through recent natural disasters. A large flood in Thailand in 2011, known as the worst flooding in 50 years, resulted in more than 600 deaths, $45 billion of economic loss (World Bank, 2011), and 800,000 houses destroyed (Reuters, 2011). Typhoon Nargis in Myanmar in 2008 killed 140,000 people, cost $4.1 billion in losses, and destroyed 790,000 houses (Oxfam International, 2009). Typhoon Haiyan in the Philippines in 2013 triggered at least 1,774 deaths, and 23,200 houses were destroyed (USAID, 2014). In addition, Typhoon Xangsane in Vietnam in 2006 caused 71 deaths, and nearly 300,000 houses were destroyed (IFRC, 2006). Such damage and loss figures not only show the destructive strength of such climate-related disasters (storms, floods) but also reveal the limited coping capacity of
local communities living in the Asia Pacific. The huge number of destroyed and damaged houses after such disasters has far exceeded the efforts of governments and humanitarian/aid agencies in post-disaster recovery and reconstruction. While we cannot reduce the strength of climate events, it is crucial to improve fragile or unsafe conditions of local housing and settlements, through the application of disaster-resilient housing design options.

2.2.3 Building Responsive and Adaptive Capacity for Housing

Recent publications highlight that it is difficult to forecast the frequency and the intensity of climate events (e.g. storms, floods) precisely because climate change is increasingly unpredictable and uncertain in its occurrence (Morecroft et al., 2012). Socio-economic development plans and strategies in vulnerable regions are often not incorporated with risk-management measures effectively (Keating et al., 2014). To address this uncertainty, a new trend of disaster management has emerged in the literature, in which the conventional ‘predict and prevent’ approaches have been gradually replaced by the ‘responsive and adaptive’ ones (IFRC, 2012).

Restrictions derived from the ‘predict and prevent’ approach-based DRR projects have indicated the need for ‘responsive and adaptive’ approaches to better prepare future DRR plans and actions. Clear evidence for this statement can be seen in the aftermath of the catastrophic flood in Bangkok, Thailand in 2011. Accordingly, the ‘predict and prevent’ approach, through the construction of a large dam as a ‘perfect’ wall to protect the city (higher than the highest flooding levels in the past), led to the overconfidence of people living behind this dam. This overconfidence caused them to not adequately prepare for the risk of super floods. This subjective sense of safety and limited preparedness were among the main causes of the huge damage and losses after this flood, particularly to housing, when the floodwaters crossed this dam and destroyed the city. Some scholars (e.g. Phi, 2013) argue that such damage could be reduced if adaptive measures were developed at local levels (i.e. raising the ground floor of houses, adding a second floor, or using water-resistant materials).

Conceptually, the adaptive capacity of an entity or system is its ability to accommodate stresses and impacts caused by an event, without significant changes to its basic functions (ISET, 2012). For housing, instead of building s
very strong house to withstand all events, including the super ones (super typhoons), owners may improve some parts of their houses for common climate events (e.g. annual storms) along with preparing cost-effective solutions for calamitous but uncommon events (e.g. Typhoon Haiyan in 2013). This perception is particularly useful for low-income people, since it not only helps reduce human loss and housing damage but also ensures cost-effective construction. It is commonly seen in the self-built group, where people seek various ways to respond and adapt to natural disaster within an affordable cost of housing construction. For example, in some cyclone-affected areas of Central Vietnam, people have built strong ‘toilet boxes’, using reinforced concrete (RC), beside their main houses, for refuge in strong typhoons (Toan & Phuong, 2012) (Figure 2.3).

![Figure 2.3: Strong toilet box made of reinforced concrete near the main house to cope with big typhoons in Central Vietnam (Toan & Phuong, 2012)](image)

Climate change has intensified the hydro-meteorological hazards in the Asia-Pacific (ESCAP & UNISDR, 2012). Floods and cyclones are recognized as the biggest hazards to local communities in this region, where human loss and property damage were clearly witnessed after recent disasters. In Central Vietnam, disasters triggered by these two hazards (flood, cyclone) have been recorded as the biggest obstacles to local housing improvement, poverty reduction, household and community development, and the growth of provinces and cities. The present research is an effort to seek possible ways of building long-term resilience in housing, especially low-income housing, against storms and floods, through examining housing design-related aspects within the context of Central Vietnam.
2.2.4 Climate-related Disasters in Central Vietnam

Climate change projections in Central Vietnam are closely linked with the appearance of stronger typhoons, the change of rainfall patterns, the increase of temperature, and sea-level rises (DMC, 2011; Care International, 2009). Damage and loss statistics for recent climate events, such as Typhoon Xangsane in 2006, Typhoon Ketsana in 2009, Typhoon Wutip in 2013, or the large flood in 1999, have revealed the climatic severity and difficulty of this country (Figure 2.4).

![Figure 2.4: Location of Central Vietnam, with some notable figures for natural disasters](Source of map: www.lichsuvn.net, accessed 20 Aug 2016)

According to the Ministry of Agriculture and Rural Development (MARD, 2009), flood, typhoon, and inundation are the three highest-frequency hazards in Vietnam, followed by tornadoes, drought, landslide, flash floods and fire (Table 2.2). According to recent forecasts, climate change has a higher likelihood to trigger more unpredictable or unprecedented cyclones and floods in the future,
particularly in the central region, known as Central Vietnam, which has a very long coastline (MONRE, 2008).

Table 2.2: Frequency of natural disasters in Vietnam (MARD, 2009)

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typhoon</td>
<td>Tornado</td>
<td>Earthquake</td>
</tr>
<tr>
<td>Flood</td>
<td>Drought</td>
<td>Frost</td>
</tr>
<tr>
<td></td>
<td>Landslide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flash flood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire</td>
<td></td>
</tr>
</tbody>
</table>

With its long coast, and population growth mainly in coastal areas, the area of Central Vietnam is the area that is most highly exposed to typhoon and flood hazards. This region is impacted by 6 to 10 typhoons per year (usually 1 to 3 strong typhoons), while there is much less frequency of storms in the north and south. Typhoons usually originate from the sea, followed by storm surges, long-lasting rains, floods, and inundations. In recent years, floods and typhoons have caused huge damage and loss in this region, and destroyed thousands of mainly low-income residential houses (MONRE, 2011), despite the endless efforts of the national and local governments, organizations, and aid agencies, in disaster risk reduction. Lack of resilient designs, improper methods of construction, and incorrect uses of building materials found in the structures of so-called ‘modern’ houses (mostly masonry structures), are considered to be the main causes of housing vulnerability (Norton & Chantry, 2008; Ahmed, 2011). This physical vulnerability has a strong link with social, economic, cultural and institutional drivers; which drivers this study aims to explore, in order to develop appropriate solutions.

From 1999 to 2015, there were ten severe, climate-related disasters in Vietnam; nine of which were storm events, while only one related to flooding (Table 2.3). The affected locations were also dominated by the central region, where cross-province impacts and consequences were recorded and reported. According to the Vietnam’s Central Committee for Flood and Storm Control (CCFSC), 80-90% of
this region’s population are affected by storms and their accompanied effects such as storm surges, heavy rains, and floods. Under the intensification of climate change, such natural hazards are believed to increase and worsen the situation and pose more threats to prone communities, particularly low-income ones, and their housing (MONRE, 2008; Vietnam Government, 2012). The national and local governments and the wider public are increasingly concerned with the actual capability of local communities for response to future disasters, and increasingly acknowledge that reducing household vulnerability and building housing resilience have become one of the key targets to stabilize and sustain the development of climate-exposed communities. To achieve this target, it demands the conducting of scientific studies on resilient housing, such as the present study, to build up a reliable database wherein plans and measures for safe and resilient housing can be generated and shaped.

Table 2.3: Large disasters in Vietnam from 1999 to 2015

*(CCFSC online database, accessed 1 July 2015)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Economic losses (VND billion)</th>
<th>Houses destroyed partially</th>
<th>Houses destroyed totally</th>
<th>Areas affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Typhoon Nari</td>
<td>1,509</td>
<td>27,700</td>
<td>511</td>
<td>5 central provinces</td>
</tr>
<tr>
<td>2013</td>
<td>Typhoon Wutip</td>
<td>11,000</td>
<td>193,702</td>
<td>528</td>
<td>6 central provinces</td>
</tr>
<tr>
<td>2009</td>
<td>Typhoon Ketsana</td>
<td>16,078</td>
<td>263,565</td>
<td>9,770</td>
<td>13 central provinces</td>
</tr>
<tr>
<td>2008</td>
<td>Typhoon Kammuri</td>
<td>1,939</td>
<td>18,550</td>
<td>990</td>
<td>13 north and central provinces</td>
</tr>
<tr>
<td>2007</td>
<td>Typhoon Lekima</td>
<td>3,215</td>
<td>111,770</td>
<td>1,853</td>
<td>15 north and central provinces</td>
</tr>
<tr>
<td>2006</td>
<td>Typhoon Xangsane</td>
<td>10,401</td>
<td>325,282</td>
<td>24,066</td>
<td>15 south and central provinces</td>
</tr>
<tr>
<td>2005</td>
<td>Typhoon No. 7</td>
<td>3,509</td>
<td>113,523</td>
<td>4,746</td>
<td>13 north and central provinces</td>
</tr>
<tr>
<td>2004</td>
<td>Typhoon No. 2</td>
<td>298</td>
<td>1,313</td>
<td>350</td>
<td>11 central provinces</td>
</tr>
<tr>
<td>2001</td>
<td>Typhoon Lingling</td>
<td>691</td>
<td>39,424</td>
<td>4,521</td>
<td>10 central provinces</td>
</tr>
<tr>
<td>1999</td>
<td>Flood</td>
<td>982</td>
<td>402,183</td>
<td>7,228</td>
<td>7 central provinces</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>9 typhoons + 1 flood</td>
<td><strong>49,622</strong></td>
<td><strong>1,497,012</strong></td>
<td><strong>54,563</strong></td>
<td>Across all provinces of the region</td>
</tr>
</tbody>
</table>
2.2.5 Understanding Potential Drivers of Disaster Risks posed to Housing

In addition to the worsening situation of the future climate, fragile conditions created by human settings and behaviours are also known as a main cause of the expanding risk exposure (McEntire, 2011). Limited awareness of at-risk communities, economic constraints of vulnerable households, lack of technical assistance from built-environment professionals, and ineffective governance and policy mechanisms, have been identified as key drivers of housing vulnerability in Central Vietnam (Tuan et al., 2015; Tinh & Phong, 2010; Huy & Shaw, 2010).

As highlighted by the national government, housing is classified as one of the four most vulnerable sectors in Vietnam (MONRE, 2008). As seen in Table 2.3 above, the number of houses destroyed by natural disasters has not exhibited a significant decline in recent years regardless of the efforts of governmental and non-governmental organizations for DRR and CCA. For instance, the 2009 and 2013 typhoons also triggered more housing damage than the 2005, 2007 and 2008 typhoons.

From the literature review in the present study, the working experiences of the researcher, and his discussions with DRR experts in Central Vietnam, there are three common driving forces of housing vulnerability identified in this region. Firstly, the limited awareness of at-risk communities and local stakeholders towards climate change, natural disaster, and safe housing construction may contribute to the increased housing vulnerability. Their perception and realization are still trapped within the ‘predict and prevent’ approach, with a preference paid to immediate or short-term measures for the anticipated events (e.g. forecasted typhoons). However, as highlighted by the IFRC (2012), the ‘predict and prevent’ approach appears to be not appropriate in the time of climate change, because it cannot address the complication and uncertainty of the changing climate. In addition, the limited awareness of vulnerable communities is also reflected in their investment priorities, where safe housing reinforcement is often not considered as their first priority in allocating the family budget, due to no income being generated from housing construction activities (Phong et al., 2014; Phong, 2013; ADPC, 2007).

The second driver of housing vulnerability is the economic difficulty of low-income households, where their financial shortages hinder their efforts to build safer houses. In particular, economic constraints affect their decisions in terms of
purchasing better (usually costlier) land in safer places to build their houses (CCCO, 2014), hiring built-environment professionals (i.e. architects or engineers) in designing the house (Charlesworth & Ahmed, 2015), and incorporating stronger (usually costlier) structural elements such as beams, pillars or bracings (DWF, 2010; Anh et al., 2012). There has been a widespread agreement among researchers that poverty is one of the root causes of household vulnerability (e.g. Wisner et al., 2004; McEntire, 2011), in which housing is often the most valuable but also the most vulnerable item of their property.

The third driver of housing vulnerability is the limited capability of local builders and construction workers in building disaster-resilient houses (DWF, 2011; ADPC, 2007; Binh, 2014). In many places of Central Vietnam, where flood and typhoon is common, local construction practices still show limitation in terms of being able to help the local housing better cope with flood and storm impacts (DWF, 2010; Anh et al., 2013). Construction methods by local builders are mostly based on their available experience and previous practices, which are usually not safe, or are lacking strong elements (e.g. beams, pillars, bracings) in the house structure.

Despite having a long history of coping with natural disaster, and a transformation from wooden to masonry architecture over nearly three decades (since 1986) (Figure 2.4), local housing construction in Central Vietnam still lacks experience, skills, and techniques for coping with climate risks effectively. In the aftermath of recent disasters (e.g. Typhoon Xangsane in 2006, Ketsana in 2009, or Nari in 2013), while most traditional wooden houses (e.g. Ruong houses in Hue City) remained intact, many masonry houses made of brick and mortar showed technical failures regarding safety performance. Thus, masonry houses frequently have formed the predominant number of damaged houses after typhoons in Central Vietnam. More than 70% of masonry houses built after 1986 (Figure 2.5) do not incorporate storm-resistant features in their design; of which, unfavourable roof shapes for storm winds (e.g. flat roof), inadequate attachments between roofing sheets and walls, and lack of structural bracings, are the most common inadequate features (Norton & Chantry, 2008).

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4 The time the country transformed from the subsidized-based to the market-oriented economy.
In Vietnam, there is a local common proverb, known as *an cư, lạc nghiệp* (housing first, livelihood second), which places *housing* as the first priority in household development. In addition, Vietnamese people believe that their house is also the asset that can reflect their economic prosperity and social position; and, hence, they often invest much money in housing improvements (Tuan et al., 2015). This makes housing become one of the most valuable assets of local families in Central Vietnam. However, the restrictions in preparing disaster-resilient measures may undermine such investments, potentially exacerbating their housing vulnerability to future climate hazards, and pushing families back to poverty if severe climate events happen. The next section analyses this issue through examining common expressions of *housing vulnerability* and underlying drivers in Central Vietnam.

### 2.2.6 Housing Vulnerability in Central Vietnam

Since this thesis deals with the issue of post-disaster housing in relation to developing a resilient housing system for Central Vietnam, understanding vulnerable conditions of local housing is crucial to identifying key opportunities and challenges in finding the best housing solutions against future climate threats. The previous section has already addressed the link between the physical vulnerability of local housing, and socio-economic and institutional restrictions.

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5 In 1986, Vietnam was reformed from a subsidized- to a market-oriented economy, with a huge import of new materials and construction methods. Masonry materials such as cement, brick or steel were popular in the world at that time and, therefore, became the common types of imported materials entering this country. These were then widely used in local housing construction throughout the country, including provinces of Central Vietnam.
such as the limited awareness and economic constraint of at-risk groups, the limited ability of local builders, or the limited governance and policy mechanisms for DRR. This section discusses the main causes of housing vulnerability commonly seen in Central Vietnam, regarding the two prominent factors, physical and social.

In Central Vietnam, housing vulnerability is exposed in various forms, dependent on the type of hazard (flood or storm) and the specific context of the involved community and households. As mentioned in the last section, cyclones and floods are the biggest natural threats to housing in this region. While floods often inundate houses for days, storms are more dangerous with their strong winds, and more likely to destroy non-reinforced houses. The following paragraphs, through reviewing recent publications on safe housing and disaster management in Central Vietnam, further analyse these vulnerable conditions, along with an explanation of associated root causes.

**Physical Vulnerability**

Physically, in flooding zones, vulnerable conditions of low-income housing are commonly exposed through the low height of the main house’s floor (lower than the common flood levels) and the lack of a heightened floor (above the common flood levels) to protect occupants and household items from flooding. The historical flood of 1999 in Central Vietnam witnessed many houses being without heightened floors, resulting in critical loss of life and property. In addition, vulnerable conditions to flood hazards are also found in the houses using solid roofs (e.g. by RC slabs or heavy tiles), where people find it difficult to open the roof to escape in the case of large and fast-moving floods. In terms of building quality, the inundation over many days inside floodwater also quickens the deterioration process of building materials, and, consequently, reduces their lifespan and load-bearing capacity.

In the cyclone-affected areas of Central Vietnam, three common unsafe conditions are found in low-income houses: (1) inappropriate site planning or improper settlement patterns; (2) mistakes in building design; and (3) incorrect use of construction methods and building materials.

According to Chakraborty et al. (2005), the location of human settlements is the first major determinant of vulnerability. Each geographic place has its own
characteristics that influence the proneness to natural hazards (McEntire, 2011). In Central Vietnam, local communities are often scattered along the coastline and in river basins that are extremely exposed to storms and floods. In addition, settlement pattern also has a critical effect on housing vulnerability (UNEP & SKAT, 2007; UNEP & IFRC, 2012). Factors of settlement pattern and site planning are likely to reduce or spread climate exposure of individual houses (Jha et al., 2010). In Central Vietnam, the inappropriate site planning of residential areas is often reflected in two main forms: (1) houses without windbreaks to protect them from the outside; and (2) houses arranged in parallel directions that intensify the wind flows between buildings (Duy et al., 2007) (Figure 2.6). These two problems are commonly seen in the coastal areas of Central Vietnam, where the distance between residential areas and the sea is not sufficient, and usually lacks windbreaks in-between (e.g. trees or sea walls).

![Figure 2.6: Inappropriate ways of human settlement planning in Central Vietnam (Duy et al., 2007)](image)

The second determinant of physical vulnerability of housing is mistakes in building designs (McEntire, 2011; Charlesworth, 2011; Ahmed, 2011). Unfavourable building typologies and designs for natural hazards, such as unsuitable building forms, the lack of strong elements and structural connections, the lack of climatically responsive measures, or inappropriate spatial layouts, are considered to be typical defects in housing designs in response to storms and floods (DWF, 2011; UNEP & SKAT, 2012; Anh et al., 2014). In Central Vietnam, failures in housing designs frequently found in the storm-affected areas include the use of inappropriate building shapes, the extension of wind-facing surfaces, and the structural attachment of veranda or balcony to the main house.

In terms of building shape, the T-, L- and U-shapes are more likely to be destroyed by storm winds, because their geometrical forms create wind-suction bags surrounding the structure (CECI, 2003; Duy et al., 2007). The simpler the
building shape, the less wind pressure the building receives, as seen in the square and rectangular shapes. However, the rectangular shapes with the dimensional ratio between the length and width of over 2.5 are also prone to storm wind (Duy et al., 2007) (Figure 2.7). This failure is usually unknown to local actors in Central Vietnam, especially vulnerable households and local builders. The geometrical form of the house within the low-income population is mainly influenced by the owner’s aesthetic or decorative expectations rather than by safety-related ones (ADPC, 2007; Anh & Phong, 2014).

![Building Shapes](image)

**Figure 2.7:** Building shapes that trigger more destruction in storms

In addition, according to ISET (2015) and Anh et al. (2012), the rapid urbanization process in Central Vietnam has seen a noticeable increase of masonry houses in the new urban, rural-urban transitioned, and even rural areas of this region. The tube house type, where one side of the house is much longer than the other side (frequently more than two times), covers most masonry houses in this region (Tuan et al., 2015; DWF, 2011). This fact has been observed by the researcher in many places of Central Vietnam he has visited.

In terms of disaster management, the high numbers of tube houses destroyed by recent typhoons (i.e. Typhoon Nari in 2013, Ketsana in 2009, Xangsane in 2006) in Central Vietnam have posed increasing concern about their typhoon-resilient capacity. The expanded wind-facing surfaces generated by its shape (tube shape) is one of the causes of their limited typhoon-resilient capacity: the long rectangular shape of tube houses leads to the formation of long gable walls on
both sides of the house, which are highly vulnerable to storm wind. As seen in Typhoon Xangsane in 2006, many tube houses with long gable walls were easily destroyed by the typhoon (Figure 2.8). For the houses whose long walls are intentionally kept for a certain design idea, the exclusion of consolidating partitions or piers in-between also increase the unsafe situation (CECI, 2003). This was evident in many destroyed houses after Typhoon Xangsane in 2006 (Binh, 2006) and Typhoon Ketsana in 2009 (IFRC & VNRC, 2010). In terms of building height, unsafe conditions are also seen in the houses whose heights are greater than 3.6 meters, because such houses are more likely to be destroyed by storm wind compared to lower houses (CECI, 2003).

Another common unsafe condition is the use of verandas or balconies that are structurally attached to the main house. According to DWF (2011), this is a very unsafe condition because the destruction of such veranda or balcony may lead to the destruction of the main house (Figure 2.9). During a storm event, such verandas and balconies are very likely to be destroyed by strong winds because their semi-open structures create wind-suction bags within them (CECI, 2003).
suggested by DWF (2011), it is better to detach verandas or balconies from the main house structure to avoid domino effects from the destroyed verandas or balconies to the main house.

**Figure 2.9:** An attached veranda is more vulnerable to storms (Researcher, 2012)

The above discussion has identified several common technical mistakes in local housing construction practices, as causes of the physical vulnerability of housing, in Central Vietnam. These mistakes are widely analysed in the housing and DRR literature, but are not applied effectively in practice, particularly within the low-income housing sector in Central Vietnam.

Finally, the third determinant of physical vulnerability is the improper use of construction methods and building materials (CECI, 2003; Ahmed, 2011; Norton & Chantry, 2008). In Central Vietnam, this problem is commonly seen through the use of thin walls (in Hoa Hiep Bac, for example), low-quality materials for wind-resistant elements (in Loc Tri), and the lack of strong connections and bracings between building parts (in Gia Lai, Kon Tum, and Quang Nam). As most masonry houses in this region are made of brick, the common use of 11cm thick walls makes them highly vulnerable to storms and typhoons, as they are unable to withstand such strong winds (Duy et al., 2007). In terms of the connection between building parts, local housing construction often lacks strong bracings and attachments between structural elements, especially for the wall and roof structures. Walls without pillars and beams (Figure 2.10), roof trusses and coverings without attachments to the structure beneath, and weak connections between elements within one part (walls or roof), are the most common unsafe conditions for storm hazards that are present in local housing in Central Vietnam.
Social Vulnerability

According to Wisner et al. (2004), social vulnerability is considered to be the characteristic of an individual or group and their situation that affects their response to a natural hazard. Social vulnerability is characterized by the factors that determine the degree to which people’s life, their housing, and livelihoods are threatened by, or exposed to, a hazard (Wisner et al., 2004). Tapsell et al. (2010) define the concept of social vulnerability in terms of three components: security (awareness and understandings of safety-related issues and long-term stability); economic (financial affordability for vulnerability reduction); and social (institutional and contextual conditions). Interestingly, these three factors appear to be clearer in the situation of Central Vietnam.

In this region, as mentioned before, the limited awareness and economic difficulty of vulnerable or at-risk households, and the limited experience of local builders in safe construction, are the common social drivers of housing vulnerability. The limited awareness of local people towards disaster risk reduction makes them underestimate the importance of safe housing and uninterested in using safety-related measures in practical construction or renovation. In addition, the financial shortage in low-income households makes a significant contribution to their increased exposure to natural hazards (Adger, 1999; Wisner et al., 2004). For high-income households, they often buy expensive plots in central urban areas with adequate urban infrastructure and public services. Their houses are frequently situated in safer or less vulnerable places, and designed by professionals (architects or engineers). On the other hand, the housing of low-
income people is more vulnerable, as their economic constraints only allow them to buy cheap plots far from the city center, frequently in the suburban and hazard-prone areas. Moreover, their houses often lack strong connections and bracings for hazard mitigation, because of the absence of professional involvement in their housing design and, therefore, technical assistance for safety purposes.

According to Yeletaysi et al. (2009), aesthetics-related aspects of human settlements, such as housing form and construction type, have a certain influence on social vulnerability. In Central Vietnam, housing vulnerability is also generated from the growing demand for fashionable construction. Rapid urbanization and modernization, with the import of new housing styles, building structures, and construction materials, have critically changed the aesthetic expectation of local residents for their housing. Instead of building a strong house for disaster resilience, people tend to place more focus on the appearance and decoration of their houses (ADPC, 2007). This may improve the appearance of their living places, but will not enhance their disaster-resilient capacity, if safety-related measures and methods are excluded. In addition, limited experience and skills of local builders, mostly masons, in terms of safe construction, also make the situation more severe and the housing sector more vulnerable. In most cases, they just build what house owners want, without critical advice or suggestions for a safer construction.

Cutter et al. (2003) identify some key aspects of social vulnerability, in which lack of accessibility to resources (including finance, information, knowledge, and technology) becomes one of the biggest concerns. In Central Vietnam, it is not easy for poor people in disaster-prone areas to access credit or loan programs and professional design services, to get financial and technical support for their housing construction. Only a small number of households, if any, can access these aids, and then frequently through a humanitarian or development project. The complicated procedure of being selected as the project beneficiaries, and the lack of supportive mechanisms to bridge the gap between at-risk groups and technical parties (e.g. local architecture offices, construction firms), are considered to be the main causes of limited resource accessibility.

Another issue related to resource accessibility is the over-dependence of people on outside support, regardless of the limited number of beneficiaries selected for receiving such aid. The financial shortage of low-income households has made
them dependent on external supports (Anh et al., 2013); and this, consequently, has undermined their preparation to cope with future disasters. Some experts argue that external support from governments, donors, and aid agencies after disasters is good to help communities quickly recover, but has a high likelihood of reducing their activeness and preparedness for future events. This is evident in some communities in Central Vietnam (e.g. in Hue or Quang Nam province), where local households often look forward to the government’s support or external help for risk reduction, rather than preparing coping measures on their own.

The last social cause of housing vulnerability comes from the limited governance of local authorities for disaster risk management. As highlighted by Adger (1999, 2006), decision-making and policy-related issues play an essential role in reducing vulnerability and increasing resilience. Johnson (2011) advocates for the importance of applying building codes and regulations surrounding the application and enforcement of building standards, in creating an enabling environment for disaster risk reduction. In the context of Central Vietnam, particularly in hazard-prone areas, there is currently an absence of legal documents or frameworks (e.g. policies or regulations) to enforce people to follow safe construction. The only assistance people receive is verbal advice and encouragement to build safer houses (ADPC, 2007). In addition, building permits are not required in most peri-urban and rural areas of Central Vietnam, where the proneness to natural disaster is often high. People living in these prone areas are free to decide what they want for their houses, based on their functional and aesthetic needs; and hence, frequently, they exclude safety-related measures since these are not in their initial priorities. This has also exacerbated and enlarged housing vulnerability in Central Vietnam.

2.2.7 A Need for ‘Building Back Better’

The above discussion indicates that housing vulnerability is commonly generated and exacerbated by both physical and social factors. Physical exposure to natural hazards is closely linked to wider socio-economic and institutional constraints. The above discussion provides an overview of the housing situation in Central Vietnam, vulnerable conditions of local housing and associated root causes. Table
2.4 depicts the seven key drivers of housing vulnerability (physical and social), identified from the review of the literature in the present study.

Table 2.4: Physical and social causes of housing vulnerability in Central Vietnam

<table>
<thead>
<tr>
<th>Causal Factors of Housing Vulnerability</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td></td>
</tr>
<tr>
<td>1. Settlement location and site planning</td>
<td>Near the sea or rivers, in flood zones or storm prone areas; unfavorable site planning for natural hazards</td>
</tr>
<tr>
<td>2. Building design problems</td>
<td>Unsuitable building shapes, attached veranda or balcony to the main house, lack of strong bracings and connections, culturally spatial inappropriateness</td>
</tr>
<tr>
<td>3. Building construction problems</td>
<td>Improper uses of construction methods and building materials, using low-quality materials</td>
</tr>
<tr>
<td>Social</td>
<td></td>
</tr>
<tr>
<td>4. Economic constraints</td>
<td>Poor and low-income households are more vulnerable to natural disasters</td>
</tr>
<tr>
<td>5. Fashion-driven rather than safety-driven construction</td>
<td>Focus on building appearance, decorations, and details for beauty purposes, rather than incorporating safety-related measures in building structure</td>
</tr>
<tr>
<td>6. Over-dependency on external supports</td>
<td>Over-dependency on the outside or external help reduces the active preparedness for future disasters</td>
</tr>
<tr>
<td>7. Limited governance</td>
<td>Lack of policies or legal documents to enforce people to follow safe construction</td>
</tr>
</tbody>
</table>

These fragile or vulnerable conditions, in fact, exist in pre-disaster periods, but commonly are identified in the aftermath of disasters. Therefore, post-disaster housing reconstruction is apparently considered to be more important in improving pre-disaster fragile conditions, rather than just focusing on rebuilding collapsed or damaged houses. This is similar to the concept of ‘building back better’ provided by Lyons et al. (2010), where post-disaster reconstruction is considered to be the best way to improve root causes of vulnerability and achieve
stable and long-term development (Archer & Boonyabancha, 2011). This consolidates the aim of the present research, to find long-term solutions for disaster-resilient housing through the lens of post-disaster housing. The next section will provide more details about the role of post-disaster housing reconstruction in building community resilience, and its linkage to the achievement of long-term resilient housing solutions, with a focus on Central Vietnam.

2.2.8 The Difference between Donor-Built and Self-Built Reconstruction

In the aftermath of a natural disaster, there is frequently a vast population whose houses are damaged or seriously destroyed. Despite the attempts of local governments and aid agencies to rebuild collapsed or seriously damaged houses, there are always a considerable number of affected households that did not gain access to such aid. These non-beneficiaries have to seek various ways of housing reconstruction on their own, known as self-built reconstruction. In the DRR literature, housing-related studies tend to focus on post-disaster housing reconstruction provided by donors (donor-built), such as the housing reconstruction projects funded by Save the Children after Typhoon Xangsane (2006) or by Vietnam Red Cross after Typhoon Ketsana (2009) in Central Vietnam. However, there have been very few studies that sufficiently examine and analyse self-built housing reconstruction (built by people without external support). To understand the overall perspective on post-disaster housing, this research examines both approaches, as follows:

➢ Donor-built Housing Reconstruction

In this approach, donors help households rebuild their houses after disasters (e.g. Karunasena and Rameezdeen (2009) for a Sri Lankan case; Shaw and Ahmed (2010) for Sri Lankan and Indian cases).

➢ Self-built Housing Reconstruction

In this approach, people rebuild their houses on their own without external support (e.g. Marcillia and Ohno (2012) for a Japanese case).

These two approaches have commonly been used in post-disaster housing reconstruction in Central Vietnam for many years, especially after the large flood in 1999. That flood attracted significant international attention to post-disaster housing reconstruction. However, while the donor-built approach was being
widely discussed and praised in forums and debates, such as the IFRC-funded houses built after the 1999 flood or the HFH-funded houses built after the 2009 typhoon, self-built post-disaster housing received limited consideration.

Since reconstruction approaches, housing design concepts, community participation and consultation, resources for housing construction, time and quality of construction, and stakeholders involved, have all been different between the donor-built and self-built approaches, it is necessary to identify which factors affect disaster risk and resilience of housing in each approach. This allows a comprehensive and in-depth understanding of the strengths and weaknesses of each reconstruction approach, and subsequently, identifies and shapes the opportunities for building a resilient housing system for future climate hazards.

2.3 The Importance of Post-Disaster Housing Reconstruction to building Community Resilience

2.3.1 Introduction

The Sendai Framework for 2015-2030, to assist and guide the global DRR, published by the United Nations in 2015, has identified the ‘build back better’ way of post-disaster reconstruction as one of the four priorities in reaching an effective DRR and resilience enhancement (UN, 2015). Within this ‘umbrella’ concept, and given the role of improving pre-disaster fragilities, post-disaster housing reconstruction is considered to be the key intervention to reduce vulnerability and strengthen the resilience of the housing sector (Kennedy et al., 2008; Lizarralde et al., 2010; Charlesworth & Ahmed, 2015).

In Central Vietnam, disaster risk reduction for the housing sector becomes one of the major goals for disaster-prone areas (MONRE, 2008), in which post-disaster housing reconstruction (PDHR) is considered to be a good opportunity to reach this target and enhance community resilience (Charlesworth & Ahmed, 2015; Charlesworth, 2014; Archer & Boonyabancha, 2011). In the three commitments of the United Nations for future disaster management released in July 2013, the concentration on building resilience is the key to disaster risk reduction (DRR), in which future DRR interventions (e.g. post-disaster housing reconstruction) are required to promote resilient capacities of at-risk communities, particularly in developing countries (UN, 2013). This commitment is used to inform future plans and actions in the field of disaster management, including housing interventions from 2015 onwards, the time that the Hyogo Framework (2005-2015) expires.
This commitment motivated the researcher to pursue the course of building resilience for one of the most vulnerable sectors in developing countries, housing, through the examination of post-disaster housing reconstruction interventions.

As indicated by ESCAP and UNISDR (2012), the smaller-scale but higher-frequency disasters such as annual floods and typhoons in Vietnam have pressed greater impacts on local communities, compared to the larger-scale but lower-frequency disasters in the Asia Pacific Region. In addition, reconstruction after such small-scale disasters, known as small-scale interventions, frequently generates large-scale impacts over a wider region (Lyons, 2009). This is evidenced in the post-tsunami housing reconstruction in Sri Lanka (Lyons, 2009), or post-typhoon housing reconstruction in Central Vietnam (DWF, 2010), where safety-related measures introduced by agencies were replicated by people in other areas outside the project sites. Therefore, this section aims to investigate the effect of PDHR within a broad context of Central Vietnam, in order to understand how it can enhance community resilience and which issues need to be considered.

This section is structured into three parts. Firstly, an overview of PDHR in developing countries in the Asia-Pacific Region is provided, with a detailed discussion of both successes and shortcomings derived from some PDHR practices there. Next, the discussion focuses on the region of Central Vietnam, where PDHR has been extensively implemented but housing damage after recent disasters has not demonstrated a significant decline. This helps draw out an overall picture of post-disaster housing in Central Vietnam, and identifies core issues and factors required for the development of disaster-resilient housing in this region. The section also indicates the important role of PDHR in developing a resilient housing system, which will be discussed in the third part of this section.

2.3.2 Post-disaster Housing in Developing Countries

PDHR interventions are usually not similar in scale, approach, safe housing design concepts, and practical outcomes for post-disaster housing, among developing countries and between communities within a country. Housing reconstruction done by CARE in India after the 2001 earthquake provided 5,500 houses (see CENDEP, 2010); while post-tsunami housing programs in Sri Lanka supported the reconstruction of over 100,000 houses (Jayasuriya et al., 2006); and 88 houses were provided by Save The Children after Typhoon Xangsane in
Vietnam in 2006. There are also different reconstruction approaches used by agencies, such as the owner-driven and donor-driven approaches in India, the contractor-driven one in Sri Lanka, or the community-based approach in Vietnam. Despite different approaches and scales, housing reconstruction projects appear to have had a similar target, of bringing the most effective housing products for disaster-affected communities. However, since potential obstacles generated from local socio-economic, cultural and political pressures may undermine these attempts, some projects did not reach their targets in practice (i.e. in India, China, Indonesia or Vietnam) (Figure 2.11). Causes of this problem varied across the countries and communities, ranging from physical to social dimensions such as the different social contexts of at-risk communities, different reconstruction approaches employed by implementing agencies, and different types and scales of natural events.

Figure 2.11: An ineffective post-disaster house is used for fodder storage in India (Barenstein, 2006)

On the other hand, some practices have shown their success in providing locally appropriate post-disaster housing, thanks to the integrated reconstruction approach with the combined use of both local and new or innovative knowledge in safe housing outcomes (Mercer et al., 2010). For example, the owner-driven housing reconstruction after the 2004 earthquake in Gujarat, India, did satisfy local people, as local wisdom was effectively used alongside new knowledge, in housing design and construction interventions (Bareinstein, 2006). In addition, the housing reconstruction project after Typhoon Ketsana (2009) in Central Vietnam, undertaken by the IFRC and VNRC, was appreciated, since local construction techniques (timber construction) were fully applied with the support of new
construction methods (reinforced concrete) (Figure 2.12). Many exemplary examples in other developing countries have revealed their efficiency in providing suitable post-disaster housing thanks to their respect of local experience and knowledge in practical implementation. This is consistent with the study of Mercer et al. (2010), whose findings show that effective DRR is only achieved once local (indigenous) knowledge is integrated with new (scientific) knowledge and expertise.

![Figure 2.12: An effective post-disaster house is used as the main house in Vietnam (Source: Author)](image)

Recently, there has been a growing concern about the relationship between PDHR and community resilience. Schilderman and Lyons (2010) and Archer and Boonyabancha (2011) argue that PDHR is a good opportunity to strengthen and build community resilience and stabilize the development of at-risk households, rather than merely be seen as recovery action separated from the development process. Instead, it is necessary to view PDHR as a key stage of the process of creating housing in both pre- and post-disaster periods. Its role should be broadened to the extent that makes local housing and communities more resilient to future shocks or changes caused by natural disasters (Schilderman & Lyons, 2011).

However, this perception has been addressed in a limited way in practice to date, where much attention is paid to the visible end-products of housing. Some practices try to produce ‘good looking’ houses, with the presence of some strong elements for risk reduction (i.e. beams, posts, roof supports), but commonly without addressing socio-cultural, economic and environmental responses properly and adequately. This was evidenced in the post-disaster housing project
undertaken by the IFRC and VNRC after the 1999 flood in Central Vietnam, where the very effective storm- and flood-resistant houses built by steel structures were unused and rejected by people, because such steel structures were culturally unfamiliar to local residents, locally unavailable, and technically hard for local workers to repair and replicate. This is also seen in other cases such as post-earthquake houses in Gujarat and Tamil Nadu, India (see Barenstein, 2012), post-cyclone houses in Orissa, India (see Chhotray & Few, 2012), or post-cyclone houses in Bangladesh (see Mallick & Rahman, 2013). These examples were unsuccessful due to the limited understanding of implementers, particularly the outsiders of at-risk/vulnerable communities, about the local context (Ahmed, 2011).

In the present thesis, the concept of PDHR has been realized in a wider context, where housing reconstruction is examined through the lens of resilience, which involves different but interconnected factors, from technical and economic to social, environmental and cultural dimensions. Limited perception on the role of PDHR in building community resilience, mentioned above, explains the ineffective outcomes of post-disaster housing in recent projects, and hinders attempts of the wider public in enhancing the resilience of disaster-affected households and communities afterward. The present research, therefore, furthers the investigation of the role of PDHR within this sense, to better understand the importance of PDHR to increasing community resilience and building a resilient housing system. The next part will discuss this issue in detail, with a focus on Central Vietnam.

2.3.3 Post-disaster Housing in Central Vietnam

Since the key aspect of this research is to seek disaster-resilient housing solutions for vulnerable areas of Central Vietnam, examining DRR interventions in housing, particularly PDHR practices, was crucial in the study, to identify successes and shortcomings or gaps in current housing implementations, as well as to derive key lessons learned for future plans and actions on safe housing.

As floods and storms are the most common disasters in Central Vietnam (Tinh & Phong, 2010), PDHR practices within this region have been dominated by these two disasters. Over the past ten years, in Central Vietnam, most of the PDHR projects have been implemented by both governmental and non-governmental
agencies, including international aid agencies. However, there appears to have been a gap between the governmental and non-governmental approaches, in which governmental agencies (i.e. ministry of construction, city and district governments) have tended to put more focus on physical improvements, while non-governmental agencies (i.e. DWF or SC) have aimed to also extend their vision to socio-economic and cultural aspects. In addition, the limited use of community consultation and the lack of BEPs’ engagement in the planning and design process have been considered as two of the main causes of ineffective safe housing products provided by them, in recent times.

In the governmental approach, two housing programs provided by the Ministry of Construction, called 167 and 716, emerged as the key responses of the national government to housing risk reduction. These two programs followed a top-down approach, where communications and consultations between actors were mainly undertaken at the authority or administration levels for the improved project management, budget allocation, and disbursement and beneficiary household selection. Beneficiary households and communities still had a limited engagement and a modest voice in selecting the housing designs and construction methods. The 167 program commenced in 2009 and ended in 2012, with a small cash supply for disaster-affected families. Families had to add more money to adequately finance their housing construction. This program tended to focus on the *quantity* rather than the *quality* of housing, since technical improvements for safety purposes were less considered, or even neglected, in most of the 167 houses.

In addition, persons in charge of the 167 housing programs were frequently local administrative staff from the commune/ward People’s Committees, without having any in-field background or experience (e.g. built environment or disaster preparedness-related experience). Designs of the 167 houses conformed to the standard designs, and were quite similar across provinces and communities; and, in most cases, they reflected a low response to local contexts and actual needs of households. Socially, this program also showed a limitation since it provided beneficiary households with the same amounts of money despite their differing economic capabilities. This caused poor families without adequate financial capacity to stop their housing construction in the middle stages and leave their houses unfinished; with the houses, commonly, as a result lacking doors, windows
structural bracings or connections. These, unexpectedly, have made beneficiary households more vulnerable, and will potentially exacerbate housing damage and loss in future disasters.

The 716 program commenced in late 2012 and finished in mid-2013, to provide 700 safe refuges-on-stilts for flood regions in Central Vietnam. Similar to the 167 program, people were encouraged to add more money to a small amount of the government-subsidised budget for completing their housing construction. These on-stilt refuges are effective for flood protection, as they were designed with the floor higher than the highest flood level of the past. These 716 houses were also appreciated since they offered beneficiary households (who could add or mobilize adequate finance) an opportunity to upgrade to two-storey houses to have more living space.

In general, there was an improvement from the 167 to the 716 program (Figure 2.13), as more stakeholder consultation and technical support from built-environment professionals were used in parallel with the cash provision. While the 167 program left the construction to be performed mainly by local people, the construction of flood-protection refuges in the 716 program involved external professional agencies to ensure the technical quality of safe housing (i.e. the NGO DWF worked as a technical consultant for disaster risk reduction purposes).

<table>
<thead>
<tr>
<th>The 167 program</th>
<th>The 716 program</th>
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**Figure 2.13:** Two national housing programs, 167 and 716, in Central Vietnam
In the non-governmental approaches, there are three NGOs who have demonstrated their important engagement in the reconstruction of post-disaster permanent housing in Central Vietnam. They are the Development Workshop France (DWF), Save The Children UK (SC), and Habitat for Humanity (HFH). These three agencies have different approaches to PDHR, different ways of conducting community consultation and using built-environment professionals, mostly architects and engineers, and, obviously, different outcomes of post-disaster housing. DWF has utilized the family-tailored approach where safe houses are provided based on the real socio-economic situation of each family; SC has offered a so-called community-based approach; and HFH has employed the test-based approach through the construction of some demonstration or model houses in the targeted community.

The researcher had the chance to observe the houses provided by these three agencies, through his former working periods; and found that the three approaches provided by these three NGOs have both positive and negative outcomes. Within the family-tailored approach, DWF applied ten storm-resistant principles in almost all their safe houses, to identify the best housing design option(s) for each household based on their living needs and financial capacity (DWF, 2010). This approach allowed people to actively participate in and control the process, particularly at the decision-making stages; and received high appreciation and adoption from locals.

Through the community-based approach, SC undertook the design of safe housing with the participation of community members in the planning and design phases (SC, 2007). However, problems were found in the construction phase, where contractors outside the community were hired for construction implementation, while an abundant local labor force was unused. This resulted in increased construction costs due to increased labor costs, and therefore, reduced the size of rebuilt houses. Through the experiment-based approach, HFH constructed a few demonstration houses in the selected disaster-prone areas (i.e. Quang Nam Province, Central Vietnam), to gain community opinions and feedback before replicating the model on a larger scale. Based on the researcher’s experience, these HFH houses were effective for storm resistance but highly expensive for most vulnerable households who mainly belong to low-income groups.
These three reconstruction approaches indicate various attempts of NGOs in seeking safe housing development solutions in Central Vietnam (Figure 2.14). Each approach has had its own strengths and weaknesses in terms of community consultation and built-environment professional involvement, and generated different outcomes for safe housing in practice. From these experiences, it is evident that, in general, the long-term effectiveness of post-disaster housing can be achieved if local responsiveness and adaptation are properly addressed in safe housing designs. The importance of integrating local and new or innovative knowledge for better risk reduction that was highlighted in the literature (e.g. Mercer et al., 2010; Gaillard & Mercer, 2012) was, again, reinforced by these PDHR practices based in Central Vietnam.

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<tbody>
<tr>
<td><img src="image1.jpg" alt="Family-tailored" /></td>
<td><img src="image2.jpg" alt="Community-based" /></td>
<td><img src="image3.jpg" alt="Experiment-based" /></td>
</tr>
</tbody>
</table>

*Figure 2.14:* NGO-funded post-disaster houses in Central Vietnam (Source: Author)

The above discussion illustrates that different approaches to PDHR can bring different housing outcomes, and that community consultation and the involvement of built-environment professionals have a strong link to the success of design solutions (Lawther, 2009; Ganapati & Ganapati, 2009; Aquilino, 2011). While government-funded housing programs have favored the improvement of technical aspects of housing, based on the government’s prevailing view of PDHR as a single recovery action, NGO-funded housing projects appear to be more sensitive and effective, with a better use of community consultation and a balanced consideration of both technical and social aspects of safe housing.
Despite attempts to reduce social vulnerability through public awareness raising and technical training initiatives, along with safe housing construction, there appears to be an absence of comprehensive approaches to link PDHR efforts with the ongoing development of disaster-prone groups and communities and their housing. As witnessed in reality, local construction practices in hazard-prone areas of Central Vietnam still contain a high potential of reproducing risks to future disasters, regardless of the availability of some safe houses built by aid agencies nearby. As observed by the researcher through his former working experiences, self-built houses (built by people), even next to donor-built houses (built by agencies), did not follow what their neighboring dwellings followed for safety purposes. What was done in the self-built houses was to follow the same practices as before, based on their available experiences gained from past events or inherited from previous generations. To account for this phenomenon, in 2010, DWF conducted a study to assess the real efficiency of their safe-housing projects in reality; and, interestingly, found that the main reasons for people not widely applying some of the cyclone-resistant principles were the cost and cultural inappropriateness of such safe construction methods.

This practical problem also poses increasing concerns about underlying drivers. Such drivers are mainly linked to the limited resources and capacity of prone communities against natural disaster (Wisner et al., 2004; Chang et al., 2010; DWF, 2010). In the light of community resilience, basic functions and facilities required for enhanced resilience need to be locally available and easy to mobilize, for accommodating changes or stresses caused by disasters (IFRC, 2012). For housing within Central Vietnam, the key driver is the ability of householders, local construction workers and community members to prepare measures for stresses or changes triggered by floods and cyclones. In this sense, PDHR becomes a suitable response, to improve pre-disaster fragile or vulnerable conditions that are commonly found and identified after disasters. This also indicates a close relationship between PDHR and community resilience, where PDHR is one of the key stages of the development process of at-risk/vulnerable communities and households.
2.3.4 Concepts of Disaster Resilience for Housing

It was found from the literature review that disaster resilience was seen as the ability of an individual, a system, or a community exposed to a hazard, to accommodate all impacts from that hazard and bounce back to normalcy in an efficient manner, without significant changes of their basic functions (ISET, 2012; UNISDR, 2009; Amaratunga & Haigh, 2011; Pendall et al., 2010; IFRC, 2012).

As ISET (2012) and Tyler and Moench (2012) argue, understanding vulnerable conditions of a given sector, such as housing in this thesis, is the key to finding the best way of building its resilience. The emerging aspect of this concept is the focus on building adaptive rather than preventive capacities for vulnerable sectors/areas to absorb negative effects caused by unanticipated hazards. This concept is quite appropriate to the present and future times, where climate change and climate-related disasters (e.g. storms, floods) are estimated to increase and extensively show their uncertainty and unpredictability (Deser et al., 2012). This concept is also similar to the viewpoint of IFRC (2012), which considers resilience to be the ability to absorb shocks, stresses, and uncertainties caused by disasters, rather than to predict and prevent disasters as before. This thesis, therefore, examines the concept of disaster-resilient housing from the perspective of this perception and through the lens of PDHR, within the context of Central Vietnam.

2.3.5 The Link between Post-Disaster Housing and Disaster-Resilient Housing

Housing often represents one of the most affected sectors by natural disasters, and frequently covers large proportions of damage and loss after disasters (UN-HABITAT, 2011). Many experts and scholars (Lyons & Schilderman, 2010; Amaratunga & Haigh, 2011; Bosher & Dainty, 2011; Johnson & Lizarralde, 2012) and agencies (e.g. UN-HABITAT, IFRC, and Habitat-for-Humanity) have highlighted the link between PDHR and the enhanced resilience of residential housing. Accordingly, PDHR not only focuses on mitigating risk exposures physically and meeting basic accommodation needs, but also addresses resident’s psychological, economic and social needs and aspirations in the long term (Tas et al., 2007).

From the concept of resilience provided in Section 2.3.4, disaster-resilient housing can be defined in both physical and social ways, in which improving
responsive and adaptive capacities for housing is preferable. As mentioned earlier, PDHR in Central Vietnam has still paid more attention to physical improvements for safety purposes, while socio-economic and cultural responsiveness have received limited consideration. Davis (2011) asserts that it is crucial to “regard shelter and dwelling reconstruction as a development rather than relief/welfare issue” (Davis, 2011, p. 209).

Some unsuccessful PDHR projects have shown a linkage to a lack of utilizing local values/resources and limited response to local contexts. For example, the post-1999 flood houses in Vietnam provided by IFRC, with the use of core steel structures for flood-resistant houses, were not appropriate to the local context, since steel materials were locally unavailable and local workers had a limited understanding of how to use and assemble steel elements:

Their plight creates a considerable risk for well-intentioned aid and recovery to actually pose greater harm than good, similar to the trends observed in Africa, as the pressure to meet immediate human needs often leads to imported resources and infrastructure that cannot be sustained after non-governmental organizations (NGOs) withdraw their aid. (Correa & Taflanidis, 2012, p. 766)

Many publications have identified the three clear stages of housing provision following a disaster: temporary housing for emergency periods, transitional housing for recovery, and permanent housing for reconstruction (Davis, 2011; Johnson & Lizarralde, 2012; SKAT & IFRC, 2012) (Figure 2.15). However, this conventional process is not always seen in reality, in particular in small-scale but high-frequency disasters such as annual floods and cyclones in Central Vietnam, where temporary and transitional housing often overlap each other. As the overall goal of the present research is to find long-term housing solutions for disaster-prone areas of Central Vietnam, this thesis only focuses on the reconstruction of permanent housing where long-term living needs and capacities of vulnerable communities and households are addressed.

PDHR is not only to restore damaged parts but also to improve pre-disaster fragile conditions (Schilderman & Lyons, 2011; Charlesworth & Ahmed, 2015). Physical improvements of safe housing need to go along with the enhancement of social, economic and environmental dimensions (UNEP & SKAT, 2007), to
sustain the development of disaster-affected communities and households (Lizarralde et al., 2010; Amaratunga & Haigh, 2011; Archer & Boonyabancha, 2011). By using this approach, it is likely to meet the demand of ‘building back better’ (Schilderman & Lyons, 2010, 2011) for post-disaster housing.

![Figure 2.15: The significance of post-disaster housing reconstruction in building long-term resilience (Based on Davis, 2011; SKAT & IFRC, 2012; Johnson & Lizarralde, 2012)](image)

However, in practice, misinterpretations of ‘building back better’ have existed, when it has sometimes been viewed as ‘build back safer’ without sufficient consideration being given to other aspects (e.g. social, cultural) of safe housing (Schilderman & Lyons, 2011). This misinterpretation is likely to lead to an excessive focus on producing visible end-products of safe housing, potentially triggering problems concerning cultural appropriateness and social suitability of housing outcomes (see Boen & Jigyasu, 2005 for an Indonesian case; Barenstein, 2006 for an Indian case):

We found that the reconstruction sector is changing only slowly. Many of the agencies involved are reluctant to move from a supply-driven relief mode to a supportive mode that is more appropriate to reconstruction. Often also, reconstruction takes place in isolation from the housing
In general, the essential role of PDHR in the enhanced disaster resilience of local housing has been clearly shown in the above discussion, to the extent that PDHR is a good opportunity to develop disaster-resilient housing. To signify the role of PDHR, an overall approach is required, with a wider vision on post-disaster housing, as presented in this thesis, in which PDHR is considered as a firm basis to build a resilient housing system.

2.3.6 Post-Disaster Housing Reconstruction as a Significant Opportunity to Building a Resilient Housing System

Several case studies (i.e. housing reconstruction after the 2001 earthquake in Gujarat, India, performed by SHA (Barenstein, 2006), or after the 2009 earthquake in West Sumatra, Indonesia, performed by CARE) have demonstrated the relationship between PDHR and the improvement of pre-disaster fragile situations (i.e. improving unsafe local construction practices or raising local awareness), an important factor for building a resilient housing system.

As mentioned before, it is impossible to view PDHR as a single recovery action separated from the development process of housing and settlements (see UN, 2006; Archer & Boonyabancha, 2011). Housing development often follows an endless process, of meeting changing needs of functional use, living space and aesthetic aspirations, generated by the urbanization, modernization and globalization process. According to Davis (1978, 2011), housing is a process wherein designers create a ‘place’ with meaning rather than a ‘space’ for protection from hazards. It involves both pre- and post-disaster interventions to bring values or benefits for occupants. PDHR, a full replacement of people’s living spaces after disaster events, therefore, could not stand outside this process. Within this perception, fragile or vulnerable conditions of housing that existed before a disaster need to be identified and improved in post-disaster housing reconstruction, for a better outcome of safe housing.

Furthermore, interestingly, in the reality of Central Vietnam, such fragile conditions are viewed as the main cause of housing risks to natural disasters. Vulnerable conditions are usually repeated by people (i.e. unsafe methods of construction) without adequate management and control from local authorities for
risk reduction. Huge damage and losses recorded after recent disasters (i.e. Typhoon Xangsane in 2006 and Typhoon Ketsana in 2009) have emphasized the importance of improving pre-disaster fragile conditions through PDHR efforts for building a resilient housing system in Central Vietnam. Using this approach, post-disaster housing reconstruction is able to upgrade the housing sector to resilient status (Figure 2.16), to maintain a stable development of the affected or prone communities (Archer & Boonyabancha, 2011; Lyons, 2009).

Figure 2.16: Post-disaster reconstruction as the key to approaching resilient conditions
(The diagram was developed by the researcher based on the literature review)

2.4 Community Consultation as an Essential Element of Housing Reconstruction

2.4.1 Introduction

The use of community consultation has been considered to bring a better outcome to post-disaster housing (Ganapati & Ganapati, 2009; Gaillard & Mercer, 2012), since community consultation and post-disaster housing reconstruction are significantly linked (Lawther, 2009; Davidson et al., 2007; Sliwinski, 2010). Rand et al. (2011) conducted a study to evaluate the satisfaction of residents towards the Oxfam-funded houses after the 2004 tsunami in Aceh, Indonesia; in which community consultation and the active involvement of beneficiaries in implementation (not only in construction works) formed the key factor for
increasing residents’ satisfaction. Gaillard and Mercer (2012) provide a road map for reaching an effective DRR in which dialogue and consultation among a wide range of stakeholders, inside and outside the at-risk community, formed the core component of the process. In addition, many publications (e.g. Hayles, 2010; Gaillard & Mercer, 2012; Bosher & Dainty, 2011) have highlighted the important role of community consultation in the success of DRR interventions, in particular in achieving the best outcomes for post-disaster housing (Lawther, 2009; Hayles, 2010).

This section, therefore, will discuss the role of community consultation in PDHR to achieve disaster-resilient housing. The issue of community consultation emerged from the literature review as one of the key elements for the long-term efficiency of post-disaster housing (DFID & Shelter-Centre, 2010; Ganapati & Ganapati, 2009) and community resilience (Magis, 2010; Paton, 2013). In some developing countries, such as Vietnam or India, community consultation has often been conducted in one-off discussions following one-off PDHR projects, and ended or discontinued immediately after the project completion. In addition, community consultation has also been perceived as one-way communication from implementers to disaster victims or affected people, to capture their living needs for future housing design developments. This is actually a limited perception of the value of community consultation that undermines efforts at improving DRR and building community resilience. To tackle this gap, the present thesis views the concept of community consultation in a broader context, where at-risk communities and households are among the key participants in the consultation process, who not only answer questions given by facilitators but also discuss and share their experiences and expectations of the selected safe housing options.

This section is divided into three parts. The first part is an examination of the significance or value of community consultation; followed, in the second part, by a debate on the relationship between community consultation and post-disaster housing, where key challenges concerning the implementation of community consultation are discussed. The third part provides a gap found in up-to-date theories and practices on PDHR, in the light of community consultation, where consultation-related problems and associated issues are identified.
2.4.2 Value of Community Consultation

The fourth Session of the Global Platform for DRR (May 2013) emphasized community engagement and consultation as one of the most important principles to achieve the best results for disaster resilience (UNISDR, 2013):

Systematic and meaningful inclusion of communities in planning, decision making and policy implementation is a must. (UNISDR, 2013, p. 13)

Ahmed and Charlesworth (2013) highlight the importance and necessity of involving community consultation to ensure local acceptance and user satisfaction towards safe housing products. Innes and Booher (2004) argue that community consultation is not only the one-way communication from implementing stakeholders to end-users but also includes shared learning activities in which users and implementing stakeholders thoroughly understand each other and collaboratively come to agreements and decisions for housing design improvements and developments:

The central contention is that effective participatory methods involve collaboration, dialogue and interaction. They are inclusive. They are not reactive, but focused on anticipating and defining future actions. (Inner & Booher, 2004, p. 422)

Innes and Booher (2004) identify four main purposes of community consultation: (1) to discover universal or public preferences; (2) to improve decisions by incorporating user’s local knowledge; (3) to achieve fairness and justice; and (4) to gain legitimacy for decisions. These purposes appear to be close to administrative and governance aspects, since they support the delivery of public decisions based on community needs. However, the issue of assisting grassroots people to better cope with natural disasters is not found in the publication of Innes and Booher (2004). In self-built housing reconstruction in Central Vietnam, many unsafe conditions were seen to be due to the lack of technical consultation with professional bodies (e.g. architects, engineers working in the DRR field) for a safer home-built environment. The present research, therefore, added one more purpose to the four purposes given by Innes and Booher (2004), in which providing technical support on disaster resilience for at-risk groups and communities is an essential task of community consultation.
From the literature, the definition of *community consultation* could be broken down into two terms: *community* and *consultation*. The *community* here not only mentions beneficiary groups and households who directly benefit from PDHR projects or are affected by disasters, but also encompasses a wide range of stakeholders, including built-environment professionals, local authorities, civil society, the private sector and builders (Bosher et al., 2007). *Consultation* here is ‘a multi-dimensional model where communication, learning and action are joined together and where the polity, interests and citizenry co-evolve’ (Inner & Booher, 2004, p. 422). ISET (2012) and Tyler and Moench (2012) argue that the process of *community consultation* consists of shared learning dialogues and proactive communicative forms, where the at-risk community and external stakeholders thoroughly understand each other prior to making decisions.

Through the lens of post-disaster housing, *community consultation* is perceived as a model or framework to enable at-risk community and external stakeholders (built environment professionals, local government, civil society, and the private sector, etc.) to communicate, learn, and interact effectively for the delivery of appropriate agreements and decisions on future plans, implementations and actions on safe housing (e.g. selecting housing designs and construction methods).

**The Nexus between Community Consultation and Post-Disaster Housing**

There is a strong consensus among authors (Pearce, 2003; Lawther, 2009; Snarr & Brown, 1982; Ganapati & Ganapati, 2009; Davidson et al., 2007; Hidayat & Egbu, 2010) that *community consultation* is the key to achieving the long-term effectiveness of post-disaster housing, and offers the affected communities a sense of familiarity, ownership, and empowerment. Although this subject is not a new topic in the DRR field, the limited use of it in recent post-disaster housing reconstruction projects has indicated the need for a further investigation of this subject within locally specific contexts or situations, such as Central Vietnam as addressed in this thesis, to understand core issues beyond an effective *community consultation*.

It is a real challenge to stakeholders or implementers who want to seek appropriate forms of community participation and consultation (Lawther, 2009; Ganapati & Ganapati, 2009). The complexity and the large-scale of PDHR projects may undermine this effort, because the so-called community-based
reconstruction is likely to be transferred to contractor-driven projects, if limited attention is paid. This may lead to the reduced involvement of at-risk communities (Barakat, 2003), and hence, limited community consultation. In some cases, especially in developing countries such as Sri Lanka (e.g. Minamoto, 2010) or Indonesia (e.g. Petal et al., 2008), misperceptions of community consultation and improper ways of consulting with involved actors has resulted in ineffective or unsuccessful outcomes of post-disaster housing. In cases of self-built housing, where people rebuilt their houses on their own, as seen in many vulnerable areas of Central Vietnam, communication and consultation with technical and professional parties for a safer construction appeared to be absent. Most of the self-built houses were built from people’s available experiences, and often followed the same structures and construction methods used for old houses that were previously destroyed by disasters. This posed a real demand for incorporating community consultation and technical assistance in providing housing for this group (self-built), to strengthen their resilience to future disasters.

<table>
<thead>
<tr>
<th>Table 2.5: Six common PROBLEMS related to community consultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Uncontrolled situations of time, cost, and building quality.</td>
</tr>
<tr>
<td>➢ Limited knowledge and skills of facilitators.</td>
</tr>
<tr>
<td>➢ Potentially creating platforms where political-conflicting opinions are given.</td>
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<tr>
<td>➢ The narrow definition of the term community.</td>
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<tr>
<td>➢ Limited use of community’s feedback in planning and implementation.</td>
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<tr>
<td>➢ One-way communication between stakeholders.</td>
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*(Based on Lawther, 2009; Ganapati & Ganapati, 2009; and Innes & Booher, 2004)*

Lawther (2009) highlights three main risks of community participation and consultation in PDHR: (1) the over-dependency on local communities may result in uncontrolled situations of time, cost, and construction quality; (2) the limited capacity of consultation facilitators may take the local community out of the process; and (3) it is likely to create a political platform with which residents may show their opposed opinions to current administration systems. Ganapati and
Ganapati (2009) came up with two challenges for *community consultation*: (a) the narrow definition of the term *community*; and (b) the limited use of community feedback in planning and implementation. These six problems have commonly been seen in many PDHR projects throughout developing countries such as Vietnam, and are the main causes of ineffective post-disaster housing products in reality.

From these challenges, it is considered that facilitating *community consultation* is not an easy task, because it requires an in-depth understanding of what is meant by the *community* in a specific context, and of the use of proper ways to consult with involved actors/stakeholders effectively. Some so-called community-based housing projects have faced problems relating to *community consultation*. For example, in a housing recovery program in Sri Lanka, persons selected for joining the consultation said that they were forced to participate and that their levels of perception were lower than others who could provide better responses (Minamoto, 2010). In the country, La Hermandad, the *community consultation* used for a housing reconstruction project after the 2001 earthquake resulted in conflicts and tensions among new residents (Sliwinski, 2010). In some developing countries, such as Vietnam and Indonesia, many houses provided by aid agencies through community-based approaches were unoccupied by people, while old houses nearby were popularly used, even in unsafe conditions (Audefroy, 2010). Therefore, *participatory* or *community-based* approaches do not always ensure a good outcome or result, if consultation facilitators have a limited understanding of the real meaning of *community consultation* for a given community and how to consult with the target groups properly and effectively (Minamoto, 2010).

Since post-disaster houses would be permanently occupied and lived in by beneficiaries, inhabitants or users need to be placed at the center of the consultation process (Schilderman & Lyons, 2011) to fully capture their living needs and capacities, before proposing resilient design options for their housing. As highlighted by Ganapati and Ganapati (2009):

*They (implementers) should involve disaster victims in the planning process on a timely basis, and not after the key decisions are made. They should present disaster victims with alternative planning process scenarios and consult with them on measures of project success.*
2.4.3 Lack of Overall Approaches for Disaster-Resilient Housing through the Lens of Community Consultation

*Community consultation,* despite being mentioned in many publications (e.g. Lawther, 2009; Ganapati and Ganapati, 2009; Barakat, 2003; Petal et al., 2008), continues to receive inconsistent consideration in the literature due to differing points of view on its concept and meaning. Jha et al. (2010) suggest a conceptual model for post-disaster housing in which community consultation is part of the process, but without specific instructions and guidelines for how to conduct consultation in practice. Davidson et al. (2007) propose a stakeholder participation model for post-disaster reconstruction with the major roles given to three stakeholders: beneficiaries (disaster victims and survivors), NGOs, and government (Table 2.6). Community (stakeholder) consultation appears to be focused on the planning and designing phases in the model of Davidson et al. (2007), while being neglected in post-occupancy periods. In fact, building modifications or extensions often occur in these post-occupancy periods, and hence, require consultation and technical assistance for proper interventions. Another limitation was also found in this model, in terms of consultation, as it was formulated from the examination of four donor-built reconstruction projects (done by NGOs and/or governments) without considering the self-built processes. In addition, the model showed a lack of detailed instructions and guidance for the engagement of stakeholders/actors in the community consultation process.

Table 2.6: Correlation between stakeholders and phases of post-disaster reconstruction (adopted from Davidson et al., 2007)

<table>
<thead>
<tr>
<th></th>
<th>Beneficiaries</th>
<th>NGO</th>
<th>Government</th>
<th>Hired Contractor</th>
<th>Private Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program initiation</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Project planning</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Construction</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Post-project modifications</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the Asian context, Leonhardt (2012) recommends the establishment of a social platform for bettering community participation and consultation, since most Asian
countries follow top-down development models where people are often isolated from the decision-making processes. This social platform is likely to create an enabling environment where at-risk communities and external stakeholders, particularly professional bodies, can freely share their opinions and learn from each other, and collaboratively come up with reasonable agreements and decisions. However, the work of Leonhardt (2012) remains limited in raising the importance of stakeholder engagement in seeking solutions, without specific guidance on how to build such social platforms for a given specific context or region (e.g. Central Vietnam).

In practice, some post-disaster housing projects with improper use of community consultation have reduced users’ satisfaction towards safe housing. For instance, beneficiaries from a housing recovery project in Turkey were not happy with their new houses since the construction mostly involved agencies without cooperation with beneficiaries to really capture and respond to their needs (Ozden, 2006). The post-2004 tsunami housing reconstruction in Sri Lanka undertaken by donors did not involve methods of community consultation in the process (Nakazato & Murao, 2007). Community consultation used for a housing reconstruction project in Aceh, Indonesia after the 2004 Indian Ocean Tsunami revealed a limitation in the extent to which local masons were provided with understanding of why and how to build safe structures (Petal et al., 2008).

It can be said that there is a significant difference between community participation as found in free labor during construction, and active engagement in the whole design-and-construction process of housing (Sliwinski, 2010). Current theories and practices appear to be effective in addressing the necessity of community consultation, but are limited in clarifying the role and contribution of community consultation and the methods to implement it in practice. It has been argued in the literature that community consultation will not result in effective outcomes for safe housing if there is a misperception of the meaning of community, limited capacity of facilitators, improper ways of consultative discussion, and limited use of community feedback.

As defined earlier, the nature of consultation is the mutual interaction and learning process between two or more groups who require knowledge from each other to come up with appropriate solutions or decisions. The development of disaster-resilient housing essentially demands the combination of both local and external
stakeholders, and both indigenous (local) and scientific (innovative) knowledge (ISET, 2012; Mercer et al., 2010) for long-term outcomes. However, there is no ‘perfect’ method or approach for community consultation (Davidson et al., 2007; Sliwinski, 2010), because of the different peoples-in-need and dissimilar cultural and social backgrounds of at-risk communities. Thomas (1995) conceptualizes public participation into seven degrees of involvement, in which the establishment of a committee, encompassing representatives from all stakeholders involved, is recommended for decision making. This committee is helpful for building public consensus on and acceptance of suggested solutions (Thomas, 1995). Davidson et al. (2007) propose a theoretical ladder to classify the level of community involvement in post-disaster housing reconstruction. Accordingly, five levels of community involvement are presented, from low to high, respectively: manipulate, inform, consult, collaborate, and empower (Figure 2.17). Empowerment, the highest level of participation, has the highest likelihood of satisfying residents, since it allows full control by residents over the whole process of housing design and construction.

![Figure 2.17: Levels of community engagement in building built-environment resilience (Davidson et al., 2007)](image)

However, the empowerment level, in some cases, is hard to achieve due to unexpected obstacles generated from local contexts and practical situations. Therefore, it is crucial to investigate what are the core issues relating to community consultation for the specific context of Central Vietnam where the present research is based. This helps to explore the key aspects of community consultation for the outcome of disaster-resilient housing. The next section provides more detail on this matter, to examine the relationship between
community consultation and the development of disaster-resilient housing, with a focus on Central Vietnam.

2.4.4 Lack of Community Consultation in designing Post-Disaster Housing

The consultation-related problems mentioned above are clearly seen in the situation of Central Vietnam, in which the narrow view of the term *community* and the limited ability of facilitators appears to be the most common. In recent PDHR projects by aid agencies (e.g. Save the Children, Habitat for Humanity, or Vietnam Red Cross), community participation for the design of safe housing has usually been limited to the involvement of disaster victims or survivors, and most consultations were generated and conducted surrounding this group (see IFRC, 2010 for the reconstruction after Typhoon Ketsana in 2009; Save the Children, 2007 for the 2006 typhoon; and HHVN, 2010 for the 2009 typhoon). In addition, facilitators used for such consultations usually have various backgrounds, from social workers and activists to office and technical staff. In some cases, untrained volunteers were used for this work. The engagement of built-environment professionals was rarely seen in this position, for various reasons, such as those architects responsible for designing safe housing (outside the beneficiary community) could not come to the site to conduct consultations. This showed their underestimation of the importance of community consultation in bringing long-term post-disaster housing outcomes.

In Central Vietnam, there has been a lack of study detailing the issue of community consultation and clarifying its contribution to the efficiency of safe housing outcomes. In addition, community consultation was only used within the donor-built group (provided by agencies), and frequently occurred in the form of one-way communications, where beneficiaries were invited to answer questions or inquiries rather than actively discussing the selected housing solutions (Anh et al., 2013).

In the self-built group, who rebuilt their houses on their own, consultation appears to not exist, except for informal local talks or sharing dialogue between residents about their housing construction or renovation. Self-built owners freely decide the form and methods of construction for their houses, and frequently exclude safety-related measures. This fact has become increasingly common in disaster-prone areas of Central Vietnam; but very few studies and publications have mentioned
this so far. This emphasizes the need for the present study to extend the view of post-disaster housing to this group (self-built), to further investigate how external parties such as local authorities or building designers can assist the improved resilience of this type of housing.

2.4.5 Summary
This section has discussed one of the three key themes of this thesis, community consultation, through the lens of post-disaster housing reconstruction and community resilience. Opportunities and challenges faced by a wide range of stakeholders in the community consultation process were also identified in the above discussion. While there is a wide agreement among authors about the significant role of community consultation in post-disaster housing reconstruction and increasing disaster resilience, narrow understanding of the term community, limited knowledge and skills of consultation facilitators, and limited uses of community feedback in planning and implementation, appear to be the most significant challenges. This section has also identified four key issues for community consultation in developing disaster-resilient housing:

- *Community consultation* is a mutual (not one-way) communication, with interactive learning and a sharing process that involves a wide range of stakeholders in seeking agreements, decisions, and solutions on the chosen safe housing options.

- Experienced and professional persons such as architects and engineers working in the DRR field are likely to bring effective community consultation, as they can fully understand and capture short- and long-term needs and expectations of at-risk/vulnerable communities, and then can translate these into spatial and technical solutions for safe housing (i.e. locally suitable spatial layouts, safe construction methods, and techniques).

- The issue of community consultation continues to receive limited consideration in disaster risk management in Central Vietnam, both in practice and in research communities. In some recent PDHR projects involving consultation activities, the outcome of post-disaster housing was not strongly linked to the findings of previous consultative discussions and talks conducted in the planning and designing phases. In research, the issue of community consultation has not sufficiently been conceptualized
and analyzed, except for some publications that mention it as an important factor for better housing outcomes. Concepts, principles, and guidelines for community consultation are still absent from Central Vietnam.

➢ The disaster-resilient capacity of self-built housing is likely to be improved if technical consultations with professional parties (e.g. architects, engineers, DRR experts) are included in the building design process. There has been no community consultation for this self-building group in terms of improving the resilience of their housing, and many unsafe conditions can be found in their existing houses.

Since the engagement of professional and technical parties is one of the important factors for improving DRR (Charlesworth, 2014; Lizarralde et al., 2010; Aquilino, 2011), the next section will further discuss the role of built-environment professionals, to better understand how architects and other building experts can enable and support the development of disaster-resilient housing.

2.5 The Essential Role of Built-Environment Professionals

2.5.1 Introduction

The involvement of BEP has been known as one of the key factors for the success of post-disaster housing and the improved resilience of disaster-prone communities (Charlesworth, 2014; Charlesworth & Ahmed, 2015; Haigh & Amaratunga, 2010; Davidson et al., 2007; Lizarralde et al., 2010; Max Lock Centre, 2009; Aquilino, 2011; Architecture-for-Humanity, 2006). The importance of professional assistance and technical input for disaster-safety improvement has been acknowledged since the 2004 Indian Ocean Earthquake and Tsunami, with time witnessing the technical weakness of many buildings as being the main cause of enormous damage and losses (Aquilino, 2011). However, there have not been many studies focusing on the role of BEPs in disaster risk reduction, except that some have mentioned it as a necessity for better disaster risk management (e.g. Davidson et al., 2007; Haigh & Amaratunga, 2010).

In Central Vietnam, this gap is exacerbated since there appears to be no research in this field; and, in practice, very few agencies have employed BEPs for post-disaster housing design and construction (e.g. Development Workshop Frances or Save the Children). This has made the objective of exploring the role of BEPs in this study more important and significant, to better understand how BEPs can
contribute to and support the development of disaster-resilient housing in this region:

More than ever there is a crucial and immediate need for architects (along with other built-environment professionals) to bring their training, competence, and ingenuity to disaster-risk prevention, mitigation, response, and recovery. (Aquilino, 2011, p. 8)

According to Architecture-for-Humanity (2006), the engagement of BEPs in meeting increasing housing needs and mitigating crises or disruptions of human society caused by natural disasters has a practical meaningfulness, although their roles are not widely appreciated and acknowledged in many countries (Aquilino, 2011). Recently, there has been a growing concern about the usefulness of scientific and innovative knowledge in DRR, where available personnel resources such as BEPs have appeared to be insufficient to meet this demand (UNISDR, 2013). The Hyogo Framework for 2005-2015 highlighted the need for science and technology in disaster risk management (UNISDR, 2005). The global platform on DRR in May 2013 pointed out the importance of professional expertise and skills in the achievement of long-term disaster resilience (UNISDR, 2013). In addition, the 2013 Asia-Pacific Housing Forum paid more attention to the promotion of resilient housing and viewed it as a pathway to poverty alleviation and sustainable development of prone communities (Habitat-for-Humanity, 2013). However, there remains a shortage of educated and trained persons to meet this goal (UNISDR, 2013):

There is an unmet demand for data, tools, methods and guidance on implementing risk reduction, and a shortage of specialists educated and trained for the task. (UNISDR, 2013, p. 14)

Therefore, this section focuses on the role of BEPs and their potential contributions to the effectiveness of post-disaster housing and the development of disaster-resilient housing in Central Vietnam. This section is structured into three parts. The first part discusses the main problems associated with the engagement of BEPs in post-disaster housing reconstruction. The second part provides more detail on the potential contribution of BEPs to the process; and the third part
deepens understanding of the role of architects in building disaster resilience for low-income housing.

2.5.2 Post-Disaster Housing Outcomes and its Linkage to BEPs’ Engagement

The increased damage to buildings, particularly housing, caused by recent disasters (e.g. the 2004 India earthquake and tsunami, the 2008 typhoon in Myanmar, the 2009 typhoon in Vietnam, or the 2010 Haiti earthquake) has highlighted the importance of professional expertise and skills to creating safer civil construction. There is a broad range of literature addressing various problems of post-disaster housing in relation to the involvement of BEPs. Such problems are not only the absence of BEPs but also the limited or ineffective engagement of BEPs in the process. As evidenced in Sri Lanka after the 2004 tsunami, owner-driven post-disaster housing, despite its spatial response to the local context, gave rise to unsafe conditions in their structures, because of the lack of BEP involvement in implementation (Karunasena & Rameezdeen, 2010). In contrast, donor-driven post-disaster housing with the participation of BEPs, even in safer conditions, has revealed its limited success, since their spatial layouts did not conform to people’s lifestyles (Karunasena & Rameezdeen, 2010). Similar phenomena could be found in Vietnam, where self-built post-disaster houses have lacked safety-related measures in their structure, while donor-built ones have faced problems regarding cultural appropriateness and local suitability (see, for example, IFRC, 2002; DWF, 2010) (Figure 2.18).

Figure 2.18: IFRC and VNRC’s steel structure provided after the 1999 flood was unfavorable to local people (IFRC, 1999)
In Tamil Nadu, India, the limited understanding of the involved BEPs of the local context led to the unsuitability of new safe houses to the local settings and, subsequently, resulted in the low satisfaction of inhabitants. In particular, most old but culturally familiar houses and existing shade-providing trees were demolished to leave space for new houses rebuilt after the 2004 tsunami (Barenstein, 2012) (Figure 2.19). Even with the support of BEPs for housing reconstruction, most contractor-rebuilt houses in Tamil Nadu dissatisfied local people due to this demolition (Barenstein, 2012):

*The contractors employed by NGOs for housing reconstruction refused to start any reconstruction work before the ground was completely cleared from pre-tsunami houses, trees, and other vegetation. (Barenstein, 2012, p. 95)*

![Figure 2.19: No tree can be found at the contractor-built sites in Tamil Nadu, India (Barenstein, 2012)](image)

In China, problems of post-disaster housing after the 2008 earthquake were seen to be due to the shortage of resources for large-scale reconstruction, particularly the lack of building materials and construction workers (Chang et al., 2010). It was explained that this problem may have resulted from the inadequate assessment of involved BEPs of local needs and capacities, from the beginning of the project. As a result, local resources were used in a limited way, while imported resources (outside the community) were heavily utilized. The amount of imported materials and labor were not sufficient to meet the huge needs of housing after this disaster. Again, this revealed a limited engagement of BEPs in assessing the real situation of disaster-affected communities and delivering appropriate safe housing design options.
The above discussion illustrates the common problems of post-disaster housing associated with the involvement of BEPs. These arguments indicate that professional assistance from BEPs is likely to bring long-term efficiency for post-disaster housing if appropriate methods for BEP engagement are employed. It was also found from the literature review that the role of BEPs is not similar across countries, regions, and communities, due to the different socio-economic contexts involved and different approaches to housing reconstruction used. Therefore, the present research examines the role of BEPs within the specific context of Central Vietnam, to deeply understand the link between BEPs’ engagement and the achievement of disaster-resilient housing outcomes.

2.5.3 Essential Roles and Inputs of Built-Environment Professionals

As mentioned in the previous part, the work of BEPs has a critical influence on the outcome of post-disaster housing and the achievement of disaster-resilient housing. According to Lizarralde et al. (2010), BEPs’ expertise and skills are needed to capture and interpret local needs and capacities into technical, functional, spatial and organizational solutions. There was a widespread consensus in recent literature (e.g. IFRC & SKAT, 2012; Max Lock Centre, 2009; UNISDR, 2004; Bosher et al., 2007) that BEPs involved in the field of DRR in general, and in post-disaster housing reconstruction in particular, include four professionals: architects, engineers, planners, and surveyors. Their roles for post-disaster housing reconstruction are various, but all are targeted to reducing damage and losses posed by disasters (Charlesworth & Ahmed, 2015; Aquilino, 2011; Lizarralde et al., 2010; Haigh & Amaratunga, 2010). Based on the guidance of IFRC & SKAT (2012) and Max Lock Centre (2009), the main roles of these four professionals are identified and classified in Table 2.7.
Table 2.7: Roles of BEPs in post-disaster housing reconstruction (based on Max Lock Centre, 2009 and IFRC & SKAT, 2012)

<table>
<thead>
<tr>
<th>Professional</th>
<th>Roles</th>
</tr>
</thead>
</table>
| Architect    | ✓ To understand users’ needs.  
               ✓ To assess possible resources and capacity for construction.  
               ✓ To do an analysis of sites and existing buildings.  
               ✓ To consult with users on their requirements.  
               ✓ To coordinate works of other professionals.  
               ✓ To test design ideas for their feasibility.  
               ✓ To develop selected options and prepare final designs. |
| Engineer     | ✓ To ensure the safe design, construction and maintenance of houses and relevant infrastructure. |
| Planner      | ✓ To advise donors, politicians, and other decision-makers for urban and regional development.  
               ✓ To help manage the development of cities, towns, villages and countryside by delivering planning policies and criteria.  
               ✓ To analyze social, economic, demographic and environmental factors to inform the physical and economic development of a region. |
| Surveyor     | ✓ To understand the whole lifecycle of property, from land tenure and boundary issues to managing the construction process, to ensure the best use of resources. |

The above table shows that each profession takes different roles when engaging in the process. While planners tend to be in charge of the issues related to the development of a wider region, architects, engineers and surveyors are more likely to deal with narrower dimensions concerning the formation of individual buildings, settlement sites, and community settings or structures. Max Lock Centre (2009) proposed a framework to detail the role of each professional
involved in post-disaster reconstruction. Accordingly, all phases of the reconstruction process were identified and interlinked with the specific tasks of each professional, as shown in Table 2.8.

It can be seen from Table 2.8 that post-disaster housing reconstruction demands the involvement of built-environment expertise, not only to support the physical formation of safe houses but also to improve local planning and construction policies and strategies and to enhance local people’s knowledge and awareness of DRR. Supported by Lizarralde et al. (2010), BEPs’ tasks are broadened to meeting user needs, in the longer term, in harmony with the surrounding socio-economic, cultural, and natural environment. Haigh and Amaratunga (2010) added three responsibilities taken by BEPs for building society’s resilience to disasters: (i) collecting and processing data (perception); (ii) facilitating decision-making processes (analysis); and (iii) disseminating and sharing knowledge or lessons to a wider range of stakeholders (communication).

However, the roles of BEPs mentioned above are not always appropriate to all the cases, since one of the key factors that may affect their engagement is the context-specific feature (Haigh & Amaratunga, 2010; Davidson et al., 2007; Charlesworth, 2014). This feature may undermine efforts to apply this guidance to practical situations, if no further investigation for a better understanding of local contexts is undertaken. Every reconstruction is unique in its approach and performance and in the way of using BEPs’ input, dependent on the particular situation of each region, community, and action involved (Haigh & Amaratunga, 2010). The role and contribution of BEPs for India-based cases (see Barenstein, 2012 for an example) are different from those of the China-based (see Chang et al., 2011) and Sri Lanka-based cases (see Ratnayake & Rameezdeen, 2008). Therefore, the present research aims to investigate the role of BEPs within the context of Central Vietnam, to deeply understand how BEPs can contribute to housing vulnerability reduction and the development of disaster-resilient housing within this region.
<table>
<thead>
<tr>
<th>Phases of Housing Reconstruction</th>
<th>Architect</th>
<th>Engineer</th>
<th>Planner</th>
<th>Surveyor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land development/landscape design</strong></td>
<td>Design landscape elements</td>
<td>Design drainage system, civil works related to physical plans</td>
<td>Overall siting of settlements, access routes, and infrastructure; regulatory guidance and enforcement</td>
<td>Baseline survey information for planners and architects</td>
</tr>
<tr>
<td><strong>Housing allocation</strong></td>
<td>Work with households and communities to allocate housing based on needs and preferences</td>
<td>N/A</td>
<td>Allocate houses in the overall plan</td>
<td>Refer to the compensation plan and procedure related to housing allocation</td>
</tr>
<tr>
<td><strong>Advice on regulations and codes</strong></td>
<td>Advise on building regulations</td>
<td>Advise on building and infrastructure regulations</td>
<td>Propose ways to monitor and enforce regulations for future risk reduction</td>
<td>Implement codes and regulations within the conditions of leases and ownerships</td>
</tr>
<tr>
<td><strong>Housing design</strong></td>
<td>Design houses with covered, open and semi-open spaces and vegetation</td>
<td>Design of safety features for housing structures</td>
<td>Manage overall impact on the use of services and transport, etc. Adjust local planning policies to address new housing and site planning requirements</td>
<td>Costing of houses for capital costs and lifetime costs</td>
</tr>
<tr>
<td><strong>Housing construction advice/supervision</strong></td>
<td>Supervision of and advice on construction activities</td>
<td>Ensure safety standards are maintained</td>
<td>Provide background information on bylaws, construction practices, and compliance</td>
<td>Ensure estimated cost and quality of buildings are maintained</td>
</tr>
<tr>
<td><strong>Infrastructure planning and implementation</strong></td>
<td>Develop interface between buildings/boundaries and infrastructure</td>
<td>Meet demands and criteria set by the reconstruction authority; ensure safety standards are maintained</td>
<td>Provide information on land-take for near-site and on-site facilities; confirm infrastructure meets regulation requirements</td>
<td>Provide guidance on ownership and infrastructure; and quality control</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>Provide training in building construction, retrofitting and maintenance</td>
<td>Provide training in safe installation, maintenance and upgrade of infrastructure</td>
<td>Provide training in monitoring and compliance of regulations/policies</td>
<td>Provide training in condition surveys, land surveys, costing and planning of projects</td>
</tr>
<tr>
<td><strong>Project planning and management</strong></td>
<td>Oversee the delivery of houses and community facilities</td>
<td>Provide technical input for project planning; identify items that may delay or risk the project</td>
<td>Provide strategic inputs to establish project goals; identify priorities for action</td>
<td>Quality and cost control of the delivery of houses and community facilities</td>
</tr>
<tr>
<td><strong>Financial planning and management</strong></td>
<td>Identify community contributions to dwellings and display them in cost model</td>
<td>Costs for retrofitting, safety features used</td>
<td>Provide estimates of demand for funding required; advice on locally generated revenue</td>
<td>Identify complete capital cost and life-cycle analysis of costs; identify other sources of finance</td>
</tr>
</tbody>
</table>
As experienced by the researcher through his former working period in the DRR field in Central Vietnam, these four professionals appeared not to be co-existing at the same time in practical housing implementation. Architects and engineers tended to dominate the professional engagement in most cases, whereas planners and surveyors were often unseen in the process. However, there has been almost no study addressing this situation in Vietnam so far. This fact motivated the present research to pursue the target of clarifying the role of BEPs in the technical improvement of local housing for safety purposes and in the development of disaster-resilient housing within the context of Central Vietnam.

2.5.4 The Role of Architects

As highlighted earlier, professionals working in the built-environment field have a potential contribution to the process of building disaster resilience for housing and settlements. Davis (2011), Charlesworth (2014), Architecture-for-Humanity (2006), Aquilino (2011), and Coulombel (2011) put focus on the role of architects in DRR, in which architectural responses have been considered to be the backbone of the professional engagement:

*The task for designers is to seek to create ‘places’ with meaning, not merely spaces. Places that provide ‘identity’ and a deep sense of ‘belonging’ and ‘security’ are essential and not merely for protection from the elements.* (Davis, 2011, p. 207)

However, the role of architects for DRR still draws limited attention in the literature. Apart from many texts mentioning the architectural response in broad and general terms, only three publications that provide more detailed consideration to this profession were found: Design like You Give a Damn: Architectural Responses to Humanitarian Crises (2006), written by Architecture-for-Humanity; Beyond Shelter: Architecture for Crisis (2011), edited by Marie J. Aquilino; and Humanitarian Architecture: 15 Stories of Architects working after Disasters (2014), edited by Esther Charlesworth. These three books are the collection of practical evidence from the real post-disaster reconstruction projects all over the world, and the real stories of humanitarian architects, to highlight their work and valuable contribution to recovery and rehabilitation efforts. However, these books tend to focus on the case study descriptions for delivering universal useful recommendations, rather than depicting specific principles or guidelines for the architect’s engagement. In addition, in practice, there is also a considerable
shortage of academically trained persons in the field of architecture and design for humanitarian interventions and disaster risk management (Coulombel, 2011). This fact supported the present research to pursue an investigation of the role of architects, to deepen understanding of their potential contribution to the DRR field and, especially, the development of disaster-resilient housing:

*It is appalling that architects remain uninterested in and out of touch with building for the most vulnerable and impoverished people.* (Coulombel, 2011, p. 287)

In the very few cases of housing reconstruction after disasters that included the participation of architects, their roles were expressed in various ways due to different local contexts of beneficiary communities and dissimilar approaches of each project. For example, Ozden (2006), through case studies in Turkey, indicated that the key requirement from architects is their support to disseminate professional knowledge and skills of safe construction to local people, to convince them to adopt and replicate safe practices in the future. In Kobe, Japan, architectural interventions were acknowledged, since the involved architects, based on their in-depth understandings of local situations, delivered appropriate measures to enhance safer living places and ensure effective community participation and consultation (Petal et al., 2008). Consequently, architectural responses have provided beneficiaries with a strong sense of ownership thanks to the high level of reflection of local tastes and lifestyles, widening economic development opportunities, and a freedom to choose design options based on the real situation of each family (Petal et al., 2008). Many ways of expression are seen in architectural responses to the humanitarian area in other case studies, in which the *context-specific* feature has emerged as one of the key aspects of an architect’s engagement.

Within the context of Central Vietnam, the architectural response for disaster-resilient housing is not similar to that in other regions, because it is shaped and characterized by local socio-economic, cultural and institutional backgrounds. Hence, the present research aims to explore *the role of architects* within the context of this region, to provide a comprehensive and in-depth understanding of the potential contribution of the architectural profession and how architects can assist and shape the development of disaster-resilient housing.
As given in Table 4, the role of architects can be sorted out into nine phases of housing reconstruction, as given by Max Lock Centre (2009). It is apparent that architectural knowledge and expertise are needed from the beginning of housing reconstruction projects to fully capture and effectively interpret local needs and capacity into spatial and technical solutions (Lizarralde et al., 2010). In the book by Aquilino (2011), based on the findings of real-world housing reconstruction projects, three major roles of architects when engaging in the DRR field are shown to have emerged:

- **Capacity Building**: to improve local construction practices through delivering disaster-resilient designs, and assessments of needs and resources for implementation.
- **Representation**: to collaborate and consult with households and communities for the best outcomes of safe housing that are appropriate and responsive to local contexts.
- **Vision**: to build up viable scenarios for the future of vulnerable communities based on in-depth understanding of their long-term needs and capacities.

These three roles are, in fact, reflected elsewhere, in the publications of Max Lock Centre (2009) and IFRC and SKAT (2012). However, while Max Lock Centre (2009) and IFRC and SKAT (2012) aimed to spread and categorise the role of architects (and other professionals) into specific tasks to guide their practices, Aquilino (2011) tended to conceptualise them into the core goals or themes needed to be met by architects and building designers. These three roles are quite similar to the findings of ACHR (2012), related to the role of architects for Asian contexts. Accordingly, architects involved in building settlements for Asian marginal communities, including the disaster-affected, are required, in order to satisfy three major purposes: (i) to improve local practices and skills through technical input and training; (ii) to meet actual needs of local communities through participatory design and planning processes; and (iii) to help them visualise new possibilities or solutions for a future transformation (ACHR, 2012).

Regardless of various approaches to defining and shaping *the role of architects* in disaster risk management, architectural responses for post-disaster housing reconstruction have both positive and negative effects on safe housing outcomes and user satisfaction afterward. This thesis, therefore, aims to further investigate
the role of architects within the specific context of Central Vietnam to understand what factors or issues influence the success of architectural responses in developing disaster-resilient housing.

2.5.5 The Need for Investigating the Role of BEPs within Central Vietnam
This section reviews the up-to-date literature on the engagement of built-environment professionals in post-disaster housing reconstruction and disaster risk management for the housing sector. Four professions of built environment are identified and considered to have made significant contributions to the process of developing disaster-resilient housing: architects, engineers, planners, and surveyors (Max Lock Centre, 2009; IFRC & SKAT, 2012). Their specific tasks have already been examined and identified (see Table 2.8), in which the involvement of architects was highlighted as the backbone of the professional and technical assistance for safe housing development (Charlesworth, 2014; Aquilino, 2011; Architecture-for-Humanity, 2006; Coulombel, 2011). However, there will be no ‘perfect’ guiding frameworks for the engagement of BEPs for all cases, as their roles and responsibilities are also influenced and shaped by local situations and contexts (Davidson et al., 2007; Haigh & Amaratunga, 2010). Therefore, this thesis explores the role of architects and other professionals within the context of Central Vietnam to identify their key functions and tasks in reaching a resilient housing system against future disasters.

Seeking appropriate housing design options for disaster-prone communities, especially for low-income groups, is a real challenge to architects and building designers, as it requires a balanced consideration of many problems or issues at the same time (e.g. risk mitigation, cultural appropriateness, cost effectiveness, or environmental friendliness) (Coulombel, 2011). The next section provides more detail on such design-related issues, through the lens of post-disaster housing, to gain a better understanding of how design ideas and solutions can improve disaster resilience for housing and settlements.

2.6 Design Responses for Effective Post-Disaster Housing

2.6.1 Introduction
As mentioned above, professional expertise on and knowledge of the built environment are crucial for DRR interventions, particularly in residential housing reconstruction following disasters. The importance of design solutions for
reducing post-disaster damage and loss have gained growing attention from international humanitarian and development agencies (e.g. UN-Habitat, Architecture-for-Humanity, IFRC, Habitat for Humanity, Development Workshop France). This section discusses the key factors associated with the design of post-disaster housing, to examine the significance of design responses in post-disaster recovery and development. This allows the identification of opportunities for building disaster-resilient households and communities afterwards. The justification of housing design responses for resilience enhancement also helps consolidate one of the key themes of this thesis, the Role of Built-Environment Professionals:

Homes have failed before anyone had a chance to live in them, and some post-disaster settlements have led to serious physical and mental-health problems for their new residents. The absence of expertise is a trespass that leaves communities more vulnerable than before. (Aquilino, 2011, p. 9)

As mentioned in Section 2.2, housing vulnerability in Central Vietnam is shaped by several drivers, from technical and economic to social and cultural dimensions. It was deduced from the Pressure and Release (PAR) Model given by Wisner et al. (2004) that vulnerability is progressed through a sequential process, where social and economic constraints are considered to be the root causes of physical (technical) unsafe conditions. To reduce housing vulnerability and improve housing resilience, it is necessary to have a comprehensive approach to dealing with these three interconnected issues, technical, economic and social, in the design process of safe housing (Figure 2.20). These issues have been extensively discussed in the DRR literature (e.g. Davis, 2011; Charlesworth & Ahmed, 2015; IFRC, 2015; Phong et al., 2014) as the key considerations for the design of safe and resilient housing.
This section justifies the architectural responses of safe housing applied by different PDHR practices, to understand how design interventions could enhance the social, economic and technical performance of post-disaster housing and potentially strengthen the resilience of households and communities to future climate threats.

2.6.2 Technical Responses for Risk Reduction

As indicated earlier, built-environment professionals potentially have a significant contribution to DRR, in particular to the improvement of housing construction towards disaster risk reduction (Aquilino, 2011). According to McEntire (2011), building secure and durable structures, particularly solid houses, that are resilient to future disasters is one of the most important interventions for better disaster risk reduction (McEntire, 2011). The participation of built-environment professionals, particularly planners, architects, and engineers, is a must to ensure that all planning and construction measures for post-disaster housing are technically safe and account for potential hazards (UNISDR, 2004).

Housing designs are, therefore, required to minimise disaster risks generated by a wide range of causal drivers, from the site or location of human settlements and settlement patterns, to the specific unsafe conditions of individual houses (McEntire, 2011; IFRC & SKAT, 2012; Jha et al., 2010; Fronteras, 2011). Jha et al. (2010) and IFRC and SKAT (2012) published handbooks to provide detailed instructions and guidelines for post-disaster habitat reconstruction, in

![Figure 2.20: Three Considerations for Safe Housing Design](Developed by the researcher based on the literature review)
which four key principles, in terms of technical responses for risk reduction, were identified:

➢ **Site planning and settlement patterns** need to address prevailing natural hazards, local climate conditions, and socio-economic situations of the region or community involved.

➢ **Housing designs** are required to consider local building practices, desired standards, culture, and economic and climatic conditions.

➢ **Local expertise** is valuable to housing design proposals, but if changes are essential for resilience enhancement, local builders and construction workers should be trained and equipped with global knowledge and best practices.

➢ **House lifespan**, from construction and maintenance to demolition or reuse, should be considered in assessing the efficiency of the selected technology options.

It is easy to track some exemplary post-disaster housing projects that show their success thanks to the deployment of the above requirements. For example, in Aceh, Indonesia, many houses provided by UPLINK’s architects after the 2004 earthquake did satisfy the beneficiary communities and households, since the proposed housing designs revealed a high respect for local housing patterns (on-stilts), local climate and people’s livelihoods, and employed innovative construction techniques of reinforced concrete to enhance the earthquake-resistant capacity (Fitrianto, 2011).

In Central Vietnam, post-typhoon houses given by the IFRC for a minority ethnic group were locally adopted thanks to their harmony with the existing vernacular housing architecture (houses-on-stilts), the employment of local labour for housing construction, and the suitability of safe housing to people’s lifestyles (Anh, 2012) (Figure 2.21).
On the other side, there were also many cases that revealed their ineffectiveness or lack of success due to the limited attention paid to the above requirements. For example, in Sri Lanka, the cultural inappropriateness of new houses rebuilt by donors after the 2004 tsunami was found. Accordingly, the existing rural lifestyles of people were not respected, such as in the use of gas cookers instead of the traditionally available firewood for kitchens, attached toilets instead of commonly detached toilets, less semi-open spaces surrounding the house, and no spaces for keeping farming tools (Karunasena & Rameezdeen, 2010).

The discussion shows that technical responses for DRR in terms of housing are varied across the countries and regions, and necessitate the involvement of built-environment professionals, especially architects and engineers, to avoid mistakes. An in-depth understanding of local experiences and knowledge in housing construction, and of people’s needs and aspirations towards their housing, are essential to select appropriate technical responses for disaster-resilient housing. In Central Vietnam, not many agencies could address and translate the above requirements into practice effectively. DWF is one of the few that is widely known as having one of the best DRR practices in this country (Ahmed, 2011). They absorbed and developed ten technical principles for safe housing construction in cyclone-prone areas, ranging from site selection and settlement planning to structural bracings and connections within individual buildings (DWF, 2010). Their principles have been locally acknowledged, since they offer a technical soundness suitable to local contexts (Norton & Chantry, 2008).
However, these principles are still limited to storm resistance, whereas flood protection and other technical aspects of safe housing (i.e. locally climatic responsiveness) are not adequately addressed. The present research, thus, examines the key technical responses for both flood and storm risk reduction, as floods and storms have been the most common and terrible hazards in Central Vietnam so far (Tinh & Phong, 2010; MONRE, 2008); and it looks at local climatic responsiveness, as the hot-humid climate is badly affecting the life of residents.

### 2.6.3 Economic Responses for Cost Efficiency

As highlighted in the literature (e.g. Wisner et al., 2004; Aquilino, 2011; Lizarralde et al., 2010; McEntire, 2011; Mileti & Gailus, 2005), economic pressures have a close link with the degree of housing vulnerability and the possibility of building long-term resilience. Economic constraints make at-risk communities and households view disaster preparedness as a secondary priority in their everyday life, following basic living needs (as the first priority); and, therefore, they hinder efforts to build resilient houses against future disasters (ADPC, 2007; Mallick et al., 2009). There has been a widespread agreement in the recent literature (e.g. Barenstein, 2006; Steinberg, 2007; CENDEP, 2010; McEntire, 2011; Mileti & Gailus, 2005) that cost-effectiveness is one of the most important goals in safe housing development for disaster-affected households, since most of these households belong to the poor and low-income population. Accordingly, design ideas and construction methods are required to maximize the use of local resources, especially local materials and local labor, to minimize construction costs (Ahmed & Charlesworth, 2013; Jha et al., 2010; Chang et al., 2010 & 2011) and increase a sense of familiarity and ownership:

*Design research is not only emotional; it is economic.* (Murphy & Ricks, 2013, p. 113)

Many case studies in developing countries have demonstrated their success in post-disaster housing reconstruction thanks to the provision of economically affordable houses. For example, post-earthquake housing in Gujarat, India was considered successful since the project made full use of local materials and local workers for cost reduction (Barenstein, 2006). UN-HABITAT ’s houses after the 2004 earthquake and tsunami in Nias did satisfy their owners as the construction mobilized beneficiary households’ family members in most construction works, to
minimize labor costs and maximize their savings for future housing
extension/renovation or for buying vital interior items (Amaratunga & Haigh,
2011). In most cases, cost-effectiveness was more likely to be achieved if support
from built-environment professionals, particularly architects, was provided (e.g.
DWF in Hue-Vietnam, or CARE in Gujarat- India), as they are the best persons to
balance different needs of at-risk communities for the delivery of cost-effective
housing options. Their design interventions are meaningful for not only dealing
with technical issues for risk reduction but also for providing financially
affordable housing for low-income people.

In Central Vietnam, the study area of this research, vulnerable communities
mostly belong to the poor and near poor groups, and have a limited access to
resources for disaster preparedness in a long run (DWF, 2010; Phong & Shaw,
2010; MONRE, 2008). The development of cost-efficient housing solutions is,
therefore, essential for them to stabilize their savings and sustain their economic
development and other improvement efforts afterward (i.e. safer construction,
better livelihoods, or improved children education). As low-income households
were the target group of this study, their housing was then examined through the
economic lens, to understand how housing design responses can support and
enable the economic stability and development of disaster-affected families.

2.6.4 Social Responses for Cultural Appropriateness
As mentioned in the preceding sections, problems of post-disaster housing
relating to the cultural appropriateness of safe houses are one of the main causes
of ineffective housing outcomes (Charlesworth, 2011; Boen & Jigyasu, 2005;
Ahmed, 2011). This matter, in fact, has been known for a long time (e.g. Davis,
1978; Chisholm, 1979), but has still existed until now with various forms of
appearance in recent post-disaster housing projects. The cultural inappropriateness
of post-disaster housing has been found in many practices, such as in Indonesia
(see Boen & Jigyasu, 2005), India (Barenstein, 2006), and Vietnam (VNRC &
IFRC, 2002). Apart from disaster preparedness and cost efficiency, housing after
disaster needs to address the social and cultural characteristics of at-
risk/vulnerable people to provide them with a so-called ‘normal house’ (Davis,
1978). According to Ahmed (2011), achieving cultural appropriateness is one of
the biggest challenges to post-disaster housing reconstruction, because of the high
pressure to provide accommodation in a short time, with a limited understanding of implementers (often from outside an in-need community) about local contexts. Cultural inappropriateness commonly is exhibited through the improper use of housing styles, building shapes and sizes, spatial layouts, building materials, construction techniques, and housing-related infrastructure (Ahmed, 2011). Among these, unsuitable functional layouts appear to be the most common mistake resulting in low satisfaction and rejection of householders. This was evident in the case of Marathwada, Indonesia, where the World Bank-funded houses followed a new urban style that contrasted with the existing rural style of local housing (Boen & Jigyasu, 2005).

In Turkey, houses provided by the World Bank after the 1999 earthquake also showed their limited cultural responsiveness, in the sense that Western-style toilets were strange to Muslim residents, whose religious activities commonly occur in the bathroom without a toilet (Ganapati & Ganapati, 2009). It was also seen in the Sri Lanka case, where the post-2004 tsunami houses showed their limited respect for people’s lifestyles in that gas cooking was used instead of traditional firewood, an attached toilet instead of the existing detached toilet was provided, or there were no spaces for keeping production tools as they had before (Karunasena & Rameezdeen, 2010). Even in a developed country such as Japan, problems of cultural appropriateness of safe housing have still existed, particularly in the housing reconstruction project after the Java earthquake (2006). Specifically, safe houses provided by donors after this disaster increased people’s dissatisfaction due to their inflexible functional layouts, which reduced social interactions among family members (Marcillia & Ohno, 2012). In Central Vietnam, the study area of the present research, many houses rebuilt by local agencies for ethnic minority groups in mountainous areas are culturally inappropriate to local ways of living, since the new masonry houses-on-floor conflict with existing local wooden houses-on-stilts. Thus, the on-floor houses were commonly unused by people, because the on-floor structures couldn’t help inhabitants avoid unhealthy air from the ground, and provided no space for storing farming tools and agriculture products, as found in the under-floor space of local on-stilt houses (Figure 2.22).
On the other hand, there were several post-disaster housing reconstruction projects that showed success thanks to the respect for and responsiveness to local culture and people’s lifestyles. In the Philippines, for example, houses rebuilt after Typhoon Durian (2006) were responsive to the local context in terms of the use of one traditional local structure made of coconut timber frames. The use of this structure provided inhabitants with a cultural familiarity and a sense of ownership, and made them willing to replicate it after the next cyclone in 2008 (Suarez et al., 2008). Housing after the 2001 earthquake in Gujarat, India, came out with remarkable results when the construction helped promote one kind of local material, known as compressed earth blocks, which provided a visual harmony with the existing masonry construction and settlement patterns (Suarez et al., 2008). In Pakistan, housing after the 2005 earthquake in Batagram was successful through the application of local construction principles, which then enabled users (households) to easily adjust or adapt to their new needs (Audefroy, 2010). In addition, in Vietnam, housing reconstruction after Typhoon Ketsana (2009), for a minority mountainous group, called Gia Rai people, implemented by IFRC and VNRC in 2010, was culturally appropriate to the local context in the sense that new houses were built in the same type of existing local housing-on-stilts, with the incorporation of one type of durable material for disaster preparedness (reinforced concrete) (Figure 2.23). Therefore, achieving cultural appropriateness for safe housing becomes one of the major goals for housing reconstruction, to help inhabitants to stay in the newly constructed houses for a longer term with
fewer modifications, changes, and dissatisfaction in post-occupancy periods (Audefroy, 2010; Boen & Jigyasu, 2005; Barenstein, 2006).

![Image: New houses following existing local housing pattern of houses-on-stilts in the Central Highlands of Vietnam](image)

**Figure 2.23:** New houses following existing local housing pattern of houses-on-stilts in the Central Highlands of Vietnam

In sum, the above evidence demonstrates the importance of cultural appropriateness to the success of post-disaster housing. Design ideas and solutions for disaster-resilient housing are, therefore, required to address social and cultural backgrounds and characteristics of the given group or community, to ensure the delivery of locally appropriate safe housing options. This research has examined this issue within the context of Central Vietnam, to further investigate the significance of cultural appropriateness to the improved resilience of low-income housing, and how it could be addressed and integrated within actual design projects.

### 2.6.5 Summary

This section has reviewed three key design responses or principles for the outcome of safe and resilient housing: *technical, economic, and social*. While the technical principles of housing designs are required for risk reduction and climatic responsiveness, economic and social responses are crucial for bringing cost efficiency and cultural appropriateness to safe housing outcomes. This is particularly meaningful to the low-income vulnerable households who currently dominate the population in Central Vietnam. These three design aspects are also crucial to developing disaster-resilient housing where technical safety, economic efficiency, and social responsiveness become the key considerations. This thesis, therefore, examines these design principles in the light of disaster-resilient housing for the context of Central Vietnam, to gain a comprehensive and in-depth
understanding of how design interventions contribute to the resilience of residential housing, especially low-income housing.

2.7 Conclusion

This chapter has reviewed the relevant literature to identify the research problems and the five areas of literature needed to be considered for developing disaster-resilient housing in Central Vietnam, as follows:

- housing vulnerability to natural disaster.
- the importance of post-disaster housing reconstruction to building community resilience.
- community consultation as an essential element of post-disaster housing.
- the role of built-environment professionals in post-disaster housing reconstruction.
- design responses for effective post-disaster housing.

This chapter highlights the importance of PDHR in building disaster resilience for vulnerable groups and communities, particularly in their housing, in Central Vietnam. Three core issues relating to this relationship emerged from the literature review:

- **Community consultation** as an essential element of housing reconstruction (Rand et al., 2011; Bouraoui & Lizarralde, 2013; Ganapati & Ganapati, 2009; Lawther, 2009; Sliwinski, 2010; Davidson et al., 2007; Pardasani, 2006; Hayles, 2010).
- **The involvement of built environment professionals** as important to enabling safe and resilient construction (Bosher et al., 2007; Charlesworth, 2014, 2011; Ahmed, 2011; Architecture-for-Humanity, 2006; Aquilino, 2011; Max-Lock-Centre, 2009).

These issues helped frame the three key themes of this thesis (Community Consultation, Role of Built-environment Professionals, Design Principles for Resilience), in seeking the answer for the overall research question, “What are the
appropriate forms of disaster-resilient housing (DRH) for vulnerable areas of Central Vietnam?”, and the three sub-questions below:

- What are the appropriate forms of community consultation for DRH?
- How can built-environment professionals assist the development of DRH?
- What are appropriate design principles for DRH?

This chapter indicates that PDHR functions as part of an ongoing process of building homes in both pre- and post-disaster stages. It was found from this chapter that PDHR can support the development of disaster-resilient housing if the three themes above receive equal consideration in planning and implementation. By addressing these themes and their mutual relation, the key research question above can be answered. The next chapter will discuss the research design, methodological approaches, methods, and techniques selected for examining these three themes within the context of Central Vietnam.
Chapter 3 : Research Design

3.1 Introduction

3.1.1 Purpose of the chapter

The previous chapter of the literature review has identified three key themes in this thesis: (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience. This chapter will outline the research design, where the chosen methodology, methods, and techniques used to examine and ground these three key themes within the context of Central Vietnam are discussed.

As this research aims to investigate key issues for developing disaster-resilient housing in Central Vietnam, the interpretive model was selected as the methodology of this study to identify the technical, social and institutional factors underpinning the development of disaster-resilient housing. This methodology also supports the identification of the research methods and the techniques of data collection and analysis afterward.

The role of the researcher as an architect for post-disaster housing recovery, and as a researcher during the writing of this thesis, was to observe the physical performance of post-disaster housing (technical) and the way people use their houses (social), alongside analysing participants’ responses collected from the qualitative interviews to interpret the fieldwork findings (as presented in the next chapters). The research design presented in this chapter helped capture human behaviour, activities and interactions towards housing vulnerability exacerbation or reduction within their natural settings, and provides an in-depth understanding of the social, economic, cultural and environmental rationales for disaster-resilient housing.

3.1.2 Terminology

There is ambiguity in the terminology used to describe social research. The methodology is often confused with research method(s), or research method(s) are frequently understood as the techniques of data collection and analysis. To clarify these terms and their meanings in this research, three relevant terms are used. These are defined as follows.
Methodology
The term methodology here refers to the theoretical and systematic paradigm, such as the two contrasting paradigms of interpretivism and positivism, used for conducting scientific research. This term pertains to “the way in which knowledge is produced” (Grix, 2002, p. 179).

In this thesis, the interpretive paradigm was employed as the philosophical framework to underpin, guide, and define the conduct of this study.

Method
The term method here refers to the precise approach or procedure (i.e. the case study or action research) that is used to explore relevant phenomena and acquire knowledge or concepts based on the identified methodology (Grix, 2002).

In this thesis, the case-study method was selected to investigate the research questions and examine the research themes.

Technique
The term technique here refers to the systematic way of collecting and processing data gathered from the fieldwork (Bryman, 2008).

In this research, in-depth interviews, focus group discussions, and observations are the three selected techniques for data collection, while the thematic analysis and grounded theory are applied for data processing and interpretation later.

3.1.3 Summary of Research Questions
Research questions often function as the signposts to allow an easy understanding for readers of a study or research (Creswell, 2003). Research questions are also useful to inform the selection of appropriate approaches, strategies, and methods for seeking answers. As discussed in previous chapters, problematic issues of post-disaster housing are closely linked with the perception of future housing implementation towards disaster risk reduction. Within this sense, and with the support of the literature review, the key question of this research has emerged, as follows:

What are the appropriate forms of disaster-resilient housing for low-income people in Central Vietnam?
This question aims to examine the sustainable forms of low-income housing that are resilient to natural disaster and responsive to the context of Central Vietnam. To clarify this point, the study investigated three sub-questions, as follows:

- **What are the appropriate forms of community consultation for DRH?**
- **How can built-environment professionals assist the development of DRH?**
- **What are appropriate design principles for DRH?**

By addressing these sub-questions, key issues for promoting DRH and shaping suitable forms of DRH in Central Vietnam were identified as a response to the overall research question of this thesis, above.

### 3.1.4 Overview of the Chapter

This chapter is organized into three main sections. The first section discusses the methodology and methods; followed by a discussion on the selected techniques for data collection and analysis in the second section. The third section examines the ethical consideration of this research to ensure the dignity, confidentiality, and privacy of research participants.

### 3.2 Methodology and Methods

#### 3.2.1 Introduction

This section provides more details on the chosen methodology and methods. In terms of methodology, there are two dominant but contrasting epistemological positions that inform the conduct of research: *positivism* and *interpretivism* (Bryman, 2008; Travers, 2001). While *positivism* is commonly used for natural science and quantitative research, *interpretivism* is more meaningful to social science and qualitative studies to generate epistemological assumptions (Bryman, 2008; Blaikie, 2000; Travers, 2001; Creswell, 2003). The *interpretivism* model allows researchers to examine and interpret social phenomena “*through a “sense-making” process rather than a hypothesis testing process*” (Bhattacherjee, 2012, p. 103) as seen in the *positivism* one.

Since this research tends to deal with qualitative issues of resilient housing through the lens of post-disaster housing, understanding how residents make sense of their housing is important and comes closer to the concept of *interpretivism* (Bryman, 2008), as this model is constructed mainly based on qualitative data (Bhattacherjee, 2012). Grounding theoretical themes and issues of resilient
housing in the real context of Central Vietnam shows the qualitative nature of this research (Creswell, 2003). Therefore, this research follows the qualitative and interpretive model, as the selected methodology, to ground and interpret the three key themes of this research identified in the previous chapters. These themes are (i) Community Consultation, (ii) the Role of Built-Environment Professionals, and (iii) Design Principles for Resilience (iii).

As Travers (2001) and Creswell (2003) argue, qualitative research has a strong link with the interpretive paradigm, in which the conduct of qualitative studies, methodologically, usually depends on the interpretive model to capture and interpret activities and behaviours associated with human groups:

Positivists, like Durkheim, favor the use of quantitative methods in researching large-scale phenomena. Interpretivists, like Weber, employ qualitative methods in order to address the meaningful character of human group life. (Travers, 2001, p. 9)

Qualitative research is fundamentally interpretive. This means that the researcher makes an interpretation of the data. This includes developing a description of an individual or setting, analyzing data for themes or categories, and finally making an interpretation or drawing conclusions about its meaning personally and theoretically. (Creswell, 2003, p. 182)

Under the umbrella of the selected qualitative and interpretive methodology above, there are several methods commonly used by social researchers in addressing their research questions, such as the methods of ethnography, phenomenology, action research or case study (Bhattacherjee, 2012). Each method has its own strengths and weaknesses in relation to the specifics of each research project, as summarised below:

- **Ethnography**
  - Emphasises a phenomenon within its own cultural context.
  - Demands a deep immersion of the researcher in the phenomenon’s context for a sufficient period of time (usually for several years).
  - Relies on the personal experience of the involved researcher, captured from his/her deep immersion, in generating insights (theory).
o Phenomenology

- Focuses on conscious experiences of people around a phenomenon such as human judgement, perceptions, actions.
- Examines the phenomenon from the subjective perspective of the participants involved, to generate insights (theory).

o Action research

- Emphasises doing something or interventions within the studied context or phenomenon.
- Observes the outcomes of interventions and generates insights (theory).

o Case study

- Focuses on intensively studying a phenomenon at one or more research sites to generate detailed and contextualised inferences and understandings of the dynamic process underlying a phenomenon.
- The researcher is a neutral observer (direct observation) in the social setting rather than an active participant (participant observation).

(Based on Bhattacherjee, 2012)

From the justification above, this study was inclined to the method of case study, since it aimed to understand the drivers of housing vulnerability and, subsequently, identify appropriate forms of disaster-resilient housing for low-income people in Central Vietnam. Within this study, the researcher played the role as a neutral observer rather than a participant. Hence, the method of case study was selected to address the research problems.

In the literature, case study is known as one of the most effective strategies for qualitative research (Bryman & Burgess, 1999) and an interpretive paradigm (Travers, 2001). The method of case study often involves the detailed and intensive analysis of single cases (Bryman, 2008) which are essential to provide an in-depth understanding of social and contextual conditions underlying a studied issue or theme. It enables a reliable interpretation of social meanings and linkages to the practical situation of the research site (Bryman & Burgess, 1999).
3.2.2 Methodology: Interpretive Approach

As mentioned, this study is framed within the interpretive approach (Travers, 2001; Creswell, 2003), as the methodology, to obtain an in-depth understanding of different but interrelated factors concerning the promotion of disaster-resilient housing. Since the interpretive approach aims to understand human behaviour (Bryman, 2008), it is helpful to guide this research in collecting field data in interactive ways to fully understand the meanings and rationales underlying human behaviour and practices on their housing. There is a clear argument made by Bryman (2008) that social researchers following the interpretive methodology tend to gain access to people’s common sense of thinking to capture and interpret their behaviour and their social world from their points of view. Accordingly, instead of discovering facts and truths of an external world from their own viewpoints, social researchers are required to thoroughly understand the participants’ construction of meanings within the participants’ social, economic, cultural, and political contexts (Hennink et al., 2011).

The character of context-specific has emerged in this approach. Within this sense, identifying appropriate forms of disaster-resilient housing for the specific context of Central Vietnam, as the goal of this research, is crucial. This necessitates a careful examination of local contextual and intervening conditions that influence and shape perceptions and practices (design and construction) of residential housing towards disaster risk reduction.

The key purpose of this paradigm is to evaluate or judge theoretical or hypothesized themes within a specific perspective of a given community or region, rather than to focus on generating new theories (Hennink et al., 2011). This makes the interpretive approach appropriate to this research, where the three key themes examined and assessed (community consultation, the role of built-environment professionals, and design principles for resilience) within the context of Central Vietnam are the central targets. These themes were then analyzed based on the situation of four case-study communities in this region, to understand how meaningful these themes are for the Central Vietnam context and what contributions they can make for resilient housing promotion.

In particular, this research applied the interpretive approach to examine the efficiency of post-disaster housing outcomes within their natural settings, in order to interpret human behaviors and actions and social phenomena involved in light
of *meanings* that people and the society bring to them (Denzin & Lincoln, 2008). Accordingly, it demands a thorough understanding of how a targeted human group is aware of their own actions and performances related to the formation of their houses (Travers, 2001). According to Travers (2001, p. 10):

> Interpretivists believe that the objective of sociological analysis should be to address how members of society understand their own actions.

In this sense, an *interpretive approach* tends to follow the philosophy of *phenomenology*, where addressing how individuals make sense of the world around them is the key aspect (Bryman, 2008). *Phenomenology* is the paradigm that is used to understand people’s actions and underlying drivers towards a given phenomenon within their own contexts (Bryman, 2008). Although the present research is not primarily phenomenological, some parts of it are underpinned by the principles of *phenomenology*, in which influential and causal factors or things around an identified phenomenon of post-disaster housing are targeted. *Phenomenology* helps provide a better understanding of the meanings that people attach to their daily affairs and ongoing living experiences (Travers, 2001; Hennink et al., 2011). Based on Snape and Spencer (2008), it requires the *interpretive* researchers to view people’s lives in a broader context to gain better understandings and interpretations of their behaviors and actions on housing reconstruction after disasters. This urged the researcher to collect viewpoints from a wide range of stakeholders, including at-risk communities, local authorities, civil society, built-environment professionals, and the private sector. They are selected as the participants for qualitative interviews and discussions in the fieldwork of this research. The capture and understanding of different points of view from various stakeholders towards housing vulnerability reduction enables the identification of key issues for the promotion of disaster-resilient housing in Central Vietnam.

Although people plan and act their sense-making processes individually, they perform them from a wider social context where similar meanings and interpretations are commonly shared among others (Hennink et al., 2011). This allows a reliable generalization of findings from studying individual cases for a wider region where these cases are based or involved. In addition, according to Travers (2001), there are no benefits for *interpretive* researchers to work on large
data sets or to focus on the adequacy of sampling for the generation of some kinds of theory. Instead, they need to know how people in a particular setting perceive and act in their local region, and to interpret these actions from their perspective. Within this research, the descriptive and explanatory research question (what are the most appropriate forms of disaster-resilient housing in Central Vietnam?) shaped the selection of the case study method for further data collection and analysis (Yin, 2009). This method not only identifies the forms of resilient housing against climate hazards but also clarifies the underlying issues beyond housing vulnerability and resilience.

3.2.3 Method: Case Study

As discussed in Section 3.2.1, case study was chosen as the research method of this study in seeking answers for the research questions. The case study is one of the most common frameworks for qualitative research (Bryman & Burgess, 1999) to provide in-depth understandings of social, contextual and intervening factors beyond an observed situation or visible phenomenon (Bryman & Burgess, 1999). In this research, the phenomenon is the exacerbation or reduction of housing vulnerability to climate threats (i.e. storms, floods) through the lens of post-disaster housing reconstruction and design-related solutions. The case study also allows qualitative researchers to examine theoretical themes identified from their literature search (Maxwell, 2005), such as the three themes emerging from the literature review of this study: (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience.

One of the most influential publications on the case study method is that of Yin (2009), with its three main steps for designing a case study:

- Define the “case”;
- Justify the choice of single- or multiple-cases;
- Adopt or minimise theoretical perspectives in data collection and analysis.

When being applied to this research, the literature review presented in Chapter 2 had framed the three themes above that could be used to define the “case”. Specifically, the “case” examined by this thesis had to contain these three themes in delivering safe housing, as the case selection criteria. This allowed the study to select four appropriate “cases” in Central Vietnam, as the cases studies, that are discussed later in this section.
One of the most controversial questions posed by the case study approach is:

*Whether findings from a case study can be used to make inferences for other cases and for a broader region involved?*

There is a widespread agreement among scholars (e.g. Platt, 1999; Maxwell, 2005; Bryman, 2008) that, from the perspective of human society, a case study often shares common senses or meanings and general laws of a social setting with other cases not studied, and thus, findings from the studied case(s) can be used to make broader interpretations and implications for other unstudied cases. The overall goal of a case study is not only to highlight the subjective meanings of an individual phenomenon, *post-disaster housing reconstruction* in this research, but also to provide a holistic explanation for its expression, where social supports and constraints are clarified and the socio-economic, political, and cultural conditions that shape its performance are identified (Platt, 1999). In this sense, the focus on a single case can inform the situation of a wider region where these cases are based, based on which the generation of comprehensive solutions are possible (Maxwell, 2005; Platt, 1999). As highlighted by Platt (1999), the study of a single case has a high likelihood of making reliable inferences and implications for other cases (not studied) located or based in the same context or situation, such as in the context of Central Vietnam in this research:

*The case(s) studied are taken to provide a basis for inference to points not directly demonstrated and with relevance to cases not studied. (Platt, 1999, p. 71)*

In addition, an important point that makes this research select the *case study method* is the importance of *case studies* to dealing with “human interest”-related issues (Platt, 1999). Accordingly, an event or phenomenon that is associated with human perceptions and behaviors can be effectively investigated and explored by the *case-study method* (Platt, 1999). Therefore, the *case-study method* is best suited to the present research, since perceptions and actions of different groups of stakeholders towards disaster risk reduction for housing were examined. This method plays an essential role to the prediction of future developments for a larger region where the case(s) are based, Central Vietnam in this research, because it allows the generation of reliable interpretations and recommendations for future actions (Platt, 1999), housing design, and construction practices.
In terms of selecting the case(s), according to Platt (1999), the selection of one case is not because of its own special features but due to its reflection of the wider region involved where the research problems and questions are found. Within this perception, four disaster-affected communities that represent the region of Central Vietnam were selected based on their sharing of common social and contextual conditions of this region. They are Hoa Hiep Bac (Da Nang Province), Loc Tri (Thua Thien Hue), Ia Broai (Gia Lai), and Tan Ninh (Quang Binh) (Figure 3.1). Common social problems of the region such as the lack of DRR information at local levels, economic constraints of at-risk groups, limited experience, and skills of local workers in safe construction, or limited governance and supportive mechanisms, are also found in these communities.

Figure 3.1: Four case study sites of this research in Central Vietnam (Map: www.dosm.gov.vn, accessed Dec 2013)

These cases were also selected due to the existence of both donor-built and self-built housing reconstruction approaches in each of them. This research examined post-disaster housing provided by agencies (donor-built) and constructed by
people (self-built), to investigate their successes and shortcomings and identify key issues for future housing implementation in the light of disaster resilience. The outcomes of post-disaster housing in these cases were influenced and shaped by social supports and constraints, social norms and aspirations, housing development trends, and regulatory frameworks, that are also found in other affected communities of the region (Central Vietnam). This is one of the reasons for selecting these communities as the case studies, based on the theory of Platt (1999).

In short, the selection of these four case studies is primarily based on two criteria:

➢ **The Relevance** of post-disaster housing there to the three key themes of this research (identified in the literature review): (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience.

➢ **The Reflection** of a broader context of Central Vietnam to the extent that common social and contextual issues of this region could be found in the selected cases (in accordance with Platt, 1999; Maxwell, 2005).

Based on these criteria, four post-disaster housing reconstruction projects undertaken by agencies at four case-study sites were then selected for further investigation: post-disaster housing provided by the NGO Save The Children UK in Hoa Hiep Bac; the NGO Development Workshop France in Loc Tri; the International Federation of Red Cross and Vietnam Red Cross in Ia Broai; and the Vietnam Ministry of Construction in Tan Ninh. These were examined and compared against the three key themes of this research and towards the development of disaster-resilient housing (Figure 3.2). These housing reconstruction projects were selected as the case studies because of their use of community consultation in planning and designing phases, the engagement of architects and engineers in housing design and construction, and the improvement of design solutions for resilience purposes.
3.2.4 Summary

The above discussion has shaped the selection of the interpretive methodology and the case study method in seeking answers for the overall research question, as follows:

*What are the appropriate forms of disaster-resilient housing for low-income people in Central Vietnam?*

This section has identified the importance of interpretive approaches in understanding and interpreting people's behaviours towards their housing. Social, contextual, and intervening conditions underlying people’s practices in post-disaster housing were then examined against the three key themes identified from the literature review in Chapter 2 (community consultation, the role of built environment professionals, and design principles for resilience).

The above discussion also highlights the significance of the case study method in grounding and interpreting the research themes above in the real context of Central Vietnam. Accordingly, four case studies relating to post-disaster housing reconstruction, both donor-built and self-built, in four disaster-affected communities in this region were selected, because of their reflection of the common features of the wider region. Grounding the research themes in these cases allows the identification of the core issues for developing disaster-resilient housing and building a resilient housing system in Central Vietnam.
3.3 Data Collection and Analysis

3.3.1 Introduction

The interpretive methodology and the case study method discussed in the last section play an important role in shaping the techniques for data collection and analysis. The literature search indicated that qualitative techniques for data collection and analysis are amongst the most appropriate techniques applied by the studies following case study methods. Especially within a human context such as building people’s houses against climate threats, as addressed by this research, qualitative techniques for data collection are more sensible and appropriate to assess perceptions and behaviours towards housing improvement and upgradation. This section discusses the chosen techniques for gathering the data from the case-study sites, and how these were processed against the research questions and objectives.

3.3.2 Data Collection

Since this research pursued the case study method, qualitative interviews and participant observation, the two most common techniques for data collection of qualitative studies (Bryman, 2008), were then applied to capture the field data from the case-study areas. There are two common types of qualitative interview, unstructured and semi-structured, in contrast to the predominance of structured interviews in quantitative studies (Bryman, 2008). In this research, semi-structured interview techniques were applied to collect opinions from at-risk communities and key informants such as architects, while the unstructured or open-ended interview techniques were used for focus group discussions. The unstructured interview was used to capture perceptions and opinions of the group discussion participants towards the openable issues raised by the research questions, such as the household situation, housing conditions, drivers of vulnerability, and unsafe methods of housing construction, or possibilities for improving disaster risk reduction at the household and community levels.

Semi-structured interviews and focus group discussions are the two most effective techniques widely used by qualitative researchers to collect field data (Hennink et al., 2011). In accordance with Maxwell (2005), questions for qualitative interviews and discussions in the present research were not only based on three theoretical themes identified in advance (through the literature review) but also attributed to the actual situation of the case-study areas, to investigate other issues.
related to housing development but not yet discussed or adequately mentioned in previous studies.

In each case study, ten semi-structured interviews with ten households, five with external support for housing reconstruction (donor-built) and five without outside assistance (self-built), were conducted, followed by two open-ended group discussions with the local representatives and local builders, fifteen persons per group, who were previously involved in the reconstruction process. The themes and questions for household interviews and focus group discussions were similar in content but different in the way respondents were questioned, due to the different backgrounds and levels of awareness of each group of respondents. The purpose of these household interviews and group discussions was to capture household-level and community-level information on housing vulnerability, the potential to build disaster-resilient housing, and how the research themes related to the context.

In addition, in each case, one official from the district authority in charge of disaster management of the district and one built-environment professional from the reconstruction implementing agency were approached to conduct key informant interviews. These key informant interviews were aimed at gaining the government’s and expert’s points of view towards the drivers of housing vulnerability and how housing resilience could be improved. Capturing perceptions and viewpoints from various groups of stakeholders towards disaster risk reduction for housing offered a better understanding of the current housing situation in disaster-prone areas of Central Vietnam, assisted the examination of the research themes in the real context of this region, supported the interpretation of human behaviour and interactions on housing construction, and enabled the determination of core issues for future housing developments.

In addition to the semi-structured interviews and focus group discussions mentioned above, observation of housing conditions and people’s activities and interactions surrounding their houses was undertaken, to add more information to the dataset and to complement points or issues that were insufficiently discussed or not mentioned in qualitative interviews. Observation is an essential tool in collecting qualitative data, along with in-depth interviews and focus group discussions (Hennink et al., 2011). As found from the pilot fieldwork, in early 2013, there were often some points that were not adequately addressed or even not
shared in qualitative interviews, especially information related to physical conditions of housing and settlements. Therefore, this research employed *observation* techniques, as a complementary tool, to assist the qualitative interviews, through photographing, hand sketching, and field noting, to record the data observed from the site.

The *observation* techniques above also supported the identification of silent norms and values of physical and social settings (Hennink et al., 2011), such as the linkage between the building structure and levels of risk exposure, or between socio-economic constraints and the ongoing vulnerability. In this research, objects for *observation* were the settlement patterns, the architecture, and construction of the surveyed houses, technical elements and details, and people’s activities and interactions around their house and within their neighborhood. This supported the interpretation of the data collected from the qualitative interviews, and helped provide further information and details on housing vulnerability and safe construction practices that were addressed in a limited way or not mentioned in qualitative interviews and discussions.

Moreover, a quantitative survey of the qualitative interviewees was also conducted at the same time as the qualitative interviews, to consolidate the appropriateness and applicability of the research themes to the real situation. Several quantitative questions were added to qualitative interview sheets, to collect quantifiable data on the qualitative issues, to check the correctness and reliability of qualitative responses from participants. This was a complementary tool, alongside in-depth interviews and focus group discussions, to fully capture the field data and enable a reliable analysis of qualitative data afterwards.

In addition to the collection of field or primary data above, this study also employed the technique of *documentation* to collect secondary data on the studied issues. Written deliverables such as project reports, working papers, policy briefs, governmental documents, maps, or other publications relating to DRH, were carefully examined and analysed to provide further data for answering the research questions posed by this project.

To check the understandability and appropriateness of the interview questions to local respondents, a pilot fieldwork was conducted in a case-study site in Central Vietnam, called Loc Tri Commune. Specifically, one focus group discussion, five household interviews, and two key informant interviews were conducted in this
to see how people understood the interview sheets, what points or questions needed to be revised, and whether the data collection techniques were appropriate to the real situation. This pilot fieldwork allowed a revision of all interview themes and questions before conducting the fieldwork proper afterwards.

There was only one major challenge faced in the real fieldwork. This was the language barrier in interviewing the ethnic minority people in Ia Broai Commune, who used a language (Gia Rai people’s language) that is different from the national Vietnamese language. However, this challenge was tackled by using a local translator who came from the community, was deeply understanding of local housing conditions, and had been used to translate for several aid projects.

3.3.3 Data Analysis

Conceptually, according to Corbin and Strauss (2008), data analysis is a process of examining a thing, concept, or phenomenon to identify its effects and influences within a given particular context, based on which, in support of a theoretical foundation (frequently through literature review), the generation of interpretations and inferences for a targeted study area, known as research findings, becomes possible:

Analysis is a process of examining something in order to find out what it is and how it works. To perform an analysis, a researcher can break apart a substance into its various components, then examine those components in order to identify their properties and dimensions. (Corbin & Strauss, 2008, p. 46)

There is a widespread agreement in the qualitative research literature (e.g. Bryman, 2008; Travers, 2001; Creswell, 2003; Braun & Clarke, 2006; Corbin & Strauss, 2008) that there are four main strategies commonly used by qualitative researchers in data analysis and interpretation:

➢ Analytic induction: to reach general explanations of social phenomena and/or human behavior (Bryman, 2008).
➢ Thematic analysis: to examine theoretical themes or hypotheses of a research through studying particular case(s) (Braun & Clarke, 2006; Bryman, 2008).
➢ *Narrative analysis*: to search new themes or issues from the stories told by the research participants about their lives (Bryman, 2008).

➢ *Grounded theory*: to generate themes or theories from the data through a systematic process of conducting qualitative research (Corbin & Strauss, 2008; Travers, 2001; Creswell, 2003; Bryman, 2008).

From the above concepts, each has their own strengths and shortcomings in dealing with qualitative data. Due to different goals and approaches of research projects, each of these four strategies may be appropriate to one project but not suitable for the others (Bryman, 2008). Frequently, the mixed use of some of the above strategies is preferable, as it offers a sufficiency of data analysis and interpretation (Creswell, 2003). In the scope of the present research, the techniques selected for data analysis were primarily based on two strategies: *thematic analysis* and *grounded theory*. While the application of *thematic analysis* helped to ground the research themes in the real context of Central Vietnam, *grounded theory* was useful to investigate further issues (other than the three themes above) that existed and were significant to the research topic but previously unknown or addressed inadequately (Bryman, 2008). The combination of these two techniques of data analysis was likely to ensure an effective data interpretation and generalization into valuable findings against the sub-research questions and the main research question of this study, as illustrated in Figure 3.3.

In accordance with these two selected techniques for data analysis, the data set used for this research was then established from the two following sources:

➢ *Source 1*: from the three themes emerging from the literature review: (i) *Community Consultation*, (ii) *the Role of Built-environment Professionals*, and (iii) *Design Principles for Resilience*.

To gain the data surrounding these themes, a set of questions for each was developed to frame the household questionnaire and the interview questions for group discussions (see the Household Questionnaires and Interview Questions in Appendices A, B, C). This enabled the study to ground these themes in the real situation of Central Vietnam, in seeking answers for the research questions above.

➢ *Source 2*: from the actual situation of the study area (Central Vietnam), expressed through the field data, in which further issues around the investigated phenomena or events may be found from the fieldwork.
To gain the data from this source, the use of open-ended questions for household interviews and focus group discussions was necessary. The questions not only focused on the themes specified in the literature review, as seen in Source 1, but also were extended to a broader context where underlying issues or driving forces of human behaviour were identified, based on which development of disaster resilient housing became plausible.

The preparation of the data set in accordance with these two sources played an important part in supporting the undertaking of thematic analysis and grounded...
theory strategies in data processing and interpretation, for meeting the research goals and objectives mentioned in Chapter 1 (Introduction).

**Thematic Analysis**

In qualitative research, *thematic analysis* is considered as one of the most common techniques for data analysis and interpretation (Bryman, 2008). The conduct of *thematic analysis* is primarily based on the themes that are theoretically established from the literature review and closely linked with the research problems (Braun & Clarke, 2006). Within this sense, processing qualitative data such as preparing and coding them into significant ways is driven by the theoretical interests or issues that researchers intend to further investigate within a given context (Braun & Clarke, 2006). In this research, the three major themes identified from the literature review (Chapter 2) are the backbone for analyzing the data collected from the fieldwork in Central Vietnam, in support of the *thematic analysis* technique, as follows:

**Theme 1: Community Consultation**

This issue was developed through a set of questions that were related to forms of consultation, contents of consultation, participants of consultation, time of consultation, and facilitation of consultation.

**Theme 2: The Role of Built-environment Professionals**

This issue was described by questions related to professional persons, professional assistance, and contributions.

**Theme 3: Design Principles for Resilience**

This issue was developed through a set of questions related to contextual (cultural, climatic, and environmental), technical, economic, and social responses of housing design solutions.

According to Bryman (2008), one of the most effective ways to undertake *thematic analysis* is the application of the *Framework* method, in which matrix-based comparisons, such as the use of *comparative tables* (see example in Table 3.1), is preferable. Accordingly, information collected from qualitative interviews is grouped in each theme to compare them and then be interpreted and generalized into findings. This is a quite simple but efficient technique for data analysis, to support qualitative researchers in reaching their expected research outcomes.
To go further with this technique for data analysis and interpretation, this also requires the application of the Framework method for the detailed analyses of the data within a particular theme or concept. As argued by Bryman (2008), this technique is also useful in dealing with the sub-themes of each of the major themes in the same manner (Table 3.2). This helps provide a clearer and deeper understanding of key themes of a study within the context of the study area, Central Vietnam in the scope of this research, to examine the contribution of each theme to the wider region and to knowledge gaps the research aims to fulfill.

Table 3.2: The use of Comparative Table for Thematic Analysis of Sub-themes

<table>
<thead>
<tr>
<th>(for example)</th>
<th>Theme 1: Community Consultation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sub-theme 1</td>
</tr>
<tr>
<td>Interviewee 1</td>
<td></td>
</tr>
<tr>
<td>Interviewee 2</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Interviewee n</td>
<td></td>
</tr>
</tbody>
</table>

The use of these comparative tables to thematically analyze qualitative data mentioned above offered this research a meaningful tool for data analysis and interpretation. In addition, according to Ryan and Bernard (2003), to ensure the efficiency of thematic analysis, it is also necessary to follow a variety of principles in the course of data processing. These include:
➢ Repetition: in a search for issues that are commonly repeated by interviewees.

➢ Non-repetition: in a search for issues that are rarely mentioned by interviewees.

➢ Similarity and Difference: in a search for similar and different responses among interviewees on a given theme or sub-theme.

➢ Metaphor: in a search for issues that are used in forms of metaphors.

➢ Transition: in a search for issues that link themes and/or sub-themes together.

➢ Theory Linkage: in a search for linkages or connections to scientific concepts or theories for the outcome of research findings.

(Based on Ryan & Bernard, 2003)

3.3.4 Summary

This section has discussed the techniques used for data collection and analysis of this research. While qualitative interviews and participant observations show their efficiency in collecting data on the ground, the thematic analysis demonstrates its usefulness for processing the data for future interpretations and generalizations into research findings and implications.

The three key themes of this thesis, (i) community consultation, (i) the role of built environment professionals, and (iii) design principles for resilience, play an important role, alongside the interpretive methodology and the case-study method, in selecting the data collection and analysis techniques. In the data-collection phase, these themes are used to identify the interview themes and questions, based on which the interviewee’s responses are generated to assist the interpretation of their meanings and implications within the context of Central Vietnam. In the data analysis phase, these themes are used as the backbone of the thematic analysis to underpin and shape the process of data analysis and interpretation, since these themes inform what types of information and data needed to be coded, compared, and interpreted.

By combining the qualitative interview and participant-observation techniques for data collection, as well as the use of thematic analysis for data analysis and interpretation, this research has reached its desired aims and objectives. Namely, not only are the three major themes critically examined, but also further issues
(other than these themes) concerning DRH improvement and development within the context of Central Vietnam are also investigated.

In relation to the personal bias of the researcher, the architectural background of the researcher and his technical expertise in safe housing construction might have an influence on the collection and analysis of the data, even where such data were mainly about social (non-technical) aspects. For example, some social data collected from the field might be paid more attention within the technical lens, even though such data were not so relevant to technical dimensions. To minimise or avoid such personal biases on the studied issues, a re-view and re-check of the research questions and objectives was regularly done throughout the research process to ensure that the data collection and analysis was in line with and fully responsive to the research problems regardless of the technical or social bases of the data.

3.4 Ethical Consideration

For studies involving the human participants and social perceptions such as this research, it is necessary to consider ethical issues to ensure the objectivity, the confidentiality, and the protected identity of the research participants (Hammersley, 1995; Kellehear, 1989). Ethics and social or human-related studies are closely connected, where the choices of methodological approaches, strategies, and data-collection and data-analysis techniques are critically affected by the ethics-related aspects (Kellehear, 1989). Type of participants, age of participants, their social and political contexts, the privacy of their personal information, the relationship between them and the researcher, and effects of the research on their lives, are among the considerable ethical issues for such studies (Kellehear, 1989).

In this research, the ethical considerations were captured through the lens of the above considerable issues and in accordance with the current regulations of ethics of the RMIT University for human-related studies. The RMIT University had granted the present research an Official Ethics Approval in January of 2013 (see Appendix D) for its subsequent fieldwork and other pertinent research activities in completing this thesis.

In response to this Approval, all participants interviewed by this research had the age of above 18 and below 60, to ensure their sufficient recognition and
understanding of the interview issues before answering. They had a full right to
decide whether to give opinions/responses or not without any influence from
interviewers or others. They could give no answer without reason or explanation
if they wanted. In addition, there was no pre-existing relationship between the
researcher and the interviewees that could influence the interviewees’ responses
or answers. All the interviewees were residents/staff living in the case-study sites
and, therefore, unknown to the researcher before (who came from another place).
The interviewees were randomly selected from the list, and their engagement in
this research was purely voluntary without influence from or reliance on anyone.

Before any interviews or discussions during the fieldwork, the participants had
clear explanations about the purpose of this research and the associated interview
or discussion, for their full understanding of the activity, before deciding whether
to give responses or not. They were asked to sign a consent form before the
interview or discussion, if they agreed. They could skip some questions during the
interview or discontinue the interview at any time if they found something unclear
or untrustworthy. These ethics-related considerations were fully respected by the
researcher in the fieldwork implementation.

Moreover, this research would not generate any cultural, social and political
biases, conflicts or tensions among participants, since the questions for interviews
and discussions were mainly associated with the housing issues and people’s
perceptions on building housing resilience to future climate threats. Information
relating to the personality and privacy of the participants would not be asked
because it was not relevant to the purpose of this research. In the case of some
questions that contain part of personal information of the participants, the identity
and privacy of individuals were protected by the replacement of their original
name and home address to avoid any further influences on them in the future.

In terms of storage, the data collected from the fieldwork are safely stored and
will be kept for at least five years after the publication of the research findings
(thesis) according to the current RMIT University policies. The hard copies of the
household questionnaire and interview sheets have been stored in a safe place,
where the researcher is the only one person that can access them.

In short, as recognised by the Ethics Approval granted by the RMIT University,
this research was classified as a low-risk study that has no or little (not significant)
effect on the research participants.
3.5 Research Validity

To validate this study, the researcher has submitted several papers that summarise the results of this study to different academic conferences and peer-reviewed journals, to check responses and feedback from international in-field experts and scholars. Overall, this study has been acknowledged and appreciated by the international research community. Namely, one paper was recognised as one of the best papers at a conference in Cyprus in October of 2013, where the researcher was invited to present the research outcomes in front of the whole workshop\(^6\); and one paper was published in a peer-reviewed journal, *Natural Hazards*, in June 2015\(^7\). In addition, during the time that this thesis was being reviewed by examiners after its initial submission on 10th August 2015, this study was afterwards submitted to the Springer International Publisher and, consequently, has been published as a reference book in the field of CCA and DRR\(^8\), in early 2016. These achievements indicate that this study is an original research project whose results have been recognised by the international research community through the published works above.

3.6 Conclusion

This chapter has described the research design, where the methodology, methods, and techniques used in this research were justified and outlined. As this research focused on exploring social, institutional, and technical issues beyond the formation of disaster-resilient housing, the *interpretive paradigm* (Bryman, 2008; Travers, 2001) was then applied as the backbone of the research design to decide the chosen research methods and techniques. The *case study* method (Platt, 1999; Maxwell, 2005; Bryman & Burgess, 1999), one of the most common and effective strategies for qualitative research, was employed to ground the three major themes of this research in the real-world context of Central Vietnam. These themes are (i) *Community Consultation*, (ii) *the Role of Built-environment Professionals*, and (iii) *Design Principles for Resilience*. The *interpretive* methodology and the *case-

\(^6\) The conference proceedings can be accessed at [http://www.disaster-resilience.net/images/Docs/ds1_proceedings.pdf](http://www.disaster-resilience.net/images/Docs/ds1_proceedings.pdf), the paper title is “Post-disaster Housing Reconstruction as a Significant Opportunity to building Disaster Resilience: a Case in Vietnam”.

\(^7\) The link of this paper can be found at [http://link.springer.com/article/10.1007/s11069-015-1826-3](http://link.springer.com/article/10.1007/s11069-015-1826-3).

study method have shown their valuable contribution in guiding the conduct of this research.

The selected methodology and methods above also affected the selection of data collection and analysis techniques. Accordingly, two common techniques for data collection in qualitative research, *qualitative interviews* and *participant observations* (Hennink et al., 2011; Bryman, 2008), were applied by this research to gather data on the ground; whereas the *thematic analysis* technique (Bryman, 2008; Braun & Clarke, 2006) was employed for data analysis and interpretation. The use of these techniques not only helped to gain reliable information and data from the field but also enabled an effective data analysis and interpretation of significant findings.
Chapter 4: Fieldwork Implementation and Case Studies

Overview

4.1 Introduction

As discussed in the last chapter on research design, the case-study approach was applied to explore key issues in delivering disaster-resilient housing in the light of post-disaster housing reconstruction (PDHR). This chapter provides an overview of the fieldwork implementation and the background of the four case-study sites, based in Central Vietnam: Hoa Hiep Bac, Loc Tri, Ia Broai, and Tan Ninh.

This chapter includes three main parts. The first part presents a summary of the whole fieldwork, conducted in mid-2013 and early 2014, where data collection methods used and key challenges faced during the fieldwork are discussed. The second part is the overview of the case-study sites, where housing situations and associated issues within each site are discussed. The third part is the discussion on the difference between donor-built and self-built post-disaster housing, to understand strengths and weaknesses of each reconstruction approach towards disaster risk reduction. This chapter functions as the foundation to support further data analysis and interpretation in the next chapters in relation to the three key themes of this thesis: (i) Community Communication and Consultation, (ii) the Role of Built-Environment Professionals, and (iii) Design Principles for Resilience.

4.2 Fieldwork Implementation

As mentioned in the previous chapter on Research Design (Chapter 3), the qualitative interviews and participant observations were used as the main methods of data collection for this research. As mentioned in Chapter 3 (Research Design), the fieldwork consists of two stages.

The first stage, called the pilot fieldwork, was in January 2013, where one focus group discussion, five random household interviews, and two key informant interviews were undertaken to assess whether the intended interview themes and questions were appropriate to the real context, and the feasibility of the selected data-collection techniques. The site for this first fieldwork was the Loc Tri Commune, one of the case-study sites for this research. The outcome of this first
fieldwork showed that most of the interview themes and questions were understandable to local people, and that the form of group discussions, and household and key informant interviews were familiar to local actors, who have joined similar forms of discussion in the past. There was a slight modification of the questionnaires after the pilot fieldwork, concerning the third theme, of the role of built-environment professionals. Most respondents, especially the self-built households, did not really understand the work of BEPs towards their housing improvement, since they have rarely seen the presence of BEPs in local housing construction. This allowed the revision of some questions on this theme, where the term BEPs was replaced by the locally familiar one, nhà thiết kế (as the designer), and some hard-to-understand points were rewritten in simpler ways to gain the full understanding of local respondents.

The second stage, called the real fieldwork, was conducted from January to March 2014, where the revised discussion/interview sheets were used to collect the field data at the four case-study sites. At each case-study site, ten in-depth interviews were conducted with ten households, five donor-built and five self-built, and two focus group discussions were undertaken with local stakeholders (local authority and community-based organizations, and local builders and village heads), twelve to fifteen persons per group (Figure 4.1). The themes and questions for these interviews and discussions focus on the three key themes of this thesis: (i) community consultation, (ii) the role of built-environment professionals, and (iii) design principles for resilience.

<table>
<thead>
<tr>
<th>Household Interview</th>
<th>Focus Group Discussion</th>
<th>Key Informant (in-depth) Interview</th>
</tr>
</thead>
</table>

**Figure 4.1:** Three techniques of field data collection used by this study
At each site, two additional in-depth interviews were also conducted with two key informants, of whom one was the government official in charge of disaster management at the district level and the other was the architect or engineer involved in local housing reconstruction after previous disasters. These key-informant interviews helped to understand the meaning of developing disaster-resilient housing from the government and expert points of view. In addition, further issues relating to disaster risk reduction for housing were also discussed in these talks, to better understand the local housing situations and local advantages and disadvantages, towards housing vulnerability reduction.

4.3 Overview of the Case Studies

As mentioned, Hoa Hiep Bac, Loc Tri, Ia Broai and Tan Ninh were the four case-study sites of this research selected from the four disaster-prone provinces in Central Vietnam, Da Nang, Thua Thien Hue, Gia Lai, and Quang Binh respectively (Figure 4.2). These four case-study sites contained the features that could underpin the fulfillment of this research’s objectives, such as the existence of both donor-built and self-built post-disaster housing, a predominant proportion of low-income households, and the use of community consultation and BEPs in housing reconstruction (for donor-built).

Figure 4.2: Four case study sites of this research in Central Vietnam (Map: www.dosm.gov.vn, accessed Dec 2013)
People living in these areas mainly belong to the poor and near poor groups whose incomes mostly fluctuate around the national poverty line⁹ and whose housing is highly exposed to natural disaster. While Hoa Hiep Bac, Loc Tri and Tan Ninh are situated in the coastal areas where floods and typhoons are common, Ia Broai is located in a mountainous area where tornados or whirlwinds and flash floods are the main hazards.

In terms of post-disaster housing, the first three sites have their donor-built houses provided by three NGOs, while the government provided this for the fourth site. Save The Children (SC), Development Workshop France (DWF), and Vietnam Red Cross (VNRC) were the three NGOs that supported the reconstruction of post-disaster housing in Hoa Hiep Bac, Loc Tri, and Ia Broai respectively, while the Vietnam Government, through its Ministry of Construction, assisted housing reconstruction for Tan Ninh (Figure 4.3).

<table>
<thead>
<tr>
<th>CASE STUDY 1: Hoa Hiep Bac (Da Nang)</th>
<th>CASE STUDY 2: Loc Tri (Thua Thien Hue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC rebuilt 25 houses after Typhoon Xangsane in 2006</td>
<td>DWF rebuilt 15 houses after Typhoon Xangsane</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CASE STUDY 3: Ia Broai (Gia Lai)</th>
<th>CASE STUDY 4: Tan Ninh (Quang Binh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNRC rebuilt 20 houses after Typhoon Ketsana in 2009</td>
<td>The government rebuilt 50 houses after 2011 floods</td>
</tr>
</tbody>
</table>

**Figure 4.3:** Overview of the case-study sites in this research

⁹ National poverty line = 400,000 VND (=19 USD) per month per capita

(Source: Decision of the Prime Minister No. 9/2011/QD-TTG: Promulgating standards of poor households, poor households to apply for stage from 2011 to 2015).
4.3.1 **CASE STUDY 1: Hoa Hiep Bac**

Hoa Hiep Bac is situated in the Lien Chieu District, Da Nang City, where cyclones are the biggest hazard to the local community. Cyclones have triggered serious damage and loss to local housing and livelihoods. This ward is next to the sea, where tropical cyclones originate and devastate its exposed areas (Figure 4.4). Signs of climate change in this ward have been clearer in recent years but increasingly unpredictable, as said by local respondents (e.g. the change of rainfall patterns, storm season, or storm frequency). Previous experiences of local people on climate occurrence and natural disaster are not correct at the current time, such as that flood tides usually occurred in July and August but are now in April, or cyclones coming earlier in recent years. Such changes make people surprised and unable to prepare coping measures for damage and loss reduction. It was found that some localized climatic events, such the long-lasting heavy rain in July 2012, were unknown to the city’s meteorology center (the responsible governmental body for disseminating early warnings), and thus not announced (through television and radio) to at-risk groups and communities.

![Figure 4.4: Location of Hoa Hiep Bac in Da Nang City (Source of map: www.danang.gov.vn, accessed March 2013)](image-url)
In previous times, this ward mainly suffered from storm hazards. However, rapid urbanization and industrialization, along with increasing construction density, have generated flood risks to storm-affected settlements. Accordingly, the rise of new industrial zones in empty lands such as rice fields or ponds, and the cover of the natural ground by concrete, has reduced space or room for rainwater and consequently triggered localized floods. This considerably affects people’s lives and reduces the lifespan and wind-resistant capacity of local houses due to the quick deterioration of masonry materials (e.g. brick, mortar) that are inundated in flood water.

The fieldwork findings also showed that the transformation of the local economic structure from being aquaculture- and agriculture-based into industry- and service-based has had a critical impact on local households, and pushes them to move to industrial factories instead of working on rice fields or at sea, as before. Without professional skills and training, they are usually recruited for temporary and unskilled jobs with low payment. These unstable and low-paid jobs restrict the economic development of low-income families and make it hard for them to escape the cycle of poverty. This also contributes to increased housing vulnerability due to the limited use of unaffordable safe construction methods.

Temporary manual labor, vendors on a train, and unskilled workers are increasingly common in this ward, while fishery and agriculture work have become more difficult due to the change of economic structure and adverse impacts of climatic events, as said by interviewees.

The housing of low-income people in Hoa Hiep Bac mostly follows the type of nhà cấp 4\textsuperscript{10}, which is locally perceived as a temporary and unsafe structure. Most respondents said that earnings of low-income people from low-paid jobs are only enough for the family’s daily food, and that the construction of an nhà cấp 4 house, even in a temporary and unsafe structure, is beyond their economic capacity. Many of them have had to borrow money from others and will repay the debt for years. Thus, the central focus of low-income people in housing construction is meeting their basic living needs (e.g. sleeping, cooking) rather than building a safe house. This is the key reason that makes this type of housing (nhà cấp 4) not technically improved, unsafe to natural disasters, and existing for a

\textsuperscript{10} Further explanation about the type of nhà cấp 4 is provided in Section 4.2.2.
long time. According to the ward authority, over 80% of low-income houses in this ward belong to the type nhà cái 4, in which many houses, besides being structurally weak, also absorb water from the outside through walls and from the roof when raining. These factors badly affect people’s lives, worsen their living conditions, and hinder the construction of safe and resilient housing.

Typhoon Xangsane in 2006 was the biggest disaster that this ward had ever experienced, and many people here were still fascinated by its awesome destruction. As one household said:

*It is a really divine wind. Before, nobody believed Da Nang could face a storm like it (Xangsane) because there were no big storms in this city previously. When it came, everyone was taken by surprise and there was no time for preparation. It caused massive damages and losses.*

*(HI 6)*

The typhoon caused serious damage to this ward such as breakage of the sea dam, the destruction of the road system, and damage to the local ships and boats. In terms of housing, 204 houses were totally destroyed, roofs of 527 houses were blown off, and 51 houses partially collapsed, as reported by the local authority. Most destroyed houses belonged to low-income groups who live in disaster-prone areas (e.g. seaside and riverside) without adequate disaster preparedness.

Moreover, because of economic constraints, not many households were able to reconstruct their houses after this typhoon. According to FGDs, 25 houses were provided by SC (donor-built), and more than 100 houses were rebuilt by house owners (self-built) in this ward at that time (2007). From on-site observations and household interviews for the present research, donor-built houses appear to have little damage after recent cyclones, such as Typhoon Ketsana (2009), while serious destruction is seen in most self-built homes.

In addition, governance mechanisms for housing vulnerability reduction in this ward were limited. According to the ward People’s Committee, the development of safe housing is lực bất đồng tâm (‘the spirit is willing but the flesh is weak’) in reality, regardless of the great efforts of local governments and aid agencies for disaster risk management in recent years. While the local authority always want people to build stronger houses, economic constraints of low-income people hinder its practical application and execution, and the local authorities have to
understand and accept this fact - to allow these people to build their houses on their own:

*Who pays money for them if safe housing construction cost much more than their economy? It is impractical to force people to follow if no economic support is provided.*

(KI 1)

The only way local authorities could assist was to deliver timely early warnings, and recommend and remind people to reinforce their houses (e.g. putting sandbags on the roof) or to evacuate to safe places (e.g. schools or multi-storey buildings nearby). In recent years, the Institute for Social and Environmental Transition (ISET), through a housing microcredit program, supported the construction of storm-resistant housing in this ward. The loan scale per household was 30 million VND\(^{11}\) for new construction and 15 million VND for renovations, with the condition of following safe construction techniques. The outcome of this initiative was positive in the sense that it provided both technical and financial support for storm-resilient housing construction. However, according to the household interviews, the scale of funding provided by ISET was quite modest, and beneficiary households (mostly poor) had to add more money (frequently exceeding their financial ability) to complete the construction of their homes.

**The Difference between Donor-Built and Self-Built Post-Disaster Housing**

This site sees the presence of both donor-built and self-built housing reconstruction after previous storms (Figure 4.5). The donor-built houses were provided by the NGO, Save the Children UK, after Typhoon Xangsane in 2006. The review of the project report (i.e. Save the Children UK, 2007) and discussion with the involved architect indicated that the structure of these donor-built houses was designed to withstand the wind level 11 on the Beaufort Scale\(^{12}\). To reach this target, the house structure needs to have a solid skeleton made by reinforced

\(^{11}\) 1 million VND ≈ 50 USD

\(^{12}\) The Beaufort Scale was first developed by Sir Francis Beaufort, U.K. Royal Navy, in 1805. This scale has thirteen levels, from zero to twelve, that correlate to the corresponding wind speed and the effect it causes to things on the ground. At the levels 11 and 12, residential houses are very likely to be destroyed if there is no reinforcement (Source: [http://www.spc.noaa.govfaq/tornado/beaufort.html](http://www.spc.noaa.govfaq/tornado/beaufort.html), accessed 18 December 2016).
concrete posts and beams, and a strong roof tightened by nails and bracings, as deduced from the discussion with the involved architect.

<table>
<thead>
<tr>
<th>Donor-built Post-Disaster Housing</th>
<th>Self-built Post-Disaster Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>by Save the Children UK</td>
<td>by households</td>
</tr>
</tbody>
</table>

**Figure 4.5**: Donor-built and Self-built post-disaster houses in Hoa Hiep Bac

Findings from the fieldwork show that self-built post-disaster housing contains more unsafe conditions than does their donor-built counterpart. Specifically, four out of five self-built houses surveyed did not have continuous beams at the middle and top levels to strengthen the walls, whereas these beams were found in all five donor-built houses (Figure 4.6). These beams play a key role in connecting all surrounding walls and intensifying the structural solidity of the house. On the other hand, the reasons for not using these beams in self-built houses were reported to be the consequence of (i) the economic difficulty of low-income households and (ii) the limited experience and skills of local workers on safe construction:

*Our biggest difficulty to build safe homes is economic. How can we think of it when we can’t afford our basic living needs, such as school fees and other expenses for daily living activities?*

*(HI 2)*

*I built my house based on available experiences of hired local masons without taking into consideration the safety-related measures because we were afraid they would cost much more money.*

*(HI 3)*
<table>
<thead>
<tr>
<th>Self-built housing</th>
<th>Donor-built housing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>No posts &amp; beams to secure the structure</th>
<th>Continuous RC beams at foundation, door, and roof levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick wall 10cm thick</td>
<td>Brick wall 10cm thick</td>
</tr>
<tr>
<td></td>
<td>Mezzanine (gang way)</td>
</tr>
</tbody>
</table>

For households with limited financial capacity.

For household with financial capacity.

**Figure 4.6:** The difference between self-built and donor-built post-disaster housing

The respondents from KIIs also highlighted the limited capacity of local workers in building safe housing. Accordingly, the limited understanding of local workers on technical requirements for safe construction has made them commonly follow previously unsafe practices in their construction work. According to one respondent:
Local masons have very little experience on the technical safety of buildings. What they usually do is following the same practices as before without an understanding of the forces or pressures generated on buildings by storm winds.  

(KII 1)

One of the most interesting points that make donor-built and self-built houses different is the use of different kinds of brick for construction. While the self-built houses used one type of locally common brick with a thickness of 10cm, the donor-built ones applied a new type of brick, thicker than local bricks, which were first provided by a local factory for this project. This makes the walls of donor-built houses thicker than self-built ones, 15cm compared with 10cm. The architect in charge of designing donor-built housing noted that the brick walls with a minimum thickness of 15cm could work as a load-bearing and wind-resistant structure. This perception was an innovative idea at that time (2007), because brick walls were widely considered as having a covering function only. To sustain this idea, the project architect tried to convince many local factories to produce this type of brick and, finally, one factory agreed. However, due to its unfamiliarity to local users and being more expensive than available local common bricks, this new brick disappeared from the scene right after the project’s completion (in 2007).

In terms of construction cost, self-built housing is more effective than donor-built housing. Although similar amounts of money were spent on both self-built and donor-built housing construction, the size of self-built houses was frequently larger than that of their donor-built counterparts, with the availability of more living spaces (Figure 4.7). As said by respondents, self-built households had to find all possible ways to reduce construction costs, such as reusing old or damaged materials and participating in all construction works wherever possible. On the other hand, despite efforts of the aid agency to provide cost-effective housing, donor-built houses were costlier. It was found that the costliness of the donor-built houses resulted from the employment of a construction contractor outside the community instead of using local labor forces for reconstruction. According to a donor-built house’s owner:

*The use of many players outside the community made the cost increase. In future projects, if possible, people here would only need the design from*
architects and then self-organise all construction works with local builders. Local authority and donors can supervise our works anytime to ensure the quality.

*(HI 2)*

**Figure 4.7:** The larger size of self-built housing (left) compared to donor-built housing (right)

*(Note that they were drawn in the same scale so that the smaller one has smaller size)*

In general, both self-built and donor-built families faced challenges in mobilizing adequate finance for their housing reconstruction after Typhoon Xangsane (2006). More difficulties were experienced by the self-built group, who, with very limited external support, fell into debt after the typhoon. Some self-built households had to borrow up to 80% of the total construction cost from others (relatives, neighbors, or friends), and were unsure when they could repay these debts. In cases of inadequate money being borrowed, they had to borrow several workdays from neighbors, relatives or friends that, subsequently, they needed to repay with the same number of workdays for the housing construction of their lenders. Through this way, self-built households could effectively support each other to finish their housing reconstruction one after another, even without sufficient finance. As explained by some householders:

*After the storm, my house was totally destroyed except for the foundation. Together with our savings, we had to borrow up to 70% to rebuild this house and we are not sure when we will be able to repay this debt.*

*(HI 9)*
Because we had too little money to hire masons, we had to borrow 50 workdays from our neighbors and friends and, afterward, worked for their housing construction for the same number of borrowed workdays as a payment.

(HI 10)

In terms of housing type, both self-built and donor-built housing follow the form of nhà cấp 4, the lowest ranking type of housing in Vietnam, as prescribed by the Vietnam Government’s Decree of 209/2004/ND-CP in 2004 (Vietnam Government, 2004). According to this decree, nhà cấp 4 is the house whose total floor area is below 1,000m$^2$ and or the building height is lower than four stories. Technically, according to the Circular 05-BXD/ĐT of 1993 by the Ministry of Construction, nhà cấp 4 is characterized by brick load-bearing walls for the structure, stones for the foundation, and corrugated iron sheets or clay tiles for the roof. The main difference between nhà cấp 4 and other types (nhà cấp 3, nhà cấp 2, nhà cấp 1) is the load-bearing structure, where the confined reinforced concrete (RC) skeleton is used in the other types.

Based on this classification, both self- and donor-built houses in Hoa Hiep Bac belong to nhà cấp 4. However, from the interview with the architect, despite the same type of building structure (nhà cấp 4), donor-built houses are technically stronger than their self-built counterpart thanks to their proper technical design with the inclusion of some strong elements (concrete beams, posts) (Figure 4.8).
Another issue that makes self-built and donor-built houses different is the use of community consultation during the design process of post-disaster housing. While donor-built houses were designed with the engagement of beneficiaries, the local authority, community-based organizations, aid agency, and architects, in meetings and talks, self-built houses had no communication with external parties except for the collaboration between house-owners and local masons who were hired to build their houses. As one self-built respondent said:

*I rebuilt my house on the old foundation and in the same type of pre-disaster house without instructions from professional sides. All we did was try to finish the construction as soon as possible for my family’s settlement.*

*(HI 8)*

The main aspect that makes self-built and donor-built houses different is the construction quality. Most self-built houses have a better construction quality than donor-built ones, particularly the wall and roof parts. For example, all five donor-built houses surveyed face the problem of water leaking from the roof (Figure 4.9), while no similar errors could be found in the self-built houses. As said by local builders, this may result from the low-quality mortar used for roof-ridges or from using an improper way of inserting corrugated iron sheets into the roof. 
ridges. This problem makes steel roof-purlins underneath rust quickly and reduces their load-bearing capability. This affects the structural stability of the house against disasters (e.g. storms) and reduces the building’s lifespan.

Figure 4.9: Water-leaking errors seen in the surveyed donor-built houses

To further explain this failure, the fieldwork findings showed that self-built householders were often the key actor and the main supervisor of all construction works, where they spent a significant amount of the family’s budget that they had accumulated through many years. All building parts and construction activities were strictly monitored by house-owners, and would be immediately corrected if something unexpectedly happened or was badly constructed. On the other hand, the donor-built houses, which heavily depended on the outside contractor, had restricted the full control of house-owners over the construction process. Although beneficiaries were encouraged to participate in their housing construction, donor-built householders said that their voices were not as powerful as their self-built counterparts, and some of their requests or suggestions were neglected by the contractor. Overall, only one out of the five donor-built households interviewed was happy with their post-typhoon houses built by the donor (Save the Children UK).

Summary
The Hoa Hiep Bac Ward is next to the sea where storm hazards are serious and potentially generate negative impacts on local housing. The donor-built and self-built housing reconstruction concurrently exists in this ward. The donor-built and
self-built houses have some similar and different features associated with their wind-resistant capacity. While most of the donor-built houses surveyed were technically strong in resisting storm wind, the self-built houses were not sufficiently safe due to lacking storm-proof measures incorporated in their housing structure. The existence of such unsafe construction practice was not only due to the limited understanding of local people on resilient construction but also because of lacking technical assistance from built-environment professionals (i.e. architects, engineers) and the economic constraint of low-income households. However, functionally, the internal spatial layout of self-built houses was more flexible than that of their donor-built counterparts, thanks to the greater control of self-built homeowners over the housing design process, whereas less decision-making power was given to the donor-built ones.

4.3.2 CASE STUDY 2: Loc Tri

Loc Tri Commune, located in the Phu Loc District in the southeast of Thua Thien Hue Province, was the second case-study site of this research (Figure 4.10). This commune has a total area of 6,259.8 hectares, of which 4,963.5 hectares is agricultural land, 1,520.02 hectares is non-agricultural land, and 95.95 hectares is unused land\(^\text{13}\). The economic structure of this commune is based on agriculture, forestry and fishery, handicraft, and tourism service, as reported by a commune staff. The commune has eight villages, of which six are agriculture-based and two are fishery-based. Up to 2016, the commune has 1,748 households with 8,498 people. The poor households\(^\text{14}\) account for 15.33% (268 households), and the near poor ones cover 11.15% (195 households)\(^\text{12}\).


\(^{14}\) Ranked by the national poverty line for 2011-2015, as mentioned in Footnote 1.
This commune, next to the Cau Hai Lagoon, is one of the areas of this province most vulnerable to climate change and natural disasters. Climate change projections in this area are associated with the irregular occurrence of climate events, different from the past and unpredictable for local people in terms of occurrence time, frequency and intensity. For instance, typhoons usually occurred from August to November in the past but now are throughout the year. Natural disasters have posed negative effects on local housing and livelihoods, mainly fishery, and resulted in considerable housing damage and economic loss in recent years.

According to household interviews, people here have a long tradition of coping with natural disasters, and thus, take disaster preparedness seriously. In eight out of ten houses surveyed, there are always some items available for reinforcing the house when a storm is forecast, such as wooden bars for putting on roof covers, tough fishing nets to cover the roof, or iron cables to anchor the roof structure to the ground (Figure 4.11). People here were not surprised when Xangsane (2006)
came, as several similar storms had visited this area before. However, due to economic constraints, they preferred the use of the immediate measures mentioned above in response to natural disasters, because it was much cheaper and locally available. As mentioned by one household:

*My family has to buy these iron cables and nets to consolidate the house when storms come. They cost not much money but can help avoid unexpected damages.*

*(HI 8)*

![Figure 4.11: Available wooden bars (left) and fishing nets (right) used to strengthen the roof and walls of local houses when storms come](image)

The housing of low-income people in this commune is still vulnerable to storms and typhoons followed by floods and storm surges. Thanks to the long history of coping with disasters, local actors here can identify the main hazards to housing and be prepared for the worsening trend of the future climate caused by climate change and global warming. Most of them believe that typhoons are likely to increase in a near future. They also believe that local housing in their area is incapable of coping with such typhoons if safety-related measures are not used. As noted by one local authority staff:

*People in this commune have realized the potential threats of storms, particularly with sea waves, because many big storms have occurred in the past. Their housing construction, despite being without building permits, has addressed some structural elements to stabilize the building.*

*(FGD 3)*
Typhoons and sea waves created by strong winds are considered as the biggest hazards to local houses in this commune (Figure 4.12). Strong winds generated from storms intensify sea waves, which subsequently press destructive pressure on local houses when they approach the land. According to local respondents, the impact of sea waves during storms and typhoons is much more dangerous than the impact from strong winds, because very strong sea waves can easily destroy the house’s walls. About 85% of local houses here belong to the type of nhà cấp 4, which was mentioned in the last section (Hoa Hiep Bac):

The most hazardous threat is from sea waves. They are high and very strong in the storms, cross the sea dike and make walls and houses collapse easily. All houses in this area must build strong beds made of concrete to protect the house’s walls.

(HI 9)

Figure 4.12: Storm and sea waves are the main hazards to local houses that made people use the wooden bars and fishing nets (shown in the Figure 4.11) for their house reinforcement

Typhoon Xangsane in 2006 seriously destroyed local houses of this commune, in which nearly 100 houses were totally destroyed and over 300 houses were damaged, as reported by a local authority staff. After Typhoon Xangsane in 2006, DWF supported the reconstruction of 15 houses, known as the donor-built houses, and people rebuilt about 40 houses, known as the self-built houses. The donor-built houses were designed in accordance with the ten technical principles of storm-resistant construction provided by DWF since 2000 (Figure 4.13).
These technical principles shaped the structure of donor-built houses provided by DWF after Typhoon Xangsane (2006) in this commune, while the building form, functional arrangement, and spatial layout of such donor-built houses were defined in consultation with beneficiary households and local builders, as stated by the interviewed DWF staff. Housing construction methods associated with the ten storm-resistant principles above are discussed in comparison with the structure of self-built houses in the next section.

The Difference between Donor-built and Self-built Post-disaster Housing

It was found that there are not many differences between self-built and donor-built post-disaster housing in Loc Tri. There are two common housing types, nhà ống (tube house) and nhà ba gian (three compartment house), that are followed by both self-built and donor-built housing construction (Figure 4.14). While the nhà ba gian is the reflection of Hue traditional houses, the nhà ống is representative of urbanization. According to housing-ranking criteria given by the national government, these two types of housing belong to the nhà cấp 4 category. Similar to the first case study, the concept of nhà cấp 4 is also misunderstood by local people, as they often consider nhà cấp 4 to be a temporary and insecure structure.

The first difference between self-built and donor-built houses is seen in the roof structure. The donor-built houses contain more structural elements in the roof than do the self-built ones, such as the addition of concrete frames at the middle of the house and on the gable walls. This makes the roof of donor-built houses more stable than that of self-built ones, and considerably improves the whole structure’s solidity. According to household interviews, the main reason for using fewer
elements in the roof structure is the limited awareness of house owners. Most self-built households supposed that such elements would cost more money and that the stability of the house was not very dependent on their presence.

![Diagram of roof structures](image)

**Figure 4.14:** The difference between self-built and donor-built houses
The second difference between donor-built and self-built post-disaster housing is the practice of community consultation and the involvement of architects and engineers in the design process. While community consultation and professionals’ engagement were seen in the design process of donor-built housing, they were not found for the self-built housing. Households whose houses were destroyed by previous typhoons but were not selected as project beneficiaries had to find various ways to rebuild their houses on their own without technical assistance for safety purposes. Some households, due to extreme economic difficulties and having no external assistance, continued to live in critically unsafe houses with some temporary repairs (e.g. replaced blown-off roof coverings or repaired damaged doors and windows). These indicate the higher level of risk posed to self-built in comparison with the donor-built housing. However, regarding local adoption, all five donor-built households interviewed were happy with their post-typhoon houses built by the NGO DWF.

**Summary**

The Loc Tri Commune is located near the sea, where tropical storms associated with increased sea waves are the strongest impacts on local housing, as emphasised by local respondents. In this commune, household families have experience in coping with these hazards, but still not sufficiently, due to lacking financial resources and technical guidance on how to increase house resilience. Similar to the Hoa Hiep Bac Ward (the Case Study 1), this commune sees the presence of both donor-built and self-built housing reconstruction after previous typhoons, namely Typhoon Xangsane in 2006. The design and structure of the donor-built and self-built houses after this typhoon is quite alike, thanks to the understanding of the involved architects about the local context when designing the donor-built houses. However, there is a difference between these two reconstruction approaches in terms of technical stability against storm wind, where the donor-built houses are stronger and have more storm-resistant components in their structure compared to the self-built ones.

**CASE STUDY 3: Ia Broai**

The Ia Broai Commune is located in a mountainous area of the Gia Lai Province, Central Vietnam (Figure 4.15). The commune has an area of 23.3 km², with a
population of 2,857 people. The economic structure of this commune is mainly based on agriculture, covering nearly 73%, with the rate of poor and near poor households at 23% and 15%, respectively, as reported (through rough estimates) by a commune authority staff. This commune is highly exposed to storms and floods. Storm hazards here are not only from tropical cyclones but also from local whirlwinds that frequently happen in mountainous areas. Flood hazards in this commune are not similar to the plain or delta regions, with the appearance of flash floods and stronger flows of floodwater. These two types of hazards become the most serious threats to local housing in Ia Broai. As reported by the local authority, this commune suffers from 10-12 storms, including whirlwinds, and 3-5 floods, per year.

Figure 4.15: Location of Ia Broai Commune, Ia Pa District, Gia Lai Province (Map: www.gialai.gov.vn, accessed April 2014)

Gia Rai people, one of the ethnic minority groups in Vietnam, are the predominant population in this commune. Their life is mainly based on

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agricultural produce (rice and cassava) in the areas far from their home, around one-hour walking distance. Some households, instead of agricultural farming, moved to working in tobacco factories nearby, which were established in recent years. However, both means of livelihoods (agriculture- and factory-based) are only just adequate for paying the daily basic needs of families (i.e. food or school fees for children) and cannot help them escape from poverty. If their houses are destroyed by natural disasters, it is extremely hard for them to mobilize sufficient resources (i.e. financial, human) for full repair or reconstruction.

Figure 4.16: Houses on stilts are commonly seen in Ia Broai, a special culture of mountainous people

In this commune, local houses currently contain strong vernacular characteristics in terms of building form, structure, and materials used. Almost all local houses are in the form of timber structures sitting on wooden posts or stilts, to accommodate various living functions above and under the timber floor separated from the ground. The main living functions, such as sleeping, cooking and eating, commonly occur on this floor, whereas the sub-functions such as storages of livestock or farming tools are placed underneath (Figure 4.17). People here have a long tradition of living on stilts (separated from the ground) to avoid unhealthy air that comes from the ground and wild animals at night. All ten interviewed households showed their strong desire to keep this way of living (on-stilts) and traditional on-stilt houses, despite the appearance of some on-ground modern houses in this area in recent times.
Figure 4.17: Sub-function of livestock-raising is put under the floor of a surveyed house

The on-stilt structure makes housing of mountainous people different from the housing of plain people whose houses are dominated by the on-ground form. Some agencies introduced new on-ground houses to this community, but people were not interested because they still preferred living in the on-stilt houses. As observed, most of the on-ground houses provided by agencies are currently used for keeping farming tools, seeds, animals, or food rather than for living purposes (Figures 4.18 and 4.19).

Figure 4.18: An on-ground house (left) recently built near an old on-stilt house (right)
However, the increasing impact of recent storms and floods has made local traditional houses (on-stilts) more vulnerable and unstable than ever before. The Typhoon Ketsana in 2009 was one of the biggest natural disasters recorded in this community. Its strong winds and heavy rains resulted in critical damage and loss to local houses and people’s livelihoods (Figure 4.20). Local farming fields (rice, cassava) were seriously damaged and many houses were destroyed by this typhoon. The commune People’s Committee said that about 100 houses were totally destroyed and nearly 300 houses were partially damaged. Most of the destroyed houses belonged to poor households who had a limited financial resource to recover and rebuild their houses after the event.

Meanwhile, external assistance for housing improvements was limited, except for some NGO-funded reconstruction projects with a relatively modest number of beneficiary households. In 2010, the International Federation of Red Cross and Red Crescent Societies (IFRC) and the Vietnam Red Cross (VNRC) funded the reconstruction of 20 houses in this commune after Typhoon Ketsana (2009), known as the *donor-built houses* examined by this study.
The assistance included financial and technical support to provide safe houses for the families whose houses were severely destroyed by this typhoon. The researcher was involved in this project as an architect of the DWF organization (contracted by IFRC as the professional consultant) to provide the design of these 20 houses and construction supervision. The key technical concept applied for these donor-built houses was fundamentally based on the ten principles of storm-resistant construction provided by DWF, as mentioned earlier. However, the researcher also conducted many discussions and consultations with beneficiary households and community members to identify the housing form, the size of the house, the materials used and the roof shape, as further discussed in the next section.

On the other hand, the number of houses that were reconstructed by people after this typhoon, known as the *self-built* houses, was not precisely captured by the local authority, around more than one hundred as estimated by a local staff. Although the local authority staff could not specify an exact number of the self-built houses, they believed that the number of self-built houses was much higher than the *donor-built* ones. As one respondent said:

> Hundreds of households who had their houses damaged by the typhoon (Ketsana) had collected timber from the forest to rebuild their houses by themselves. We are not sure how many but I think at least one hundred new houses were self-built after the disaster here.

(*FGD 1*)

Therefore, post-disaster housing provided by IFRC and VNRC (donor-built) and by people (self-built) after Typhoon Ketsana (2009) is examined in the present thesis to understand opportunities and challenges faced by each reconstruction approach, and the potential to develop disaster-resilient housing for this community.

**The Difference between Donor-Built and Self-Built Post-Disaster Housing**

As mentioned, housing in Ia Broai was seriously damaged by storms and floods. While storms and whirlwinds are the main threats to the house’s roof and walls, annual floods make the supporting wooden posts under the house deteriorate and rot quickly. The local authority reports that Typhoon Ketsana in 2009 triggered
winds stronger than level 12 on the Beaufort scale, with two-metre-high flooding on average.

The difference between the donor-built and self-built houses is clearly seen in the load-bearing structure, where RC skeletons were used for the donor-built houses while timber ones were used for the self-built ones (Figure 4.21). As observed, the reinforced-concrete skeleton is technically stronger and has a longer lifespan than the timber one. In addition, differences between donor-built and self-built houses were also found in the length of roof overhangs, the quality of wooden planks used for walls, and the use of connections between roof elements. Accordingly, self-built housing shows more unsafe conditions than does donor-built housing, such as the common appearance of longer roof overhangs that tend to blow off in strong winds, low-quality wooden planks, and lack of connections between roof purlins and coverings (Figure 4.22).

**Figure 4.21:** A donor-built house with RC frame (right) beside a self-built house with wooden frame (left) (Source: Author)
Figure 4.22: Different technical features between self-built and donor-built houses in Ia Broai
The difference between donor-built and self-built housing is also seen in the construction process. Although the steps to build a house appeared to be similar between the two reconstruction approaches in the two main stages, (i) structure and roof construction and (ii) wall installation, time for completing a self-built house was often longer than for a donor-built one, frequently taking one to three years for finishing the construction of a self-built house. In addition, no design service was provided to the construction of self-built housing, while architects were involved in the provision of donor-built housing. For self-built housing, the first stage of construction is the installation of a structural skeleton by timber pillars and beams with a roof on top, before proceeding to the second stage of adding wooden planks for walls. The construction period of a self-built house varies and is dependent on the actual condition of each household, frequently lasting from three months to two years in accordance with their economic capacity and the availability of accumulated materials (Figure 4.23). For donor-built houses, due to the time limit of the post-typhoon housing reconstruction project, the construction of these houses was completed within one month on average, in which the concrete skeleton and walls were built and installed at the same time.

**Figure 4.23**: Similar process of construction but different duration of construction and design service between donor-built and self-built post-disaster housing
The difference between donor-built and self-built houses in terms of the construction process and time of completion also relates to housing resilience: namely in the longer time of building construction, as seen in the surveyed self-built houses, especially for the houses whose construction crossed two years due to lacking resources for completing the construction in a shorter time. These houses are more vulnerable when the stormy seasons come, because their unfinished structures could be easily destroyed by storm wind. On the other side, the donor-built houses which were built within one month, usually in the dry season, were surely not susceptible to storm events because no storm visited them during the construction period. This reflects another side of vulnerability of self-built households whose economic constraints hindered them from mobilising sufficient resources for constructing their homes in one period. Socially, four out of the five donor-built households interviewed were satisfactory with their houses provided by the donor after Typhoon Ketsana in 2009.

**Summary**

The Ia Broai Commune is located in a mountainous area of Central Vietnam, where storms and floods are the biggest hazards to local housing. Most of the commune population belong to Gia Rai people, an ethnic minority group in Central Vietnam, who prefer living in on-stilt houses. The commune sees the presence of both donor-built and self-built houses reconstructed after Typhoon Ketsana in 2009, where similarities and differences between these two reconstruction approaches could be found. Remarkably, the form of donor-built and self-built houses is alike, where the on-stilt building structure was applied by both approaches; while the difference between them is clearly seen in the use of construction materials: namely, that timber was used for the structural frame of the self-built houses whereas reinforced concrete was for the donor-built ones. There were several reasons associated with such similarity and difference, which are further discussed in the next chapters.

4.3.4 **CASE STUDY 4: Tan Ninh**

Tan Ninh is a poor commune of the Quang Binh Province, Central Vietnam, where local livelihoods are mainly based on agriculture produce. The commune has an area of 11.567 km², with a population of 5,161 people scattered across five
villages\textsuperscript{16} (Figure 4.24). The commune is considered as one of the poorest communes of the province, with the rate of poor households at about 30\%, as stated by a commune authority staff. This commune is located in a low-lying area and suffers from flooding every year. The floods in late 2010 have been considered amongst the biggest events that this commune has ever experienced, with the level of floodwater up to two meters on average. People’s livelihoods, which were mainly based on agriculture production, were seriously impacted by this flood, with huge damage and loss, as agreed by most local respondents in the household interviews and focus group discussions. Many local houses were fully inundated where flood levels crossed their roof.

\textbf{Figure 4.24:} Location of Tan Ninh Commune, Quang Ninh District, Quang Binh Province (Map: \url{www.quangbinh.gov.vn}, accessed April 2014)

In this commune, people mostly belong to poor and near poor groups whose incomes fluctuate around the national poverty line. They have much experience in

coping with flooding, thanks to a long history of facing flood disasters. They usually build a sub-floor in their houses higher than annual flood levels, or adjust crop patterns or harvesting times in accordance with climate occurrence. In addition, most households have a small boat for transportation in the flooding season. However, due to climate change, floods in recent years have been more severe and unpredictable for local people in terms of their frequency and intensity. The floods in 2010 are a good example, since they exceeded all big floods of the past and seriously devastated the commune. Local housing was among the most affected sectors, which experienced significant damage and loss after these events.

Recognizing the importance of improving flood-resistant capacity for local housing here, in 2013, the Vietnam Government, through its Ministry of Construction, selected this commune as one of the beneficiary sites for a flood-resistant housing reconstruction project. This project, called 716, provided permanent flood-proof houses for poor households who live in the extremely low-lying areas and whose existing houses were severely damaged by previous floods, especially the 2010 flood. This project was completed in late 2013, with fifty flood-resistant houses built in this commune, known as the donor-built houses, examined by this study. According to the interviewed households, the design of these donor-built houses was conducted in consultation with a wide range of stakeholders and incorporated with some new design ideas for flood resilience that were different from the local common practices, as highlighted by a local authority staff. For example, the concept of “chòi chống lũ” (flood-preventive shelter), where a two-story structure with a floor higher than the biggest flood level in the past was proposed. In response to the local context, some donor-built houses incorporate this structure in their main house to better accommodate current living functions. These are further analysed in the next section in comparison with the self-built houses constructed by people after the 2010 flood.

**The Difference between Donor-Built and Self-Built Post-Disaster Housing**

There are three features that make donor-built different from self-built housing (Figure 4.25). The donor-built houses were built with the use of (i) the provision of a stronger structure with a higher floor than those that are self-built, (ii) a larger area of the flood shelter to adequately accommodate living functions in normal times, and (iii) technical assistance for housing design and construction.
In terms of building structure, as seen in the 716 houses, a double story structure made of reinforced concrete (RC) was provided in which the second floor is relatively high, above 3.6 meters (Figure 4.26). As explained by the project’s technical staff, the high level of the second floor helps protect occupants and their assets from super floods like the 2010 events, and offers an adequate space underneath for living functions. On the other side, in the self-built houses, flood shelter is still temporarily made with wooden planks and has floor levels much lower than the donor-built, below 2.7 meters as observed in the surveyed houses. Flood shelter usually exists in the form of a heightened sub-floor right under the roof of the main house, locally called chan or tra.

Related to the usable space of flood shelter, the donor-built houses show a larger area than their self-built counterparts. As observed, all five donor-built houses have their flood shelter with a minimum floor area of 12 square meters, while the area of flood shelter in the self-built is equal to or lower than 5 square meters. With a larger floor area, the donor-built houses can use the flood shelter for other functions such as sleeping, children studying, or farming product storage. However, the limited floor area of the flood shelter in self-built housing only allows its use for keeping a few valuable items of the family, in normal times.
Concerning the use of *community consultation* for housing design generation and development, the design of donor-built housing received external support from a wide range of stakeholders, including the province and local governments, community members, and professional consultants. At that time, the NGO Development Workshop France worked as the professional and technical consultant for this project, to add disaster-resistant features to the building structure and to monitor construction. The design of the 716 houses also involved methods of community consultation from the beginning phase of the project, to capture local needs and capacity before developing design and construction solutions. However, in self-built housing, only two local actors are seen in its formation: homeowners, and local construction workers hired by them. In addition, support from other external parties, especially building designers, was unseen in the construction of self-built housing. In terms of people’s acceptance, three out of the five donor-built households interviewed were satisfactory with their 716 houses provided by the government.

**Summary**

The Tan Ninh Commune is situated in a low-lying area where annual floods are the biggest natural hazards to the local life and people’s housing. Similar to the
three case studies above, this commune sees the presence of both donor-built and self-built houses provided after previous floods, particularly the big flood in 2010. The donor-built and self-built houses constructed after this flood have some similarities and differences in terms of structural and formal performance. Specifically, both donor-built and self-built houses have a second floor higher than normal flood levels, to protect people and household items from flooding. However, this floor exists in the form of a small garret under the roof of the self-built houses, while in the donor-built ones this was built as a second storey for a living functional space (e.g. bedroom, children study room). Such similarities and differences are further analysed against the research themes of this thesis, in the next chapters.

4.4 Conclusion

This chapter provides an overview of the four case-study sites selected for this research. In general, these sites are prone to floods and/or typhoons, and people living there belong to poor and near poor groups with limited resources and capacity for coping with natural disasters. Their housing is among their most valuable but also their most vulnerable items, which has a close link with household poverty, substandard living conditions, and ongoing risk to future climate hazards.

Post-disaster housing provided in these case-study sites was implemented by both donors (donor-built) and people (self-built). The number of donor-built houses is relatively modest in comparison with their self-built counterparts. It was found that there are several features that make donor-built houses different from self-built ones, ranging from technical issues such as building structure and spatial arrangement, to social aspects such as community consultation, the involvement of built-environment professionals (i.e. architects, engineers), and the responsiveness to socio-economic and cultural conditions of inhabitants through design solutions.

In general, donor-built houses show a better performance in terms of disaster risk reduction, while self-built ones are more efficient in responding to socio-economic and cultural conditions of occupants. This indicates that, although the donor-built houses were designed in support of community consultation, the involved architects were still not fully aware of what people actually aspired for their houses, and thus, the design outcomes of safe housing were not really
responsive to the need and aspirations of inhabitants. This relates to the ways of conducting community consultation, engaging built-environment professionals, and incorporating community feedback into resilient housing design options. These issues are further analysed in the next chapters, to provide a clearer understanding of how these issues affect the resilience of households and to what extent they are linked and support each other in reaching a resilient housing system. These are also framed within the three key themes of this thesis, namely (i) community participation and consultation, (ii) the role of BEPs, and (iii) design principles for resilience, that are critically analysed in the next three chapters.

Specifically, in terms of community participation and consultation, the case studies show that it is necessary to identify suitable ways of discussion with beneficiary communities, who should be involved in the discussion; and show what mechanisms should be based to frame the discussion towards the desired outcomes of disaster-resilient housing. In relation to the role BEPs, it is important to determine at which stages building designers or architects/engineers are needed and what technical inputs are demanded from them in shaping resilient housing design options. Regarding design principles for resilience, the technical, economic and social dimensions of disaster-resilient housing should be carefully considered, to inform and shape housing design options that are not only resilient to storms and floods but also appropriate to the local socio-economic and cultural conditions of the involved group or community. Further discussion and analysis of these aspects are provided in the next three chapters.
Chapter 5: Community Participation, Consultation and Communication

5.1 Introduction

This chapter discusses the key findings from the four case studies mentioned in the last chapter in terms of the first theme of this thesis, *Community Participation, Consultation, and Communication*, in three main sections. The first section is the examination of the consultation and communication forms that emerged from the process of post-disaster housing reconstruction at the case-study sites (Figure 5.1). The second section is the identification of key stakeholders whose consultative inputs are significant to promoting disaster-resilient housing. The third section focuses on a broader view to examine the need for supportive mechanisms to enable interactive discussions and shared learning dialogues between stakeholders involved in the design, procurement, and construction of local housing.

![Diagram of Community Consultation & Communication](image)

**Figure 5.1:** Three main components of community consultation for building disaster-resilient housing
It was found that identifying methods of consultation and communication between stakeholders (how it is done), key participants (who does it), and appropriate supportive mechanisms (what resources are needed), are the core components of the consultation process for the outcome of post-disaster housing and the delivery of resilient housing.

5.2 How is it done?

This section discusses the main forms of consultation and communication that were used in the design of post-disaster housing at the case-study sites. Communication and consultation forms refer to ways of information exchange and knowledge transfer between relevant stakeholders in the provision of post-disaster housing and the improvement of disaster preparedness for housing. It was found from the fieldwork that there are four main forms of consultation and communication that were widely applied in providing post-disaster housing and enhancing housing risk reduction:

- **Community Meetings** - the direct communication between an at-risk community, local authority, and external stakeholders on general issues.

- **Separate Household Interviews** - the direct communication between at-risk households and in-charge technical staff on specific technical aspects of post-disaster housing (i.e. spatial arrangement, methods of construction, materials used).

- **Informal Local Sharing Dialogues** - the direct communication among local people and between local people and the involved persons on the issues that were previously unplanned at the unorganised places (e.g. on the road, at market or café/food shops).

- **Broadcasting** - the indirect communication between local authorities and an at-risk community through mass media to popularize early warnings and recommendations for damage and loss reduction.

In the design process of post-disaster housing, while community meetings and separate household interviews are commonly seen within the donor-built group, informal local talks or sharing dialogues appear predominantly in the self-built group. According to group-discussion respondents, community meetings and separate household interviews in previous housing reconstruction projects are the
one-off communications that only existed within the project duration (3-6 months). On the other hand, informal local talks or sharing dialogues happen frequently on roads, markets, fields, or in the front veranda, etc., and discontinue once all construction works are completed. The investigation of donor-built housing indicated that community meetings and separate household interviews are the two combined forms of information and knowledge sharing used by the implementing agencies (i.e. DWF, SC) to search for appropriate housing solutions. These consultations are helpful for not only capturing local needs and capacities but also sharing local and innovative knowledge and expertise on housing risk reduction, as seen in the case of Loc Tri (LT) and Hoa Hiep Bac (HHB) where local construction techniques were integrated with new methods of construction.

However, such consultations were far from bringing effective housing outcomes in the case-study areas. As reported by local respondents, community meetings and separate household interviews still followed one-way communication where people and community members were invited to answer questions raised by facilitators rather than to actively discuss the chosen housing solutions. In addition, community meetings and household interviews were frequently conducted in a formal discussion whose contents and participants were well prepared in advance, while informal local sharing dialogues were unintentionally established when people accidentally met within their community area (Figure 5.2). This also explained the different outcomes of post-disaster housing between the two reconstruction approaches, donor-built and self-built.

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<thead>
<tr>
<th>Community Meeting</th>
<th>Household Consultation</th>
<th>Informal Local Sharing Dialogues</th>
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<td><img src="image3" alt="Informal Local Sharing Dialogues" /></td>
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<tr>
<td>Donor-built Housing</td>
<td>Self-built Housing</td>
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**Figure 5.2:** Different forms of consultation applied by different reconstruction approaches (donor- and self-built)
5.2.1 Community Meetings - An Open Consultation to contextualize the Problem

The fieldwork showed that community meetings used for designing post-disaster housing were organized in two main forms: indoor (meeting in a closed room) and outdoor (meeting on site) (Figure 5.3). Indoor meetings were found in the case of HHB, LT, and Tan Ninh (TN) and the outdoor ones appeared in Ia Broai (IAB). In HHB, community meetings for post-disaster housing reconstruction were organized twice. The first time was to inform general issues of the project such as the project scale, the donor agency and targeted beneficiary group, funding limit, project duration and in-charge parties. The second time was to identify the design and construction solutions for post-disaster housing implementation. Participants also varied between these two meetings. In the first meeting, donor and implementing agencies, local authorities (ward and district), grassroots mass organisations, and in-need community representatives (quarter heads and beneficiary households) joined the discussion; whereas in the second one, the architect, local authority representative, building contractors, and some beneficiary households were the key participants. As said by interviewees, these two meetings were important to make clear the project aims and implementation methods and collaboratively come up with agreements and decisions on the selected housing designs and construction methods.

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<th>Indoor</th>
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<td><img src="image1.jpg" alt="Indoor Meeting" /></td>
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**Figure 5.3:** Indoor and outdoor meetings used in post-disaster housing reconstruction at LT and IAB

Conversely, in the case of LT and TN, a community meeting was conducted on one occasion from the beginning of the project. Participants for this meeting were similar to the case of HHB, with the presence of a donor representative,
implementing agency, responsible architects, local authorities, grassroots mass organizations (i.e. women’s union, farmers’ union, fatherland front), in-need community representatives (quarter/village heads), and beneficiary households. Due to being organized only once, there were many issues raised in this meeting, ranging from socio-economic issues to technical aspects in terms of the development of post-disaster housing.

It was found that community meetings organized in the three case studies above followed a formal method where participants gathered in a closed room (indoor meetings) to discuss the issues previously prepared. Meanwhile, in the case of IAB, community meetings were conducted in an informal way where the on-site discussions (outdoor meetings) of a group of stakeholders were formed on the ground, frequently at the sites of damaged houses, to capture the real situation of local housing, household needs and capacity before furthering design and construction solutions. As mentioned in Chapter 4, the researcher worked as the project architect at that time, responsible for the design of 20 post-disaster houses for this commune (IAB). He was one of the key participants in these outdoor meetings. From the author’s experience and focus group discussions, such outdoor meetings were supportive to the design outcome of post-disaster housing, because they allowed a better understanding of local contexts and practical housing situations before deciding the selected design solutions, especially with the cultural-specialised communities such as the ethnic minority groups in IAB, whose on-stilt housing type becomes a typical and unique vernacular architecture. These outdoor meetings frequently included a series of individual and collective talks outside and inside the damaged houses; and, sometimes, saw the unintended engagement of some local residents who had much experience on disaster and wanted to share their stories.

In terms of the community meeting’s content, there was also a difference between the indoor and outdoor meetings. While general and fixed issues regarding the provision of post-disaster housing were frequently discussed in the indoor meetings, more specific and flexible subjects such as strengths and weaknesses of local construction or possible ways of building safe housing were addressed in the outdoor ones. It could be inferred that this difference had a close link with forms of community meeting (indoor or outdoor) and kinds of information participants wanted to share or gain through meetings. In addition, discussion themes were
commonly well prepared in advance for the indoor meetings, while they were unplanned and possibly previously unknown for the outdoor ones due to new issues arising from the scene.

In all four case studies, regardless of its form (indoor or outdoor) and frequency (one or two times), community meetings were always the first method of consultation used by implementers at the beginning phase of housing reconstruction projects, to capture community-level information and seek initial agreements between relevant stakeholders for the next steps. Such community meetings had a strong link with the separate household interviews afterward - the second method of consultation - that were central to gaining household-level information to produce post-disaster housing design options.

5.2.2 Separate Household Interviews - A Focused Consultation to tackle the Problem

This method of consultation is an indispensable supplementary discussion to the community meetings mentioned above, to gain household-level information for safe housing design development. Functional and spatial needs, household capacities, local and new experience and knowledge on safe housing were discussed in this consultation with the involvement of two main actors, at-risk households and in-charge technicians (e.g. architects, engineers). These were the face-to-face discussions frequently occurring inside the damaged houses of beneficiaries and being facilitated by an architect or a project technical staff (Figure 5.4). Agreements between households and in-charge technicians on the chosen design solutions and construction methods were made after these separate household interviews. In HHB and LT, the architect visited almost all beneficiary households to consult with them before proposing housing design solutions, while a random visit to several beneficiary households was found in IAB and TN due to the lack of project technical staff, as mentioned by respondents. However, the outcome of post-disaster housing, in reality, says different things. Although more household visits and talks were carried out in HHB, people in this ward have revealed a limited satisfaction towards their post-disaster houses (donor-built), compared to their counterparts in IAB and TN where there was less frequency of household talks. As said by a donor-built householder in HHB:
Our functional needs were not met in the new house (donor-built) despite what we said upfront with the architect. If the bedroom was a little larger to fit a double bed, we wouldn’t sleep on the floor.

(HI 3)

Figure 5.4: Household consultation made by the DWF technician in 2010 for their post-Ketsana housing reconstruction project

It was found that people often shared more stories in separate household interviews (SHIs) than in community meetings. Local households preferred such separate and focused talks with the project technical staff in SHIs, because they could express their true opinions and suggestions towards their new houses (donor-built) without any dependency on or influence from others. As noted by one key informant, the reason that hindered people in saying their true stories in community meetings was the presence of local authority representatives, who may not select them as beneficiaries for the next project if their opinions did not meet the authority’s expectation. Sometimes, information collected from community meetings conflicted with that gained from separate household interviews. For example, as seen in HHB, while the tube house was the best option for reconstruction derived from the community meetings, this housing type was then not preferred by most owners in separate household interviews as it restricted the spatial flexibility for functional alterations later. The difference in functional arrangement between donor-built and self-built housing, where more flexibility is seen in the self-built, is clear evidence for this statement (Figure 5.5).

Accordingly, the flexibility of self-built housing is due to an easy change of living functions in each room (i.e. from living to sleeping or inversely) and the spatial
expandability of functional rooms to both longitudinal and horizontal directions, while the tube-based donor-built houses only allow the spatial extension in the longitudinal direction (frontward or backward), as illustrated in Figure 5.5.

Methodologically, the separate household interviews were quite similar among the case studies, in which house-owners actively engaged in the discussion and freely provided their feedback or suggestions on the chosen housing design(s). The difference between the case studies in terms of household consultation, as mentioned, was only found in the use of different facilitators and the amount of household feedback addressed in design outcomes and construction interventions. In HHB, LT, and IAB, the facilitator for separate household interviews was an architect who was responsible for delivering housing design options; while, in TN, an officer from the commune People’s Committee was used for this position. It was deduced that facilitators who had a built-environment background, such as architects or engineers, were more likely to fully capture local needs and capacity and translate them into tangible and technical solutions for disaster-resilient housing.

However, the built-environment background of the consultation facilitators is not sufficient if household feedback is not adequately addressed in design and construction interventions. As seen in HHB, even though the architect facilitated...
the household interviews, the beneficiary families were still not happy with their donor-built houses, because their actual needs and suggestions were not included in the housing outcomes.

5.2.3 Informal Local Sharing Dialogues - A Direct Communication for Local Experience Sharing

Unlike the two above methods of formal discussion that were widely used in the donor-built group, informal local sharing dialogues appeared to be the most common form of discussion in the self-built group. Informal local sharing dialogues within the case-study areas referred to the discussion between house-owners and other people, frequently local construction workers, neighbors, relatives, and friends, in terms of housing construction or renovation. As mentioned earlier, while community meetings and separate household interviews are the one-off communications only used for the design stage of donor-built housing, informal local sharing dialogues appear to last continuously throughout the design-and-construction process of self-built housing, and discontinue once all construction works are finished.

Discussion topics for these local sharing dialogues are also diverse, from the physical appearance of the house, its functional and spatial organization, and load-bearing structure, to construction methods, materials used, and local worker teams selected for construction. Such informal local sharing dialogues have a close link with the outcome of the self-built housing, to the extent that some parts of the house were built based on others’ recommendations or suggestions. In LT and TN, shared local experiences were mainly seen through the replication of safe construction techniques that are accumulated from a long history of coping with disasters. Outstanding is the use of continuous bracings inside the walls and concrete beds and altars for storm resistance in LT, and the use of a timber garret right under the roof for flood protection in TN. Dissimilar to LT and TN, shared experiences in terms of safe construction in HHB were quite limited, since local people here have a much shorter history of facing disasters. Accordingly, this area has been first aware of storm risks since 2006, the time Typhoon Xangsane landed and triggered huge damage and losses to local housing and livelihoods. Therefore, local experiences shared within the self-built group in HHB for safe housing were also limited, and are mainly reflected through the use of unsafe practices such as
the construction of thin walls without strong elements inside (posts, beams) (Figure 5.6).

![Figure 5.6: One self-built house in HHB without posts and beams for structural strengthening](image)

Most self-built house owners said that their decisions on housing construction were often influenced by others’ opinions, particularly suggestions from local workers who were hired for their housing construction. Their discussions with local construction workers often occurred on the site where the house was allocated, to clarify all information and unclear aspects before construction (due to having no design drawings). Sometimes, they used wooden or bamboo sticks to mark the position of functional rooms on the ground. As one local builder stated:

*I often discuss with house-owners for many hours about what type of housing they want, how much they spend, and how many rooms and their positions before drawing out their housing form in my mind. Our talks must be on the construction site to identify exactly where each room is and what its size is.*

*(FGD 3)*

5.2.4 Broadcasting - An Indirect Communication for Information and Knowledge Transfer

In addition to the three main forms of community consultation and communication above is the *broadcasting* method based on the public radio and television systems and the mobile phone networks. Although the role of broadcasting was initially overlooked by the present research due to numerous publications that mentioned it as a tool for early warnings, its certain contribution
to housing damage and loss reduction in recent disasters captured from the field investigation made the research reconsider and view broadcasting as a supplementary way of information exchange and knowledge transfer for disaster risk reduction.

Common ways of broadcasting through public television and radio channels were found in all case studies, but the efficiency in disaster response and preparedness was different among them, especially in the radio broadcasting. In all case studies, early warnings disseminated to at-risk households in the previous storms were found, and were mainly based on the commune radio system where several electric-based loudspeakers were arranged in each village. However, the early warnings transferred through this system appeared to be faster in HHB and LT than in TN and IAB. This was due to the activeness of the in-charged units and persons, usually from the commune’s disaster flood and storm control committee, and the availability of electrical power sources to operate this system. The slow dissemination of early warnings also affected the response and preparedness of households, since they had not enough time to prepare coping measures. In some villages of IAB located in remote mountainous areas, no early warnings were provided to households in previous storms due to there being no electricity.

As found from the case of HHB, LT, and TN, information disseminated on public radio and television programs is not only about the strength and movement of a coming hazard (e.g. a storm or flood) and general recommendations for preparedness, but also includes visual instructions and guidance on how to construct or reinforce safe houses. In response to the calamitous Typhoon Haiyan in November 2013, instead of verbal general recommendations for housing consolidation as before, visual and graphic plans and posters for safe construction/consolidation techniques were shown on public television channels. Householders said that this method of communication through visual illustrations or posters was attractive to the public, understandable to normal people, and allowed them to follow the issues properly. Some techniques, such as how to anchor roof parts to the structure below or to the ground, are easy to do, but previously unknown to some people. By using this method, broadcasting has extended its role in popularizing safe construction knowledge and techniques to the wider public within a short time, to allow at-risk/vulnerable groups and communities to better cope with natural disasters.
Another interesting finding from the fieldwork is the usefulness of mobile phones in the improved information exchange between actors during disaster seasons, for damage and loss reduction. Mobile phones were found in all case studies, and almost all adults there, regardless of their economic capacity, had at least one mobile phone in hand for daily communication. The booming development of mobile phones in Vietnam in recent years has brought about a new way of communication that quickens the speed of information transfer without face-to-face meeting.

Local respondents highlighted that information transferred through mobile phones is the quickest method of communication compared to other ways (i.e. television, radio, fax, document delivery). Mobile phones helped improve internal communication between members within a community, a household family and local mass organisations such as Women’s Union, Farmer’s Union, Youth’s Union or Vietnam Fatherland Front Committee, in reminding each other in preparing coping measures. As stated by one local Women’s Union staff in LT, she had informed 32 at-risk households within her women’s union branch to prepare solutions for protecting human and property in just 15 minutes thanks to her mobile phone - the thing that could not be done by conventional broadcasting ways (radio, television, fax), especially when the electric power source was cut off.

This indicates that the use of mobile phones is relatively helpful in emergency cases where electric-based communications (radio, television, or fax) are disconnected due to disaster impacts. According to the provincial disaster management officers, the national and provincial CFSCs are increasingly aware of the importance of the mobile phone in transferring early warnings and timely recommendations for better local responses to natural disaster. It was said that, in a near future, the government will deliver policies or advocate initiatives to popularize early warnings on the mobile phone network, probably through text messages or the establishment of disaster-related calling centers, which are free of charge to the public.

5.2.5 A Need for Regular Consultation and Communication

The discussion of the key consultation and communication forms above has pointed out the importance of information exchange and knowledge transfer to building disaster resilience for housing. Community meetings and separate
household interviews, as the ways of consultation, and informal local sharing dialogues and broadcasting, as the ways of communication, have shown their significant contribution to the outcome of post-disaster housing and the improvement of local construction practices in the light of disaster resilience.

It was found that community meetings need to be organized in both indoor and outdoor forms. As mentioned above, indoor meetings are often used to discuss issues already known or prepared in advance to better understand their meanings to a given context; while outdoor meetings are helpful in identifying new things arising from the scene and previously unknown to participants. These two forms of community meeting support each other in filling the gaps or shortcomings in each of them and providing sufficient information for safe housing design interventions. The discussion above also indicated that community meetings should be organized more regularly (not one-off as in the case studies), such as monthly or quarterly, to ensure that necessary information and knowledge on safe and resilient housing are sufficiently perceived and shared between actors before implementing resilient measures for housing or relevant decisions.

In terms of separate household interviews, it was found that experiences and skills of facilitators play a key role. As found from the case studies, the effectiveness of household interviews is mainly dependent on the capacity of facilitators to capture and address household responses to housing design, rather than the number of household interviews undertaken. Capacity required from household interview facilitators includes the method of discussion with different households to allow their full understanding on consultation issues, and the ability to address household feedback in housing designs. It was deduced that persons who have a professional design background, such as architects and engineers, are more likely to meet this demand. In addition, strategies for conducting household interviews are also important to capture better responses and feedbacks from the interviewed households. Depending on the specific conditions of each household and the interview themes or issues needing to be further investigated, possible strategies could be: (1) collective discussion between all household family members, (2) grouping men and women from the affected households, (3) separating the affected and unaffected households or the male-headed and female-headed households from a community, or (4) considering the households within and without labour (income generation) capacity.
One of the key findings from the fieldwork is the absence of plans and drawings in the consultative discussions above, although such discussions serve the delivery of housing design outcomes for practical construction. Most of the discussion issues were still presented in the form of verbal discussions and written documents, where participants gave their opinions and responses based on these information sources. Verbal discussions are frequently difficult for normal people, such as community members and vulnerable households, to fully understand design-related issues of safe housing (i.e. functional and spatial arrangements, safety-related measures); and, therefore, hinder their active engagement and critical comments or responses.

In relation to informal local sharing dialogues, it was found that people’s experiences are commonly shared in local discussions, and have a strong influence on the design and construction of self-built housing. However, the success of informal local sharing dialogues tends to depend on people’s awareness of safe construction and their accumulated experience or wisdom concerning disaster preparedness. As seen in the case studies, communities who have less experience of coping with natural disaster often build their houses with fewer safety measures. In addition, local construction workers usually play a key role in these local sharing dialogues, since they are also the advisors of house-owners in selecting and deciding housing design and construction solutions. To increase the efficiency of these talks, this necessitates the involvement of a wider public in raising local awareness, and providing at-risk/vulnerable households with necessary knowledge and skills on safe and resilient housing.

In terms of broadcasting, the visual method of information exchange and knowledge transfer through the introduction of understandable posters and drawings on public television channels has shown its usefulness for disaster risk reduction for housing. This makes people more interested in safe construction and know-how for the safety of their housing. In addition, the development of the mobile phone network has a considerable contribution to make to the improved disaster preparedness at local levels, as it offers the quickest way of communication to warn people of a coming event and remind them to prepare coping measures in time.

It was also found that the above consultation and communication methods still worked separately in the case studies. These methods revealed a limited linkage in
the flow of information and knowledge between actors, in which some kinds of information were repeated many times while some others were insufficiently mentioned or even neglected. Frequently, technical issues were paid more attention in consultative meetings and discussions, whereas social, cultural and institutional aspects were addressed in a limited way or not mentioned. Sometimes, information captured from different forms of consultation also conflicted with each other.

5.3 Who does it?

The discussion on the consultation and communication forms above has indicated the necessity to identify the key participants needed for information exchange and knowledge sharing for disaster-resilient housing outcomes. The fieldwork showed that there are four main groups of stakeholders involved in the consultation process for post-disaster housing reconstruction and resilient housing development: the Vulnerable Households and Civil Society, Public Sector, Professionals/Resource Persons, and Private Sector. In each group, the fieldwork also figured out the key actors involved whose consultative inputs are critical to the formation of post-disaster housing and the improvement of local construction practices (Table 5.1).

<table>
<thead>
<tr>
<th>Vulnerable households and Civil society</th>
<th>Public sector</th>
<th>Professionals/Resource persons</th>
<th>Private sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ Vulnerable households</td>
<td>→ Central and local flood and storm control committees</td>
<td>→ Built-environment professionals (i.e. architects, engineers)</td>
<td>→ Construction contractors (Firms)</td>
</tr>
<tr>
<td>→ Local construction workers</td>
<td>→ Commune (Ward) authority</td>
<td>→ DRR practitioners</td>
<td>→ Material suppliers</td>
</tr>
<tr>
<td>→ Mass organizations (i.e. women’s union, farmers’ union, youth union)</td>
<td>→ Mass media</td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Non-governmental organizations (NGOs)</td>
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Overall, these groups of stakeholders have different roles to play in developing safe and resilient housing following disasters. Their degrees of participation in the consultation process are not similar across consultation forms as well as between the case studies. In all cases, the group of civil society shows their most common
engagement into the process, compared to other groups. The quantitative survey of the qualitative interview respondents (102 persons totally) indicates that the highest percentage of involvement was given to the group of vulnerable households and civil society (39%), in comparison with the public sector (30%), experts (22%), and private sector (9%), as seen in Figure 5.7.

Figure 5.7: Percentage of stakeholder engagement rated by qualitative interviews respondents

The consultative inputs of vulnerable households and civil society are found in both reconstruction approaches (donor-built and self-built); while, for the three other groups of stakeholders, their inputs are only seen in the donor-built approaches (Table 5.2). The following parts provide further discussions on each group of stakeholders, to examine their contribution to community consultation for post-disaster housing reconstruction and building a resilient housing system.
Table 5.2: Four groups of stakeholders involved in community consultation initiatives

<table>
<thead>
<tr>
<th></th>
<th>Vulnerable Households and Civil Society</th>
<th>Public Sector</th>
<th>Professionals/Resource Persons</th>
<th>Private Sector</th>
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<tbody>
<tr>
<td>Community Meetings</td>
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<td>Separate Household Interviews</td>
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<td>Informal local sharing dialogues</td>
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<tr>
<td>Donor-built &amp; Self-built</td>
<td>Donor-built</td>
<td>Donor-built</td>
<td>Donor-built</td>
<td>Donor-Built</td>
</tr>
</tbody>
</table>

5.3.1 Vulnerable Households and Civil Society

As seen in Table 5.2, this group shows the most common presence in all consultative interventions for post-disaster housing, with the involvement of four key actors: vulnerable households, local construction workers, mass organizations, and non-governmental organizations (NGOs). Qualitative interviews and discussions have pointed out various kinds of inputs taken by these actors in the consultation process for post-disaster housing across the case studies. While households and local construction workers usually narrow their consultative inputs to tangible issues related to the formation of housing products (i.e. the arrangement of functional rooms, construction methods, or materials used), mass organisations and NGOs seem to extend their focus to intangible dimensions where contextual and intervening conditions for safe construction implementation are included. Physically, the quantitative survey of the qualitative interviewees (102 persons) shows a higher proportion of consultative involvement given to at-risk households and local builders (35% and 31%, respectively), in comparison with mass organizations and NGOs (19% and 15%) (Figure 5.8).

Vulnerable households receive the most attention from respondents (35%), as they are the best persons to understand their situation, their constraints and capacity in reducing risks, and their actual needs and aspirations for their housing. Most interviewees believed that the active participation of at-risk households is the key to achieving effective and long-term housing outcomes.
Figure 5.8: Proportion of actor involvement within the group of vulnerable households and civil society

Socially, qualitative findings through interviews and discussions indicated that the collaboration between disaster-affected households and local construction workers is the key to the success of housing reconstruction for both approaches (donor-built and self-built). In the case studies, these two actors often belong to the same group or community, where they share similar socio-economic and cultural features, a firm foundation for their thorough understanding of each other in seeking housing design and construction solutions. Within the self-built group, house-owners and local construction workers (hired by owners) were totally free to discuss all issues related to housing construction (through informal local sharing dialogues mentioned earlier), and collaboratively came up with technical details (i.e. building form, spatial layout, selected materials and construction methods). In most cases, the number of functional rooms (bed, living, or kitchen) and the expected spatial layout were first given by the owner and then further discussed with local builders, before proceeding to final decisions on building design and construction made by the owner.

On the other hand, for the donor-built group, consultative inputs of households and local workers to post-disaster housing appear to be not as effective as for the self-built. According to household interviews, consultative inputs given by beneficiaries and local workers were not addressed adequately or even ignored in practical housing implementation, as seen in the case of HHB, where family needs were then not met in post-disaster housing outcomes. In the meantime, in the
cases of IAB and LT, the voice of local households and workers appeared to have more power, as their feedback was highly respected and practically integrated into the housing design and construction solutions. As evidenced on the site of IAB and LT, the use of local housing forms, three-compartment (locally called *Nha Ba Gian*) for LT and on-stilt (*Nha San*) for IAB, for the donor-built ones was highly appreciated by local people, as it met local living needs and responded well to the local context. As seen in Figure 5.9, the donor-built house (red dot line) is responsive to the existing local housing patterns thanks to its formal harmony with local houses nearby, through the use of on-stilt structure and similar kinds of materials.

**Figure 5.9**: The responsiveness of donor-built housing to the existing local housing pattern in IAB

Another factor that hindered the active participation of local households was the political pressure generated by the presence of the local authority in meetings and discussions. Some households said that they rarely told the truth or shared their real stories in public meetings because they were afraid of being excluded from the beneficiary list for the next projects, if something they said was out of the local authority’s expectation.

In regard the two other actors, mass or community-based organizations and NGOs, their inputs are extended to broader issues surrounding safe housing construction, their consultative contributions also vary, and often receive limited
appreciation from local people. While mass organization’s inputs are often unclear and can be narrowed to public awareness-raising initiatives, the contribution of NGOs, as the donor and implementing agencies within the case studies, is clearly seen through their coordination and implementation of housing design and construction works.

However, degrees of NGO engagement are not similar between the case studies. While the NGOs were usually involved as the leading actors throughout the design and construction process of post-disaster housing for the case of LT and HHB, they joined as the donor and consultant agencies in IAB and TN. However, regardless of the degree of participation, household satisfaction was seen only for the cases where the NGO empowered local voices and integrated people’s feedback into practical interventions. The quantitative analysis of the qualitatively interviewed households showed that donor-built households in HHB exhibit the lowest level of satisfaction towards the NGO engagement, since their expectations were not addressed adequately in practical housing construction, whereas the highest level was given to the case of LT. As seen in Figure 5.10, all five donor-built households (100%) in LT were happy with their post-disaster houses provided by DWF, while only one of them (20%) in HHB was satisfied with the houses built by SC. As observed, spaces for fishing tools (livelihood) and family worship (culture) were provided in all five donor-built houses in LT, and made beneficiary families there happy. As one donor-built householder in LT said:

*DWF staff worked as our friends. They were very friendly and always had open minds. They listened and understood what we needed and satisfied us with appropriate and specific solutions.*

*(HI 5)*
Figure 5.10: Household satisfaction towards their donor-built housing in different case study sites

In a broader view, the involvement of mass organizations and NGOs in housing resilience enhancement was still limited in the case studies, as their consultative inputs were still one-off and discontinued as soon as the project completed. In addition, issues for building long-term housing solutions (i.e. cultural appropriateness, socio-economic and climatic responses, or policy-related advocacy) were not sufficiently mentioned or even neglected in their consultation initiatives, except for their focused introduction of safe construction techniques. From household interviews, at-risk households seemed to be unaware of the true meaning of disaster-resilient housing and often perceived it as a strong or robust structure. Without an overall understanding of the benefit of disaster-resilient housing, such safe construction techniques were easily forgotten by people, since their life was not only about coping with disasters but also dealing with other important issues (livelihoods, employment, children education, etc.). It was found that people often built or renovated their houses primarily based on their available experiences and neighbours’ experiences, rather than new knowledge introduced from the outsiders. According to one household:
I built my house according to what I had seen from people here. It is the valuable local experience that has existed for a long time. Information from the outside was useful only for letting people know in advance a coming event and having time to prepare coping measures.

(H1 7)

5.3.2 Public Sector

The reconstruction of post-disaster housing and the improvement of local preparedness on housing also saw the involvement of three actors: the Committee of Flood and Storm Control (CFSC), local authority (including People’s Committee) and mass media (local radio- and television-broadcasting stations/departments). These actors are arranged in this group because their roles in dealing with contextual and intervening issues could enable the development of disaster-resilient housing at the local levels. However, as found from the case studies, these actors are only active for the donor-built group. Giving the explanation for this, a local authority representative pointed out the reason related to governance aspects. Accordingly, while donor-built housing reconstruction was managed and monitored by the local authority and other stakeholders (i.e. donor, implementing agencies), the self-built style was freely done by people without any involvement of the local authority and external stakeholders.

The involvement of these three actors in the consultation process also varied among the case studies. The public sector in LT appeared to show the highest activeness to post-disaster housing compared to the other cases. In all the case studies, the local CFSCs such as commune- and village-level CFSCs demonstrated the highest effectiveness in response to natural disasters, and often shared many stories about disaster impacts and preparedness in consultative meetings and talks. The quantitative survey of 102 qualitative interview respondents showed the predominant proportion of consultative engagement given to the CFSC in comparison with the local authority and mass media (Figure 5.11). Accordingly, 56 out of 102 respondents (55%) express their appreciation for the role of CFSCs in communication and consultation, whereas only 18 respondents (17%) paid more attention to the contribution of the mass media.
Dissimilar to the actors in the group of *at-risk households and civil society* discussed in the last section, the actors in the *public sector* group tended to put more focus on governance- and awareness-raising related issues. Inputs of CFSCs, local authority, and mass media to the development of safe housing were frequently associated with operational and administrative works, to ensure the construction of post-disaster housing ran smoothly and to improve the flow of information and knowledge for damage and loss reduction.

There is a similarity between the case studies in that the local disaster management mechanisms were mainly based on an action plan, which is annually designed and adopted by the CFSCs at multiple levels. In some cases, there may be additional plans and strategies for damage and loss reduction for some specific locations due to their greater exposures to disaster risks. However, contents of such action plans lacked instructions and guidelines on disaster-resilient housing construction, except for several written recommendations on urgent or immediate measures of housing reinforcement (putting sandbags on roof or anchoring roof to the ground) in response to a coming hazard. Focus group discussions with local representatives revealed that the commune and ward authority adhered completely to the directions and tasks of the action plan adopted by the district government.

*All local departments here absolutely conform to the tasks in this action plan to initiate specific actions for damage and loss reduction in at-risk areas of this ward. We never think of using other measures outside this plan because it already shows all necessary measures for disaster management.*
In practice, the action plan for disaster management was usually initiated through a conventional administrative system from the national government to the grassroots local communities with a CFSC established at all levels (Figure 2.4). Members of CFSCs are mainly administrative officers in charge of various sectors at the same level. It was found that the CFSCs at the quarter/village level were the most effective, as they are the pioneering force to help the community reduce damage and loss when a disaster occurred. They work as the main information channel in disaster seasons within the community, where directional information from the commune/ward authority is disseminated to at-risk households. On the other hand, real situations of each at-risk area or group were reported back to the local authority through this CFSC to make timely appropriate decisions for damage and loss reduction. The head of this CFSC is also the quarter/village head, who deeply understands the real situation of each household and the community, and who has a position of high prestige in the community. However, as mentioned earlier, the lack of information related to resilient-housing development in the action plan narrowed their role to immediate or short-term measures such as reminding people to reinforce their houses or asking them to move to safer places in case of strong typhoons or big floods.

Sub-committee for storm and flood control in each hamlet is very busy in the disaster season. They have to go to each household to remind them about housing reinforcement and property protection and have become the bridge to transfer information between at-risk communities and the local authority during disasters.

As mentioned in the last section relating to communication forms, the mass media had an important role in its broadcasting method, to provide early warnings and popularize knowledge, experiences, and lessons on safe housing and resilient construction to the wider public. The means of mass media that are significant to the improved local preparedness, as found from the case studies, are based on local television and radio broadcasting systems, free of charge for public accessibility. However, the radio is being gradually less heard by local people while television is becoming the most common way of relaxation in families and the key information channel for at-risk/vulnerable households in disaster seasons.
Almost all households visited have at least one TV in their homes. Previous conventional broadcasting through verbal recommendations on radio and television seems to be boring to local people and shows its limitation in guiding practical interventions for risk reduction. Realizing this, the national television station applied a new approach to responding to a calamitous typhoon in late 2013, in which visual guidelines for safe housing construction were first provided on public television channels. As mentioned, this method showed its extensively positive effects to local preparedness improvement, as many people did follow such visual and understandable instructions. According to household interviews, many of the safe construction/reinforcement techniques introduced on television were very simple and easy to follow but unknown to them before. As said by one household:

*The technique of tying the roof to the ground by ropes and bamboo stakes introduced on television was used to strength the roof of my house. Before, I only thought of putting sandbags on the roof when storms came.*

(HI 1)

5.3.3 Professionals/ Resource Persons

In the development of donor-built post-disaster housing, there are always one or two professionals or technicians whose inputs are important to design developments. They include *architects, engineers*, and *DRR practitioners* or *resource persons*. Architects and engineers used by the agencies are the local professionals based in the same province as their reconstruction project. Resource persons here refer to the ones who are not academically educated in universities but possess much experience on safe housing construction thanks to their long working periods in the field.

Although it is hard for the fieldwork respondents, particularly local representatives, to clarify the role of these professionals in building safe and resilient housing, it can be derived from their narratives that professionals tend to deal with technical issues of post-disaster housing. Their inputs to the consultation process predominantly appeared in the design and construction works to create better housing products after disasters. Their role aimed to ensure post-disaster housing is resistant to future disasters, responsive to local contexts, and appropriate to people’s lifestyles. However, their inputs were only seen in the
donor-built group, but not in the self-built. The quantitative survey of qualitative interviewees indicated the predominant involvement of architects (52%) in the consultation process in comparison with engineers (31%) and DRR practitioners (17%). Accordingly, 41 out of 80 respondents (52%) agreed with the involvement of architects, whereas 34 (31%) and 15 (17%) respondents showed their appreciation of the presence of engineers and DDR practitioners, respectively (Figure 5.12). There were 22 interviewees giving no answer to this question, as they were not aware of any contribution to local housing construction made by these professionals.

![Figure 5.12: Different proportions of stakeholder engagement within the Professionals/Resource Person group](image)

It was found that in-charge technicians who facilitated separate household interviews, one form of community consultation mentioned in the last section, were mainly an architect (for the case of HHB, LT, and IAB) and, sometimes, a local authority staff (for TN). The main purpose of this consultation was to clarify needs and expectations of families towards their new houses (donor-built), to seek appropriate housing design options, and to identify the family’s capacity for practical reconstruction. Households in LT and IAB seemed to be happy with the involved architects, who understood their real situation and addressed their needs and expectations in the chosen housing designs. On the other hand, donor-built households in HHB seemed to be not satisfied with their new houses, since their feedback was not integrated into practical housing implementation.
5.3.4 Private Sector

The fieldwork findings showed that the contribution of the private sector to community consultation for post-disaster housing was quite limited, and was only found through the involvement of construction contractors for the donor-built group and material suppliers for the self-built. In the donor-built group, contractors were frequently the outsider of the in-need community that was contracted by the donor or implementing agency to build post-disaster houses. They were usually invited to join community meetings in the planning phase of the project, and often provided limited input or even no response to given housing solutions. The key informant interviews with a contractor who built post-disaster houses (donor-built) in HHB showed that little feedback on housing options was provided by the contractor due to their limited understanding of the local context (they came from outside), and the focus of most questions on other issues was not so relevant to their background.

In the self-built group, once construction methods were agreed between households and local construction workers hired by them, local material shops were then approached by the owner to search for the cheapest materials to use. As found from the household interviews, construction material sellers frequently had a little experience on the strengths and weaknesses of each kind of material (i.e. waterproof capacity of roof covers) and could advise their clients on what kinds of materials were suitable for their housing construction based on their financial capacity. However, local material sellers tended to put more focus on expensive materials and the convincing of clients to purchase them.

5.3.5 The Central Role of Local Actors in Community Consultation

With the discussion of four key stakeholder groups above, the actors engaged in community consultation for post-disaster housing were similar across the case studies. However, degrees of participation and amounts of consultative contribution to the outcome of post-disaster housing varied across the case studies. The data analysis pointed out the twelve actors whose consultative inputs were critical to the success of post-disaster housing and the development of resilient housing system (Figure 5.13). They comprised at-risk (affected) households, local workers, mass organizations, and NGOs (for the civil society group); CFSCs, local authority, and mass media (public sector); architects, engineers, and DRR practitioners (experts); and construction contractors and
material suppliers (private sector). In general, each of these actors had a platform and role to play under an overall target of building resilient housing to future disasters.

![Diagram showing consultation involvement of actors in housing reconstruction]

**Figure 5.13:** Proportion of consultation involvement of the actors in housing reconstruction

From the qualitative survey, the contribution of local actors, including at-risk households, local workers, CFSCs, and the local authority, emerged as the key factor for the efficiency of post-disaster housing. To assist the qualitative finding above, the quantitative survey of all qualitative interviewees showed the highest levels of consultation involvement given to these actors, as seen in Figure 5.13. Findings from the fieldwork suggested that these local actors need to be actively involved in the whole process of housing design and construction and in the decision-making stages, to ensure the long-term efficiency of housing outcomes. They are the only actors who deeply understand local situations, disaster risks, and impacts posed to local housing, and actual local needs and capacities for housing interventions in the short and long terms.

The fieldwork also indicated the important engagement of built-environment professionals, particularly architects, throughout the consultation process in
capturing local needs and capacities and translating them into spatial and technical solutions for housing. The success of donor-built housing in LT and IAB has a close linkage to the involvement of architects, who were not only the designers of post-disaster housing there but also the facilitators of most consultative meetings and discussions between actors. Quantitatively, the survey of qualitative respondents also indicated a significant proportion of involvement given to architects, although their input was only seen in the donor-built group (Figure 5.13). This will be further discussed in the next chapter, where roles and responsibilities of built-environment professionals, especially architects, are examined and clarified based on the fieldwork findings.

5.3.6 Challenges to Community Consultation and Communication

In summary, most stakeholders invited into the survey could realize the benefit of involving local and external actors in decision making for safe and resilient housing construction. However, not many of them could outline the way to implement it. The data analysis has indicated six key challenges to the achievement of meaningful community consultation and communication. These are (1) the irregular and improper use of consultation and communication forms, (2) the limited linkage between consultation and communication initiatives, (3) the limited capacity of consultation facilitators, (4) the limited use of community feedback in housing design and construction, (5) the political pressure placed on grassroots people from the local authority, and (6) the lack of overall consultation plans or frameworks; which are likely to hinder information sharing and knowledge transfer between stakeholders and potentially trigger unexpected housing outcomes.

5.4 Lack of Supportive Mechanisms for Shared Learning Dialogues

The common appearance of one-off consultations (community meetings, household interviews) in the design of post-disaster housing has pointed out the lack of supportive mechanisms for ongoing discussions and shared learning dialogues. The case studies showed that consultative meetings and discussions in seeking housing design and construction solutions only existed for several months, dependent on the project duration, and ended right after the project completion. It is hard for people to remember lessons learned from these consultations if no similar consultations are provided later. As seen in HHB, people seem to forget the important techniques for safe construction provided by
the agency SC (i.e. how to consolidate wall corners or roof ridges) after six years, without being involved in any such similar shared learning dialogues.

It was explained that the lack of supportive mechanisms mentioned above has a close relation to the shortage of primary resources for practical implementation. Namely, this is the shortage of finance to organize consultative meetings and interviews more regularly, the lack of technical inputs from in-field professionals for resilient housing, and the absence of accompanying legal frameworks. These three resources need to go together to ensure ongoing communication and consultation and its meaningful contribution to local housing improvements in the light of disaster resilience. In brief, there are three key streams of supportive mechanisms that are the backbone of effective and long-lasting community consultation and shared learning dialogues: technical, financial, and legal.

Technically: mechanisms need to be developed that can bridge the gap between grassroots at-risk people and in-field professionals and resource persons. The fieldwork showed that local architects and engineers appear not to be involved in the process of delivering safe housing for low-income people. Low-income households are not their targeted clients, since they earn little or no money from them; but also, hiring architects for housing design is not preferred by low-income families due to their economic difficulties. Households are still isolated in the course of protecting their homes from natural disasters.

This leads to the problem that up-to-date knowledge and expertise on safe housing construction appear to be unknown to at-risk households, except for their available experiences accumulated through facing previous disasters. For example, the short history of coping with disaster in HHB (suffered from typhoons since 2006) has led to the limit of local responses to future typhoons if technical assistance is not provided. In addition, one-off training sessions to provide local actors with basic principles and techniques of safe construction were not enough to ensure their broader influence and replication in the community. In addition, technical training was mainly provided to the donor-built groups who were the beneficiaries of reconstruction projects, while the self-built group noted the absence of such training. Local actors, including at-risk households, tend to view the term ‘technical’ disaster risk reduction as the performance of safety-related measures without considering other technical aspects of housing that are
also significant to people’s lives (i.e. climatically and culturally responsive features).

Financially: it is important to develop appropriate financial programs to assist low-income households to better respond to natural disasters. As mentioned earlier, economic constraints become the biggest obstacle to resilient housing improvements, as safe construction is usually not their priority. Moreover, unlike many developed countries, a welfare system to assist low-income groups in better coping with disasters does not exist in Vietnam. Instead, mutual help between the affected households based on their strong social relations (i.e. friendship, being a good neighbor) emerges as the most common local action in response to and recovery from disasters. Since the number of households who benefited from aid and reconstruction projects was relatively limited, people often find ways to quickly recover and return to their normal life rather than wait for outside support.

In the case of LT and TN, where natural disaster has been known for a long time, people view disaster as part of their life. Coping with disasters becomes one of their common living activities. Gia Rai people in IAB also believed that disaster damage and loss are the consequence of bad or evil human behaviors to God, and they accept those losses without any complaints. As mentioned by one household in LT:

Disaster (typhoon) has been experienced by people here for a very long time and become part of our life. Repairing or rebuilding homes after disasters is a common living activity of most families here.

As found in the case of HHB and LT, conditional credit programs for storm-resistant housing were provided by agencies to help build safe houses for low-income people, financially and technically. All beneficiaries could borrow a portion of a loan to partly cover their housing construction under the condition of following safety design criteria provided by architects. In another view, the key informants interviewed suggested that households living in extremely disaster-prone areas should purchase insurance for their housing to get an economic return when disasters strike their houses. Another view is that insurance providers should consult with DRR experts and practitioners to extend their focus to this group (currently no providers offer insurance for vulnerable housing), to integrate financial strategies with technical supports to improve the resilience of poor and
low-income people and widen their social responsibility. Currently, there are local self-organised saving groups run by people to mobilize funds for poor families. This helps them accumulate a significant amount of money after a period for further improvement or development efforts.

Legally: the fieldwork indicated the necessity to develop policies to control and manage unsafe practices of housing construction. There have been no regulations to stipulate safe construction in the case-study areas. People still build their houses on their own and frequently do not incorporate strong elements (beams, pillars) in the structure. The lack of such policies to control unsafe construction practices in hazard-prone areas leads to the isolation of at-risk groups from BEPs. Even the fieldwork findings showed the importance of involving at-risk people in the decision-making process. In practice, people still do not realize their right in decision making, and often think their involvement in decision making is good luck for them. Therefore, there is a need for policies to outline rights and responsibilities of at-risk groups and households in decision making, to allow them to actively engage and respond to housing solutions.

In addition, language barriers found in the case of IAB also resulted in the need for administrative interventions to enable the engagement of ethnic minority people whose language differed from the national language. IAB respondents felt that the key obstacle faced during housing reconstruction project implementation at that time was the language barrier, where untrained local interpreters were used to transfer information between actors. As experienced by the researcher, who used to be the architect for this project, information transferred by local interpreters was usually not as sufficient as the original, and therefore, restricted the full understanding of each other for final decision making.

It was found that the professional involvement in community consultation was still one-off and ended right after the project completion (donor-built reconstruction projects). Every day, local practices of housing construction continued without technical assistance and guidance from professionals for safety purposes. One of the key reasons for that was the limited governance. Currently, there are no legal documents to assist and guide safe housing construction in the case-study areas. Short-term solutions for protecting people and property from disaster impacts are still preferred in current governance mechanisms, whereas longer-term strategies for raising housing resilience such as the application of
Building permits for safe construction are in absence. As seen in HHB, most actions taken for disaster risk management in this commune were totally based on an action plan that mainly focused on immediate responses to disasters (e.g. evacuation and rescue plans just before, during, and right after a disaster).

According to one commune authority staff:

At the beginning of the stormy season, this ward will organize a meeting with the participation of village leaders to implement the action plan for each vulnerable area. Solutions to reducing disaster impacts, evacuating, rescuing, relief and recovering after disasters will be planned and assigned to each department.

(FGD 3)

5.5 Conclusion

Developing disaster-resilient housing is the continuous process of understanding exposure to hazards and key drivers beyond vulnerable conditions, and enhancing responsive and adaptive capacities of the housing through design and construction interventions in the light of shared learning dialogues. It was deduced from the case studies that the collaboration between local and external actors throughout the consultation process becomes the key factor for effective, long-term housing outcomes, because local experiences are integrated with innovative or new design ideas and construction technologies.

The above discussion has drawn out three key factors for meaningful community consultation in achieving disaster-resilient housing. These are (i) consultation and communication forms, (ii) key stakeholders involved, and (iii) supportive mechanisms for shared learning dialogues. In particular, four main forms of consultation and communication (community meetings, separate household interviews, informal local sharing dialogues, and broadcasting) were identified in line with four key groups of stakeholders (at-risk households and civil society, public sector, professionals/resource persons, and the private sector) and three main streams of supportive mechanisms (technical, financial and legal).

In terms of consultation and communication forms, community meetings, separate household interviews, and informal local sharing dialogues have shown their significance to the success of post-disaster housing reconstruction. However, community meetings and household interviews need to be undertaken more
frequently and regularly, not as the one-off initiatives as in the case studies, to intensify shared learning between stakeholders and to spread new knowledge and experiences on DRR, especially the design requirements for resilient housing, to at-risk groups and communities. In addition, the data analysis has pointed out the need to link these forms of communication and consultation to better the flow of information and knowledge on safe and resilient housing among stakeholders. As seen in the case studies, these four consultation forms show their poor connection where shared information and experience is often overlapping, inconsistent or, sometimes, conflicting with each other.

In relation to key stakeholders involved in community consultation and communication, while a variety of stakeholders were involved in the provision of donor-built housing, only two actors (households, local workers) appeared in the construction of self-built. In addition, limited perceptions of local actors on the importance of community consultation still exist, where community consultation is simply understood as the involvement of local people and community members in meetings and discussions. This explained the limited capacity of self-built housing (without community consultation) to cope with disasters compared to their donor-built counterparts (with community consultation). In another viewpoint, the engagement of many stakeholders at the same time (i.e. in public meetings) is not always the key to success if there is no overall discussion plan or framework to base it on. As seen in the case studies, some information (i.e. safe construction techniques) was repeated many times by participants, while other important issues (i.e. cultural appropriateness, cost effectiveness) were less mentioned or even ignored in consultations.

Related to the supportive mechanisms for shared learning dialogues, it was found that technical, financial, and legal interventions are the three key supports for regular consultation and communication. Technical supports need to go along with financial and legal assistance to create an enabling environment where low-income people and other stakeholders can actively engage in the consultation process to seek long-term housing solutions. This significantly supports the delivery of resilient housing products for vulnerable low-income families. This also helps strengthen social relations and networks within and outside the community, which may be weakened by natural disasters. The case study findings
showed that such social relations and networks were among the key factors for effective disaster response and recovery at the community and household levels.

Findings from the fieldwork also indicated the important role of built-environment professionals (BEPs), particularly architects, in the whole consultation process for post-disaster housing, although their inputs were only seen in the donor-built group. The next chapter will further the discussion on this theme, to clarify the key roles of BEPs in developing disaster-resilient housing for low-income people, based on the case-study findings.
Chapter 6: The Role of Built-Environment Professionals in Building Resilience for Housing

6.1 Introduction

This chapter discusses the second theme of this research, the Role of Built-Environment Professionals (BEPs), in the light of the case study findings. As mentioned in the previous chapter on community consultation and communication, BEPs involved in the provision of post-disaster housing in the case-study areas included three types of professionals; architects, engineers, and planners. The role of other professionals, such as landscape architects and building surveyors, is not found in the design and construction process of post-disaster housing in the case studies, and thus is not discussed in this chapter.

In the case studies, architects and engineers played an important role in developing spatial and technical solutions for post-disaster housing. However, their roles were not only in designing post-disaster housing but also extended to facilitating community consultation, monitoring construction work and improving local awareness, as mentioned in the last chapter. In addition, the data analysis also indicated the role of planners in providing planning solutions and settlement patterns that may reduce disaster impacts on individual residential buildings.

Through witnessing serious disaster impacts on housing in their region and in other provinces through television, people living in the case-study areas were increasingly aware of the importance of disaster preparedness and gradually paid more attention to safe construction. However, besides economic constraints, the lack of technical assistance from BEPs makes their housing construction to still be based mainly on local experiences, which are believed to be insufficient to achieve safe and resilient construction. As highlighted by one architect in HHB:

*Without instructions on how to build resilient houses, local construction practices are unable to satisfy the needs of risk reduction for big disasters like Xangsane.*

*(KII 1)*

The fieldwork findings show that the role of BEPs, especially architects and engineers, in resilient housing construction is more than designing tangible safe
housing products. Instead, their role has widened to improving local awareness on disaster resilience for housing, organizing and facilitating mutual discussions and shared learning dialogues at multiple levels and reconciling opposite opinions or viewpoints of different stakeholders towards disaster risk reduction.

There are three key issues related to the role of BEPs that emerged from the fieldwork. They are: (i) *local barriers to BEPs engagement*, (ii) *the importance of professional assistance in promoting disaster-resilient housing* and (iii) *the role of architects*. Each of these will be discussed in the following sections, to examine the key roles and potential contributions BEPs can make to the development of disaster-resilient housing.

### 6.2 Local Barriers to the Engagement of BEPs

It was clearly seen throughout the fieldwork that the engagement of BEPs was still a one-off and only existed within the donor-built post-disaster housing reconstruction projects. Specifically, three main barriers emerged from the case studies that critically affected the engagement of BEPs. These are: (i) *the misperception of local stakeholders*, including at-risk communities on housing safety; (iii) *the economic constraints of at-risk households*; and (iii) *the lack of incentive schemes to sustain innovative ideas* for disaster resilience.

#### 6.2.1 Misperceptions of local stakeholders on housing safety

Based on the discussion with local builders and on-site observation, the housing of low-income people in the case-study areas, except for the commune of IAB, largely belongs to the type of *nhà cấp 4* (Figure 6.1), the lowest ranking type of housing in Vietnam as prescribed by the national government’s Decree 209/2004/ND-CP of 2004. According to this decree, *nhà cấp 4* is the house whose total floor area is below 1,000m$^2$ or building height under four stories. Technically, according to the Circular 05-BXD/ĐT promulgated in 1993 by the Ministry of Construction, *nhà cấp 4* is characterized by load-bearing brick walls for the structure, stone for foundation, and corrugated iron sheets or clay tiles for roof cover. The main difference between *nhà cấp 4* and other housing types (*nhà cấp 3, nhà cấp 2, nhà cấp 1*) is the load-bearing structure where reinforced concrete (RC) skeletons and slabs are used in those types according to that Circular.
While local builders, community-based organisations and local authorities supposed the housing type of nhà cấp 4 was incapable of withstanding big disasters (i.e. cyclones stronger than level 12 on the Beaufort Scale), the interviewed architects who were involved in the previous projects of post-disaster housing reconstruction believed that this type could become a disaster-resilient structure if proper technical designs and construction methods were employed. As observed in LT and HHB, the houses provided by Development Workshop France and Save The Children after Typhoon Xangsane (2006) belonged to the type of nhà cấp 4, and had no critical damage in the following typhoon (Ketsana in 2009). This fact indicates that misunderstandings about the stability of nhà cấp 4 still exist in local perceptions, where nhà cấp 4 is merely defined as a one-storey brick (or cement-block) house without incorporating an RC skeleton and/or RC roof slab(s). The concept of nhà cấp 4 houses is, hence, distorted in reality, where it has been widely considered by local stakeholders as a temporary and unsafe house. The construction of such so-called temporary houses is commonly done by owners and local workers without any assistance from professional bodies. As said by some local authority staff:

*Before the storm (Xangsane), local houses in this ward mostly belonged to nhà cấp 4, unsafe and weak. After the storm, people started to build safer houses with the addition of more RC posts in the structure.*

*(FGD 2 in HHB)*
People here are poor. Their income is only enough for food and nhà cắp 4. To them, there are many other vital needs other than safe construction.

(FGD 3 in LT)

The misunderstanding of the concept of nhà cắp 4 also leads to a dominant social belief that houses made by RC skeletons and slabs are the best for disaster resistance, and that houses without such RC parts, as seen in the existing nhà cắp 4 houses, are easily destroyed by natural disasters, particularly typhoons. Ironically, building houses with those RC parts triggers a costlier construction which is unaffordable to low-income people and, therefore, undermines efforts of raising disaster resilience for this group. As said by one household (above) and one architect (below) in HHB:

This house (brick house) is unable to resist typhoons. Only RC houses can withstand them. If I have money at any time, I will build an RC house immediately because of intense fears from the last typhoon (Xangsane).

Living in this brick house, if there will be a big storm again, we must head to a primary school nearby, about 5-minutes running distance.

(HI 3)

People always think brick houses are incapable of resisting storms but in the SC (Save-The-Children) houses I designed, even by brick, they can withstand storms effectively.

(KII 1)

This misunderstanding also has a negative effect on governance mechanisms for resilient housing construction. Practically, one of the driving forces for the professional involvement (mainly architects) in individual housing design is to help owners prepare architectural drawings for building permit applications. As seen in the case of HHB, all housing construction works are required to have a building permit before construction, except for the type of nhà cắp 4, a preferable housing type of low-income people as it is suitable for their limited economic capacity. What people do before the construction of their nhà cắp 4 houses is to send a permission form to the ward authority, including simple floor and elevation plans (not technical drawings), to allow in-charge units to check whether it is situated in the right area of residential land and the building form is not too strange. For safe-construction management, the local authority has no check, since
this issue is not officially required and no specific regulations and instructions for safe construction are given. This is a limitation of local governance for housing construction that restricts the involvement of built-environment professionals, particularly local architects and engineers, in assisting the improvement of unsafe housing for low-income groups.

6.2.2 Economic Constraints of At-risk Households for engaging BEPs

From the viewpoint of low-income people, if building permits are applied in practice, it will be hard for them to follow because they have to pay an extra cost for design services. According to the local authorities, most households living in at-risk areas are considered to be poor or near poor, because their monthly family income fluctuates around the national poverty line. As emphasized by the householders interviewed in HHB, they were not interested in hiring architects for their housing design as it was beyond their economic capacity. Similarly, people in LT and TN showed their underestimation towards the engagement of BEPs in local housing construction. Most of them believed that their available experience on disaster preparedness was adequate to cope with future disasters and that technical support from architects and engineers for safe construction was not necessary to their situation.

However, the discussions with local builders and key informants in HHB, LT, and TN, revealed that professional expertise for resilient housing construction provided by BEPs was significant in assisting local workers to gain a better understanding of the fundamental principles of structural strengthening and how to implement them in practice. Similar to the opinions of the households interviewed, local builders also showed their concern about high costs triggered by this professional service that may have discouraged low-income families to approach architects and engineers for their housing design and construction. As explained by one local builder:

*The need for architects and engineers’ help is to calculate how to reduce the construction cost at the same time as ensuring the structural stability. For example, can roof beams be built with two iron bars inside, how to connect roof frames with walls, or is it possible if using RC pillars with
three iron bars? We are practically implementing a lot but not understanding wind pressures and forces placed on the building.

(FGD 3)

On the other hand, low-income households living in disaster-prone areas are frequently out of the targeted client range of architects and engineers, as they earn little or no income from this group. For example, in HHB, local architectural offices place more focus on the middle- and high-income groups, because the housing of this group (not nhà cấp 4) always requires a building permit before construction, for which architects can charge for a design service and building permit application fees. As mentioned by one local authority staff in HHB:

The poorer, the more vulnerable they are because they cannot afford the hire of design service and the use of some costly safety-related measures with good-quality materials.

(KII 3)

6.2.3 Lack of Incentive Schemes to Sustain Innovative Ideas for Disaster Resilience

The investigation on donor-built housing in HHB and IAB indicated that new construction techniques for disaster resilience applied by the architects were not replicated after the project completion. In HHB, after the typhoon Xangsane (2006), local experiences on housing construction showed their limits in helping people cope with disaster. For example, brick walls were widely used by local builders only for covering purposes, while building experts have indicated their technical effectiveness in withstanding storm winds if proper ways of brick wall construction are applied. As observed in the donor-built houses visited, walls with a thickness of 15 cm or more can work as load-bearing and wind-resistant elements. This was an innovative concept in housing construction at that time (2007), suggested by the project architect, since almost all local houses here had their walls of 10 cm thickness or less.

However, this innovative idea faced critical problems in practice since there were no types of brick for that wall-size (15 cm thickness) available on the local market at that time (all local bricks were 10 cm thickness). The architect had to approach local brick factories to convince them to produce this kind of brick, and one factory agreed with his proposal to produce the 15cm thick brick for his project. However, local builders related that, due to its unfamiliarity to local people and
higher cost than existing local bricks, this type of brick disappeared from the scene right after the project completion. This also led to the disappearance of an innovative technical solution for disaster-resilient housing because of the lack of incentive schemes for its continuity. Design solutions for disaster-resilient housing accompanied with this innovative idea also disappeared from the scene for that reason.

In IAB, innovative ideas for resilient housing construction were found in the use of RC skeletons under the traditional form of housing-on-stilts (Figure 6.2) for the donor-built post-disaster housing provided by IFRC and VNRC. At that time, while local people still preferred housing-on-stilts, local authorities wanted to replace this form with the new type of housing-on-floor to reduce deforestation caused by using timber. However, since this region suffers from both storms and floods, the house-on-floor is unable to cope with annual floods with an average level of 1.5 meters, and local people were not interested.

![Figure 6.2: RC skeleton was applied for building local houses-on-stilts by IFRC and VNRC](image)

To compromise with the above challenge, the architect proposed a new idea to combine two conflicting ideas into one solution: *house-on-stilts with reinforced concrete*. The retainment of the on-stilt form did satisfy local people, and the use of RC materials met local authority expectations, as it was likely to change local perceptions on the usefulness of new materials for deforestation prevention. However, similar to the case of HHB, this innovative design was not used and replicated in the community later, since the use of RC parts led to a higher cost than timber, the latter which was free if collected from the forests nearby. This
shows the governance-related limitations, where administrative mechanisms to control deforestation and incentive schemes to encourage the application of innovative designs for resilient housing were missing.

The three local barriers mentioned above not only exist within the case-study sites but also appear in many vulnerable areas of Central Vietnam, since they reflect the social and contextual aspects of safe construction rather than the technical inputs of BEPs for safe housing. Fieldwork findings show that the BEPs’ potential role to contribute to disaster resilience for housing is clearly positive regardless of some conflicts between household perceptions and expert opinions towards the BEP engagement. On one hand, local people and community members (i.e. local builders, community-based organizations) believed that architects and engineers are not necessary for the construction of low-income housing, as they increase the cost of construction. Due to economic constraints, low-income people often worked with local workers (masons, carpenters) to build their houses on their own based on their real needs and available resources (finance, labor). On the other hand, key informant interviews indicated that at-risk households and local construction workers usually have a limited understanding of wind forces and pressures on building structure. What they do is to follow previous experiences of local housing construction that have a common lack of secure bracings and connections between structural elements for risk reduction. This, again, highlights the importance of involving professional bodies in reducing housing vulnerability and reaching a disaster-resilient construction for low-income and at-risk communities.

In short, the current gap between at-risk communities and BEPs due to the three barriers mentioned above necessitates the involvement of central and local governments and the public, to seek a bridging connection between these two groups for the outcome of the long-term resilient housing to future disasters.

6.3 The Necessity of Professional Assistance to develop Disaster-Resilient Housing

As determined by the case studies, local construction practices currently follow unsafe techniques that are either inherited from previous generations or imported from the outside through builders and contractors. Brick houses without RC posts and continuous beams and roof attachments are commonly seen in HHB and TN, while wooden houses-on-stilts without walls and roof reinforcement appear
dominantly in IAB. In addition, housing consolidation measures taken by people in LT and HHB in response to a coming storm mainly focus on roof strengthening and doors/windows tightening, based on their experience. As said by its local authority, there is a lack of technical guidelines on how to reinforce other parts of the house (i.e. foundations, walls) and how to achieve disaster-resilient construction.

According to local builders, many low-income households, due to their financial shortage and limited awareness of disaster preparedness, frequently stop their housing construction in the middle stages and leave it unfinished, frequently without doors, windows, roof coverings, or wall plastering (Figure 6.3). This leads to risky exposure to the next disasters, but not many of them are adequately aware of that. Housing damage and loss are experienced in storms, as clearly seen in Typhoon Xangsane (2006), where uncompleted houses experienced a large proportion of the housing damage, according to local respondents. The interviewed DRR experts highlighted the limited perception of at-risk households and local builders of the importance of resilient housing construction as the main cause of such problems. This shows the necessity of BEP engagement in the process to provide at-risk communities with basic and advanced knowledge on disaster preparedness for housing, at the same time as supporting household economy development.

![Incomplete house without doors and wall finishing due to limited finance](image)

**Figure 6.3:** Incomplete house without doors and wall finishing due to limited finance

Fieldwork findings also indicated that the usefulness of professional assistance for resilient housing outcomes goes beyond the provision of safe housing products.
According to group discussions and key informant interviews, besides technical measures for safety purposes, housing for low-income people, even within limited construction costs, needs to address other broader issues to bring human comfort for occupants and make the buildings harmonious with the surrounding environment and landscape. In particular, the responsiveness of the house to the hot-humid climate, building forms and roof shapes, and the provision of open public spaces within the neighborhood, are among the key issues needing to be addressed in resilient housing strategies. Group-discussion respondents and key informants affirmed that this task can only be done by architects and planners who are trained and authorized to deal with such problems.

In reality, there have been several conditional credit programs to support the construction and renovation of safe housing in the case studies (HHB and LT), where the involved architects were required to visit each household to capture the real situation, living needs, and economic capacity before delivering design options. Most designs given by architects are dissimilar from house to house in terms of building form and functional spatial layout (due to no standard design being applied), but similar in using disaster-resistant principles such as the use of continuous beams at the foundation and roof levels. This approach is highly adopted in the community as it meets actual needs of at-risk households. However, according to respondents, it is hard to extend this approach to a larger scale in a wider region, because of the limited number of architects to reach every household and the lack of resources or supportive schemes to enable their mass engagement.

According to the interviewed architects, for the cyclone-prone areas such as HHB and LT, it is technically difficult to verify the level of risk exposure of each house, because it also depends on external factors outside the building such as windbreaks (other buildings or trees) nearby or storm wind directions. Supporting this statement, one local respondent showed the proof that, after Typhoon Xangsane (2006), there was a case in which a two-storey reinforced concrete house was seriously damaged, but a temporary house nearby remained intact although its structure was much weaker. This indicated the importance of settlement and site planning measures in enabling housing resilience to natural disaster besides specific aspects of building design and construction. In particular in the case of HHB and LT, where people live in an extremely at-risk area near the
sea, solutions for site and settlement planning for disaster risk reduction are more meaningful and necessitate the professional input from architects and urban planners. As noted by one architect:

\[
\text{Urban planners and architects need to sit together to design appropriate settlement patterns with specific criteria of building sizes and setbacks where wind pressures and impacts on individual buildings (houses) are significantly reduced. (KII 2)}
\]

6.4 The Role of Architects

The above discussion also depicts a critical role taken by architects to the design and construction of disaster-resilient housing. From the fieldwork, the role of architects can be found and clarified into three main tasks:

- **Consultation Facilitation**: to organize, coordinate and implement shared learning dialogues for the long-term efficiency of resilient housing outcomes.
- **Building Design**: to provide spatial and technical solutions of resilient housing for achieving human comfort, cultural appropriateness, and building safety.
- **Capacity Building**: to popularize and share new knowledge and expertise on disaster-resilient housing for at-risk communities and relevant stakeholders.

In terms of the *consultation facilitation* task, as discussed in the last chapter, the project architects showed a dominant role in organizing and implementing consultative meetings and discussions with various stakeholders, locally and externally, to seek appropriate design options of post-disaster housing. As clearly seen in the case of LT and IAB, the architects had a leading role in facilitating community consultation and capturing needs and capacities of local families, which were effectively interpreted into specific spatial and technical solutions of post-disaster housing.

Related to the *building design* task, fieldwork findings showed that the provision of living spaces that are not only safe but also culturally appropriate and climatically comfortable to users is crucial. To ensure human comfort, spatially and climatically responsive designs are needed to satisfy functional expectations
of the family and to reduce adverse impacts of local climate (hot and humid). As seen in LT and IAB, the functionally spatial layout of donor-built houses designed by the architects has met the family’s expectations, where living and livelihood needs are addressed in the design. Eight of ten donor-built households interviewed in these two cases said that their houses are spatially sufficient to accommodate vital functions of living (i.e. sleeping, eating, or toilet). In addition, as indicated by the key informants, disasters do not last throughout the year (frequently from August to November), but most of the year people are faced with extreme and adverse impacts of the local climate (hot and humid) that critically affect their health and result in their limited productivity. However, the focus on safe construction in recent housing projects has underestimated the importance of climatically responsive designs to bring human comfort for occupants. As clearly seen in HHB and TN, all the visited donor-built houses show their limited climate responsiveness; of which, the lack of natural light and natural ventilation inside functional rooms are the most common (Figure 6.4).

![Figure 6.4: Lack of natural light in a donor-built house in HHB](image)

To achieve cultural appropriateness, as found from the fieldwork, respect to the existing housing patterns and people’s lifestyles is the key to success. As seen in the case of IAB, the design of donor-built houses in the local form of house-on-stilts after Typhoon Ketsana (2009), provided by the architect, was highly appreciated in the community, because it addressed local ways of living and the vernacular housing tradition. Living and livelihood needs are, in turn, arranged above and below the house floor separated from the ground in their design. Thus,
all donor-built houses surveyed are currently used as the main house for the families to accommodate their daily living activities. In addition, the keeping of the on-stilt structure makes the donor-built houses harmonious with the existing local housing patterns where this on-stilt architecture is predominant. As said by one commune people’s committee staff:

The project’s technical staff (architect) offered a design that met specific lifestyles of Gia Rai people and demands of disaster preparedness as well. Houses provided by the IFRC and VNRC after Ketsana (donor-built) have also shown their structural solidity and remained intact in recent storms and floods.

(FGD 2)

To confirm their safety, donor-built houses designed by the architects at the case-study sites showed their inheritance of local wisdom and the introduction of new construction techniques in promoting disaster-resilient housing. Valuable local experiences were learned by the architects from their survey of practical situations and then reapplied in their new housing designs. In HHB, for example, from the survey of damaged houses after Typhoon Xangsane (2006), the project architect found out that this storm had destroyed all building parts of unsafe local houses except for their front verandas made with closed RC frames (Figure 6.5). Learning from this fact, he applied this lesson to his design of post-disaster housing (funded by Save the Children UK), in which the whole building structure could be consolidated in the same manner with the addition of continuous RC beams. To increase the solidity of buildings, he also recommended the use of thicker walls (15 cm instead of 10 cm), since he believed that the presence of these two elements could help the house withstand typhoons effectively. Also in IAB, RC materials were first used in the construction of on-stilt houses (donor-built) to improve their disaster resilience capacity, and were highly appreciated by locals.
Concerning the capacity building task, findings from the fieldwork suggested that architects are needed to provide at-risk communities with basic and advanced knowledge on disaster risks posed to housing, and how to achieve resilient construction, based on which, local awareness and capacity can be improved. The household interviews demonstrated that self-built and donor-built families had limited awareness towards disaster risks and resilience. For example, in HHB, eight of ten households surveyed said that natural disasters in their region have reduced, as they have not experienced any big storms such as Xangsane since 2006. Three of the respondents felt that Xangsane was a once-in-a-hundred-year disaster and will not happen again in this century. This limited awareness explains the lack of incorporating disaster preparedness measures in their housing construction or renovation. As explained by one architect:

At the time right after Xangsane, due to many houses being destroyed, the pressure of building safe houses made people easily accept and follow safe construction principles. Nowadays, when economic pressures are greater than disaster management, most practices of local housing construction does not conform to safety-related criteria. In addition, due to the lack of knowledge of local masons and the subjectiveness of householders, most new houses built in recent years do not incorporate storm-resistant features and may, obviously, be incapable of coping with future typhoons.

(KI 2)

In addition, great traumas from the previous disasters, such as Typhoon Xangsane (2006) and Ketsana (2009), also exist now and negatively affect local awareness.
of disaster risk reduction. This reduces people’s beliefs in the safety of their houses, even if designed by BEPs with the presence of disaster-resistant features. As said by one donor-built house owner in LT:

*I don’t think my house can withstand the typhoon like Xangsane. All of us must run to safer places if Xangsane revisits. We still remember very clearly what happened in the Xangsane seven years ago.*

(II 3)

Limited awareness of disaster risk reduction is also found in the viewpoints of local authorities and community-based organizations. Focus group discussions indicated that building resilient housing was considered as the sole responsibility of households, and that local authorities and mass organizations played a supportive rather than a responsible role through offering help before, during and after disasters. Strategies for raising housing resilience for longer-term periods, such as the provision of administrative and supportive mechanisms to control unsafe practices, appeared to be absent in their feedback. In addition, as mentioned earlier, misunderstandings of local stakeholders towards the safety of nhà cấp 4 houses are also linked with the absence of professional engagement in awareness-raising interventions, particularly from architects.

Another interesting finding from the fieldwork is the limited access of at-risk groups and households to research and practice publications on safe housing. Some researchers and practitioners have delivered technical guidelines for safe housing through their reports and books. However, not many of them are in Vietnamese (being mostly in English), since such projects were often funded by foreign donors. This critically hinders the accessibility of the public to their findings. As noted by respondents, at-risk people are usually unaware of what in-field researchers and experts have found out for their region in terms of disaster risk management, particularly on housing. As said by people in LT and HHB, there were several research projects already done in their region, but the only benefit they could get was a little money given by implementers as compensation for their meeting participation. Some research projects promised to provide them with research findings on safe housing at the end of the project; but, in reality, no research findings have been delivered to them so far. This shows a big gap between in-field professionals and in-need communities, where knowledge and expertise for safe and resilient housing construction are still out of reach of at-risk
households; and, again, highlighted the role of the architectural profession in filling this gap.

6.5 Conclusion

This chapter has clarified the significant role of BEPs, especially architects, for the provision of safe and resilient housing for low-income groups, and identified the key challenges to their engagement. Three main barriers to the involvement of BEPs within the case studies context have been identified: (i) *misperceptions of local stakeholders including at-risk communities on housing safety*; (iii) *economic constraints of at-risk households*; and (iii) *the lack of incentive schemes to sustain innovative ideas for disaster resilience*.

In terms of *misperceptions of local stakeholders*, it was found that some local concepts on housing safety are not similar to the formal definitions of the government, as seen in the different meanings of *nhà cấp 4* houses given by local and national stakeholders. Local people appear not to believe in the safety of their existing houses (*nhà cấp 4*) if some parts are strengthened, and always think of a replacement by new and stronger ones in the future; but, economically, this is unaffordable for them. This misperception has a negative impact on safe and resilient housing development and the engagement of BEPs. It hinders BEPs in convincing local stakeholders to improve unsafe conditions of existing housing types rather than to build stronger but much costlier houses.

Related to *economic constraints of at-risk households*, it was found that financial shortages of low-income households are closely linked with the absence of BEPs in their housing construction. The limited economic capacity of low-income households makes them uninterested in hiring design services for their housing construction; and on the other hand, makes BEPs not view them as within their range of target clients.

Regarding *incentive schemes to sustain resilient designs*, it was found that there is a lack of incentive or supportive mechanisms to maintain innovative ideas in terms of safe housing construction. Design solutions that are resilient to natural disasters, socially appropriate, and economically affordable for at-risk communities, are not replicated by people due to the lack of support from local governments and the wide public.
It can be said that these three barriers have widened the gap between local BEPs and at-risk groups, and contributed to housing vulnerability. While economic constraints hinder the involvement of BEPs in safe housing development, lack of incentive and administrative mechanisms for the safer construction of nhà cấp 4 houses make local BEPs stand outside the process. In the context of the case studies in particular, and the region of Central Vietnam in general, architects (sometimes with engineers) usually engage in housing design once architectural drawings are required for building permit application. However, as mentioned, the construction of nhà cấp 4 houses, a preferable type of housing for low-income people, requires no building permit. This restricts the involvement of BEPs in sharing their technical and professional knowledge on the safe and resilient housing to in-need groups and communities.

The discussion in this chapter also indicated the three main roles of architects to the promotion of disaster-resilient housing. Their roles comprise: (i) Consultation Facilitation, (ii) Building Design, and (iii) Capacity Building. While the first two roles, of consultation facilitation and building design, are clearer and much discussed by respondents, the third, of capacity building, was rarely mentioned directly in qualitative interviews. However, the examination of the narratives has identified the third role of architects, where improving local awareness and capacity for safe and resilient housing construction is the key intervention.

In consultation-facilitation roles, it was found that architects are among the key persons to organize and lead consultative meetings and discussions with various stakeholders, to come up with appropriate housing design and construction solutions. In building-design roles, architects show their significant input not only to the improvement of housing safety but also to the provision of human comfort (through climatic responsive designs) and cultural appropriateness (through spatial and formal designs). In capacity-building roles, architects are required to disseminate and share professional knowledge and expertise in terms of sustainable housing design and construction to in-need groups and communities, through appropriate forms of communication and consultation mentioned in the last chapter.

Although these three architectural roles were clarified through the fieldwork, in reality, not many local architects are interested in the field of disaster risk reduction. Based on the author’s experience in the educational sector in Vietnam
and further discussions with key informants, one of the key reasons for this problem is the lack of sessions or subjects related to disaster risk reduction in the curricula of current architecture training programs in Vietnamese universities. This potentially leads to the underestimation of local architects of the importance of disaster risk reduction in stabilizing the development of prone communities or regions.
Chapter 7: Design Principles for Disaster-Resilient Housing

7.1 Introduction

The discussion on the role of built-environment professionals, particularly design inputs of architects and engineers, in the previous chapter has pointed out the importance of technical design interventions in achieving disaster-resilient housing. Spatial and structural measures addressed in housing designs have shown a significant contribution to the reduction of housing vulnerability and the enhancement of living conditions of low-income families. This chapter discusses such measures in the light of the broader field of disaster resilience, to further understand how design responses or principles enable the long-term efficiency of low-income housing.

Design interventions for housing in disaster-prone areas such as the case-study sites are essential to ensure damage and loss reduction and provide meaningful and comfortable living spaces for occupants. Therefore, it is necessary to give a balanced consideration to various, but interrelated, issues of housing design to bring about the effectiveness of housing outcomes. The case studies show that there are three key design principles that strongly influence the outcome of post-disaster housing and affect user satisfaction: technical, economic, and social. Namely, technical principles are important to bring safety and climatic comfort for occupants, while economic and social responses are crucial to bringing cost-effective and culturally appropriate design solutions (Table 7.1).

Table 7.1: Three design principles for resilient housing

<table>
<thead>
<tr>
<th>Technical</th>
<th>Economic</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety-related measures</td>
<td>Maximized use of local resources ((\text{materials, labor})) for construction</td>
<td>Spatial arrangement appropriate to the family’s living needs and social aspirations towards housing</td>
</tr>
<tr>
<td>Climate responsive strategies ((\text{i.e. natural light and ventilation}))</td>
<td>Reduced costs of building operation, maintenance, functional changes or extensions</td>
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<td></td>
</tr>
</tbody>
</table>
In the implementation of post-disaster housing in the case-study areas (architects were only involved in the donor-built group), issues relating to spatial arrangements, structural performances, and cost effectiveness of construction and renovation works that derive from the self-built group are also examined to inform future design practices on safe housing. In general, donor-built housing is good at technical safety-related measures whereas the self-built type shows its strengths in meeting economic and social needs. The next sections will detail these three design principles of disaster-resilient housing in the light of the case-study findings.

7.2 Technical Principles

As mentioned above, technical principles are important to improving the resilience of housing to climate threats, namely flood and storm events, as well as bringing a human comfort to the occupants. Technical issues addressed in this thesis include not only the safety of the house to storm and flood hazards but also the responsiveness of the house to the local climate (Table 7.2). This demands a balanced consideration to both these aspects in designing resilient housing options for people in Central Vietnam, since their habitat is highly prone to floods and storms as well as severely impacted by the tropical hot-humid climate.

<table>
<thead>
<tr>
<th>Safety</th>
<th>Climate Responsiveness</th>
<th>Integration of Safety and Climate Responsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Storm safety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Strong connections</td>
<td>→ Openings on both sides</td>
<td>→ Safety measures should be designed in the light of local climate responsiveness and vice versa.</td>
</tr>
<tr>
<td>→ Simple building forms and roof shapes</td>
<td>→ Top openings (i.e. roof windows) to intensify natural ventilation</td>
<td></td>
</tr>
<tr>
<td>→ Structural separation of sub-spaces</td>
<td>→ Natural ventilation</td>
<td></td>
</tr>
<tr>
<td><strong>Flood safety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Heightened floor</td>
<td>→ Capture indirect sunlight</td>
<td></td>
</tr>
<tr>
<td>→ Empty structure under the house</td>
<td>→ Natural light</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.2: Technical Principles of Resilient Housing Design
7.2.1 Safety

Safety is always considered as one of the first priorities in post-disaster housing reconstruction, since it helps reduce human loss and property damage and contributes to the stability of disaster-prone or affected communities. However, economic constraints, together with the limited experience of local people of safe construction, have resulted in the production of unsafe houses in the self-built group, while, in the donor-built group, safety seems to be better addressed. From the case studies, the self-built houses are usually constructed in the same manner as previous houses destroyed by disasters, without following safety standards; and risks for future disasters are reproduced. Fundamental elements of structural stability such as pillars, beams, or bracings are rarely seen in the structure of self-built houses. If any, such elements often exist separately (i.e. having pillars without beams or beams without pillars) and/or in improper ways (i.e. long intervals between pillars, beams at the foundation but not at the roof levels).

As discussed in Chapter 4 (Overview of the Case Studies), floods and storms are the two main types of natural disaster faced by the case-study areas. Post-disaster housing there was provided to cope with these two hazards. In the donor-built group, housing designs frequently focused on dealing with an individual hazard such as storm or flood resistance (the one that previously destroyed the house). Namely, the donor-built houses in HHB, LT, and IAB are designed for storm resistance, due to being rebuilt after Typhoon Xangsane (2006) and Ketsana (2009); or the donor-built houses in TN are targeted for flood protection, because of being built after the big floods in 2010 and 2011. In the self-built group, due to the lack of technical assistance and guidance, people frequently build houses of the same type and structure as previous houses without an adequate use of safety-related measures.

Storm Safety

In response to storms and typhoons, it was found that donor-built housing shows better technical performance than their self-built counterparts thanks to the presence of more safety-related measures in the building structure. In HHB, the donor-built houses have thicker walls and more concrete pillars and beams in the structure compared to the self-built ones. In LT, roof bracings and consolidation frames for gable walls are seen in the donor-built houses, while being unseen in the self-built. In IAB, load-bearing structures created by reinforced concrete were
only found in the donor-built houses, whereas timber was used for self-built. Or in TN, a much higher and stronger flood shelter is added to the structure of donor-built houses but is not found in the self-built. These additional features for safety purposes help improve the disaster-resistant capacity of the building structure and make donor-built houses stand firm in subsequent disasters.

One of the key findings of the fieldwork is the use of similar safety principles in the design of donor-built housing across the case studies. Three similar technical principles have emerged from the fieldwork as the backbone of storm safety for donor-built housing:

- **Strong connection** of all building parts (foundation, walls, and roof) and within each of these parts;
- **Simple building forms and roof shapes** to avoid wind-suction bags surrounding the house;
- **Structural separation of sub-spaces** (i.e. veranda) from the main house.

In terms of **strong connection**, it was found that RC pillars and beams are commonly used to connect the foundation with walls and roof parts. Pillars are often placed at the intersections of walls and along the long walls with an average interval of 2.5 to 3.5 meters to stabilize the house vertically. Beams are frequently added to the structure at the foundation and roof levels to tighten all pillars and walls and secure the house horizontally. The combination of these two elements (pillars and beams) from two directions, vertically and horizontally, is believed to bring the structural stability against storms, as seen in recent typhoons where the surveyed donor-built houses received little or no damage.

RC beams also play an important role in connecting the walls and roof parts of donor-built houses. In HHB, roof purlins and cover sheets are securely fixed to the walls underneath through the placement of roof edges into the RC beams alongside the gable walls (Figure 7.1). In LT, connections between walls and roof parts were improved by iron wires (usually 6-8 mm in diameter), which were added to the structure to tie roof trusses to the walls beneath. These iron wires were inserted into the top of the walls during the initial construction and covered by plaster.
To connect elements within one part of the house (i.e. walls or roof), the roof becomes the most important part that receives much more attention due to its greater levels of exposure to storm winds. In the aftermath of a storm, the roof is often the most affected part compared to others (foundation, walls). Various forms of roof damage were seen in the case studies, from blowing off cover sheets to the destruction of purlins and trusses. Solutions for strengthening the roof are also different between the case studies. For example, to protect roof covers from storm winds, inserting roof edges into wall beams and screwing nails are preferred in donor-built housing in HHB and TN, while placing concrete ribs (for clay tiles) and steel bars (for corrugated steel sheets) are widely used in LT (Figure 7.2).
It was found that, while the techniques for roof cover protection in HHB are locally replicated, the two methods used in LT are not widely applied, because steel bars quickly rust in rainy seasons and easily destroy corrugated iron sheets beneath, and concrete ribs are locally believed to bring bad luck to the family. As said by one representative from the commune People’s Committee:

*The use of concrete ribs on the roof of DWF houses is very good for storm resistance but locally unfavorable since people believe it may cause bad luck to the family.*

*(FGD 3)*

Related to the principle of *simple building form and roof shape*, rectangular building forms and gable roof shapes with a pitch of 30-45\(^{\circ}\) are the most common solutions in the donor-built houses. These two features appear predominantly in all post-disaster houses provided by the agencies in HHB, LT, and IAB, where storms and typhoons are the most common hazards. According to the architects involved, the geometric simpleness of the rectangular shapes and the gable roofs help reduce wind pressures on the structure thanks to no wind-suction bags being created around the house (Figure 7.3).

**Figure 7.3:** The simple building shape (left) receives less wind pressure compared to other non-simple shapes (right) due to no wind-suction bags created

Concerning the principle of *structural separation of sub-spaces*, detached verandas from the main house are commonly seen in the design of donor-built housing. In the case-study areas in particular, and in Central Vietnam in general, the semi-open space of these verandas is useful not only to prevent direct sunlight (very hot) and rain but also to function as a social place where family members can meet and talk with others (i.e. neighbors, friends, or relatives). The veranda is
one of the most important living spaces for Vietnamese families and, hence, is indispensable to the formation of their housing, as commonly seen in the surveyed houses, both self-built and donor-built.

However, in terms of safety, such verandas are highly vulnerable to storms and typhoons because these semi-open spaces create a wind-suction bag under the roof that easily blows off roof covers and destroys other elements if attached (beams, pillars). To avoid its domino effect to the main house, designers have developed ways to detach the veranda from the main house’s structure, to ensure that the destruction of the veranda has no impact on the main house (Figure 7.4).

![Diagram of detached and attached verandas before and after a cyclone](image)

**Figure 7.4:** The detached veranda triggers no damage to the main house (above) compared to the attached veranda (below)

In the self-built group, people’s interventions for safety purposes are diverse and, in general, not as good as their donor-built counterparts. In HHB, where people have experienced typhoons since 2006 (the same time as Typhoon Xangsane affected Vietnam), households have preferred the use of immediate or short-term measures for risk reduction such as putting sandbags on the roof, anchoring roof elements to the ground, or tightening doors and windows. Longer-term solutions
such as incorporating safety measures from the beginning of initial construction were frequently absent. As explained by HHB people, these temporary measures were preferred because they took less time and money for preparation.

In LT, where disaster impacts have been experienced for a much longer time, people are more serious about the safety of their housing. Regardless of their economic constraints, the structure of their houses is always incorporated with safety-related measures right from the initial construction. As observed, reinforced concrete (RC) beds and altars are added to the structure of the house for stabilizing the footing of envelope walls (Figure 7.5 & 7.6). People in LT believe that these measures can help the house withstand strong sea waves during storms, the most dangerous threat to local housing in stormy seasons, as indicated by local respondents. In the economic lens, the cost of adding these RC elements to the house structure are affordable for low-income families, frequently covering 5 to 10% of the total cost depending on how many elements the owners want to have in their house. The creation of such RC beds and altars is, in fact, a valuable local wisdom of LT people in terms of disaster risk reduction. As said by one household in LT:

You can find RC beds and altars in all local houses here. Because of their long-term experience facing strong typhoons and sea waves regularly, people here, by themselves, developed this solution, which is very effective, cheap, and durable.

(HI 6)
Figure 7.5: RC beds and altars work as the strengthening elements for the housing structure

Figure 7.6: RC bed (left) and RC altar (right) were found in the surveyed houses

Learning from this local experience, the agency DWF has applied these features in their post-disaster housing in LT. As stated by one beneficiary household of DWF:

*The project staff (DWF) were very kind when they listened to the household’s proposals and they accepted this solution of RC beds design because it was necessary for disaster preparedness.*

*(HI 4)*

In addition to the use of RC beds and altars, people in LT also show their activeness and creativeness in disaster preparedness when adding two to three RC beams in the middle levels of the house to connect all envelope walls together and
intensify the solidity of the whole structure (Figure 7.7). These beams usually consist of two iron bars with 6-8 mm in diameter inside, and function quite effectively in stabilizing the house during typhoons, as said by local builders. People here believed that the use of this technique, together with RC beds and altars above, makes local housing in LT strong and capable of withstanding storms and typhoons accompanied with storm surges, as has been the case in past disasters.

Figure 7.7: Continuous RC beams go around the building to strengthen envelope walls

Another finding from the fieldwork is the use of ‘strong boxes’ in some self-built houses. Although the self-built houses are, technically, not as good as their donor-built counterparts in general, their owners seemed to be more creative when preparing a safe place inside their house for emergencies posed by calamitous typhoons. Eight out of ten self-built houses surveyed in HHB and LT have a ‘strong box’ (Figure 7.8) made with an RC frame and slab, where family members could take refuge during catastrophic typhoons (e.g. Typhoon Haiyan in 2013 being forecast to land in Central Vietnam). For other times of the year without disasters, such ‘strong boxes’ are used as family toilets. However, according to self-built owners, even if their houses were incorporated with such ‘strong boxes’, they would only use it as a last resort if it was impossible to evacuate. For the donor-built houses, none of them have such measures for emergencies; the only option is running to the nearest safe place.
Besides the valuable local experiences above, many technical measures for safety purposes taken by self-built owners were mostly short-term. For example, in HHB, the roof structure was connected to the walls underneath through iron frames additionally installed after being damaged by a storm or typhoon. Or in LT, to protect roof covers, self-built owners prefer the use of quick measures such as covering the roof by fishing nets or placing sandbags or wooden bars on the roof (Figure 7.9). Such temporary measures are not adequate to protect the house from typhoons, as witnessed in previous typhoons, where many self-built houses using these techniques were destroyed.

Figure 7.9: Quick reinforcement measures by iron frames (left) and sandbags (right) in self-built housing
**Flood Safety**

In response to floods, both donor-built and self-built houses prefer to raise the floor level higher than previous floods, frequently above the annual average flood levels. However, forms of heightening floor levels are not similar across the case studies and between donor-built and self-built housing. For example, in TN, while the donor-built houses include a double story structure, the self-built ones only have a sub-floor or loft (by timber) under the roof of a single-storey structure.

In addition, flood risks faced by the case-study areas were not only from seasonal floods where long-lasting inundation was seen (as in TN), but also from flash floods where water flows are strong and likely to destroy the house (in IAB). To respond to each of them, different techniques were also employed in the housing construction.

In IAB, where flash floods are common, both self-built and donor-built houses were built on stilts, where the house’s floor was separated from the ground, frequently 1.5 to 2.5 meters high. Besides the traditionally cultural characteristic of living on stilts for IAB people, these on-stilt houses were also responsive to annual floods, because the empty space under the house created by stilts allowed floodwater to flow easily without destroying the main structure. In the donor-built houses, the use of concrete stilts instead of timber posts, as in the self-built, helps avoid material deterioration induced by floodwater and extend the house’s lifespan.

In TN, where seasonal floods dominate, adding a second floor to the main house is the favorite choice of implementers. However, the ways used to add this second floor are not similar between donor-built and self-built housing. While the donor-built houses were provided with a double story structure next to the existing old house, the self-built ones (single story) include a sub-floor under the roof, locally called *chăn* or *tra*, to evacuate family members and valuable items in case of flooding (Figure 7.10).
Figure 7.10: The double story structure used in donor-built housing (left) and a sub-floor under the roof of a self-built house (right)

The difference between donor-built housing in TN and in IAB is the change of safe-housing designs during the construction period. In TN, although there was a standard design for the double-storey donor-built houses to follow, the on-site construction was mainly dependent on the real situation shaped by the existing house and the family’s expectations. In all five donor-built houses, the double-storey structure was placed on the existing house (Figure 7.11, left photo). Householders explained that this not only helps the house better cope with floods but also expands their living spaces to the second floor, an idea that was not found in the standard design. This idea was initially proposed by owners and then considered and approved by in-charge technical staff.

However, there were some technical requirements that the double-storey donor-built houses had to follow for safety purposes, such as that the floor structure must be solid, the floor level must be higher than the biggest floods in the past, and that the minimum floor area be 10 square meters. On the other hand, in IAB, the standard design was strictly followed by the construction team in practice, because most of the old houses were destroyed by disasters at that time and people agreed to build new houses according to the provided architectural designs.

Another finding from the fieldwork in terms of flood risk reduction is the use of movable and durable furnishings inside flood-resistant houses, both donor- and self-built. As observed in TN, light-weight furniture such as plastic tables and chairs were commonly used in the surveyed houses. These plastic items were not
deteriorated or damaged by floodwater, and allowed easy movement or hanging on the ceiling when floods happen. Since housing of low-income people frequently has a narrow usable area, moveable furniture also allowed an easy functional change of living rooms for other purposes. As one owner said:

*On the occasions of my family reunions such as death anniversary days of our ancestors, all chairs and tables (of plastic) in this room (living room) are moved outside to make space for our relatives coming.*

*(HI 4)*

**The Need for Integrating Flood and Storm Safety**

Besides the findings related to storm and flood safety above, the fieldwork also showed that the coping strategies followed were not appropriate to the current and future times, where climate change has triggered new threats to local communities and unplanned urban development has generated new risks. The areas that previously suffered from floods only are now facing storm hazards, and vice versa. In TN, where flooding was the only type of disaster experienced in previous times, storm impacts have started since October 2013, the time Typhoon Wutip visited and caused huge damage to local housing. At that time, people were surprised at this typhoon and had very limited or no preparation, because their preparedness measures only focused on flood protection.

In HHB, where storms dominated local disaster impacts, flood impacts have been known in recent years due to unplanned urban development, which includes the construction of industrial zones and new urban settlements in low-lying areas (i.e. rice fields or river basins), new roads perpendicular to flood channels, the increase of construction density, and the decrease of natural ground area. These have reduced space or room to retain water in rainy seasons, blocked waterways, and generated flood risks to previously storm-affected communities. Since masonry structure is increasingly being used in local housing construction, floodwater makes such structures weaken quickly, shortens the lifespan of inundated materials, and reduces their disaster-resistant capacity. New and unprecedented disaster risks found from the case studies have posed a necessity to address multiple hazards in future housing implementations, for the long-term effectiveness of housing outcomes.
7.2.2 Climatic Responsiveness

One of the key findings from the case studies related to the technical design of post-disaster housing is the limited consideration given to responding to local climate (hot and humid) and bringing climatic comfort for occupants.

In the donor-built group, the excessive focus on the safety performance of rebuilt houses led to a limited attention to other issues of housing that are also important to human lives. While disasters only happen for a short time of the year, normally within 1-3 months, impacts from the hot and humid climate are faced by people throughout the year. Their effects, such as high temperature and humidity, on people’s lives, are substantial and critically affect people’s health and their working productivity. High temperatures make people tire quickly, and high humidity makes interior spaces stuffy and expands the growth of viruses and bacteria that potentially increase transmittable diseases or infections. To deal with these problems, as emphasized by architects, it is necessary to capture more natural light and intensify natural ventilation in the living rooms of the house. As highlighted by one architect:

*Natural disasters happened few times per year while high temperature and high moisture affected people’s life throughout the year. Why do we put more focus on disaster preparedness while less consideration is given to climatic responsiveness?*  
*(KII 1)*

In HHB, seven out of ten surveyed houses have insufficient natural light and ventilation in their interior (Figure 7.11), due to the lack of openings and improper design for cross-ventilation. The lack of natural light and ventilation is also seen as the main reason for the growth of moss and mold on masonry materials (i.e. bricks, plaster). Their presence accelerates the deterioration process of masonry materials, and reduces their load-bearing capacity and lifespan.
In the self-built group, people were aware of the climatic disadvantages they were facing. However, due to lack of technical instructions, climatic responsive measures taken were quite simple and frequently functioned ineffectively. For example, in HHB, to allow hot air to move out of the house, small holes were added to the top parts of gable walls (Figure 7.12). However, as said by householders, these holes could not improve the situation, and people still felt hot in the summer. Or in LT, small windows were used on the top of gable walls to allow hot air to move out of the house; but, in reality, these windows made little contribution to bringing climatic comfort for occupants. On the other hand, the reason to widely use such small openings (holes, small windows) in local housing is to reduce storm impacts and strong wind penetration into the house in the stormy season.
Another important finding from the fieldwork related to climate responsive design is the existence of veranda spaces in the post-disaster houses visited, both donor-built and self-built. The creation of such semi-open spaces next to the main house is one of the most outstanding architectural features of the tropics such as the case-study areas. The veranda functions as the ‘buffer zone’ between inside and outside of the house to block direct sunlight (very hot) and reduce rainwater penetration into the interior of the house (Figure 7.13). Socially, as mentioned earlier, the veranda is also a public space where family members frequently meet and talk with their neighbors, friends, and relatives (Figure 7.14). As further observed, overhangs are used on the top of doors and windows of some post-disaster houses to avoid direct sunlight and rain penetration into the house.
7.2.3 The Need for integrating Disaster Preparedness and Climatic Responsiveness

The discussion above has pointed out the two important technical streams for housing design and construction in disaster-prone areas, disaster safety and climatic responsiveness. Related to disaster safety, three key principles for storm-resistant housing have been found from the case studies: (i) strong connections between building parts, (ii) simple building forms and roof shapes, and (iii) structural separation of sub-spaces from the main house. These principles were widely applied in the construction of donor-built housing and, frequently, used at the same time in individual buildings. Meanwhile, in the self-built group, these principles are rarely addressed at the same time in one single house. Some houses have a veranda detached from the main structure but lack strong connections between building parts, or the converse.

The discussion also indicates the necessity of using a ‘strong box’ inside the house for emergencies posed by catastrophic typhoons (i.e. Haiyan in 2013), to avoid human loss. This box is the safe shelter for occupants in case they could not run to other places and the structure of their house is seriously destroyed by typhoons. It was deduced that these boxes need to be made with closed and solid structures such as reinforced concrete skeletons, and can be used as a functional room of the house in normal times (i.e. toilet or storage).

In terms of flood protection, the discussion outlines the common use of heightened floors (in TN) and empty structure under the house (in IAB), in response to seasonal and flash flooding, respectively. Firstly, the heightened floor (for seasonal floods) is not only in the form of a sub-floor right under the roof of the single-story houses but also exists as a double-story house that occupants can
use for living functions at other times (i.e. study or bed room). It was also found that, if a flood-resistant shelter is provided next to an existing old house, it should be based on the real physical conditions of this existing old house rather than strictly conforming to standard design(s). This helps provide more suitable living spaces and ensures a user’s satisfaction. The only thing needing to be considered is what technical features the construction must follow for safety purposes. Secondly, the empty structure under the house is widely used in the areas prone to flash floods, particularly in the mountainous areas of Central Vietnam such as IAB. These on-stilt houses respond well to flash floods since the hollow structure made by stilts under the house allows an easy flow of floodwater.

It was found that coping with individual hazards will not be enough in the future, since climate change and unplanned urban development are generating new and unprecedented risks to local communities. Regions previously suffering from storm hazards are now impacted by floods, and vice versa. Therefore, housing designs for disaster-prone areas in Central Vietnam need to take both flood and storm risks into account, even if the construction site is currently affected only by one of them. This proactive preparedness will help avoid unexpected damage and loss if unprecedented events occur.

In terms of climatic responsiveness, strategies for blocking direct sunlight (very hot), avoiding rain penetration, and intensifying natural ventilation for internal spaces of the house, are identified as being key considerations. Disasters are only seen for some months in a year, while adverse effects of the local climate are experienced throughout the year and greatly impact local life. The design for climatic responsiveness is, hence, as important as for disaster safety. Since people in Central Vietnam are facing negative impacts of the hot and humid climate, such responsive strategies above are essential to make their houses cooler in the sunny season and avoid wetness and dampness in the rainy season.

It was found that the veranda space plays an important role in bringing climatic comfort for occupants. This semi-open space functions as a ‘buffer’ zone between the inside and outside of the house to reduce the direct impacts of the sun and rain for living spaces. It is also an indispensable place for families thanks to its contribution to enhanced social relations and interactions of family members with the community. However, verandas, frequently, are the most vulnerable parts to storms and typhoons due to wind-suction bags being created by their form. This
problem is tackled by one of the safety principles mentioned above, *the structural separation of sub-spaces* from the main house.

In short, developing sustainable housing for disaster-prone areas in Central Vietnam necessitates a balanced consideration of both disaster safety and climatic responsiveness issues. Disaster-resistant measures need to go along with climate-responsive strategies in the proposed housing designs, not only to reduce unexpected damage and loss caused by disasters but also to bring climatic comfort for occupants and improve their living conditions in the longer run.

### 7.3 Economic Responses

#### 7.3.1 Economic Constraints versus Safety Design

In the case-study areas, most disaster-affected households belong to poor and near poor groups whose incomes fluctuate around the national poverty line. Their sources of income are mainly based on agriculture produce (in IAB and TN), fishery (in LT), or temporary or low-paid jobs in factories (in HHB). In coping with disasters, they have limited financial capacity to improve the safety of their housing, especially the use of safe construction techniques for their houses. After disasters, they become poorer because a significant amount of their budget is spent on housing repairs or reconstruction. Many households were in debt since the money borrowed from others was yet unpaid. Some owners reported that they already borrowed more than half of the total cost of their housing construction and were unsure when they could repay these debts. This makes them unable to escape poverty and undermines attempts for housing vulnerability reduction. As said by one household in HHB:

> After the storm, my house was totally destroyed except for the foundation. Together with our savings, we had to borrow up to 70% to rebuild this house and we are not sure when we will be able to repay this debt.

*(HI 9)*

In addition, not many households can ascertain their accumulated losses over the years gathered from annual housing repairs or reconstruction, which also affects other development efforts of their family. When being asked, people could figure out the economic loss after the most recent event easily, but it was hard for them to identify the accumulated loss after a certain period (e.g. after 2, 5, or 10 years) or several events. Architects noted that such a sum of losses covers a considerable
amount of the family budget of low-income households; and, if their houses were technically safer, they could save a deal of money over the years, which could be subsequently used for other development or improvement efforts (i.e. livelihoods investment, education, or healthcare). According to one household in IAB:

*Storms are the most dangerous events in this area. My house was already repaired four times due to them and might again need to be repaired after future storms.*

*(HI 2)*

In brief, economic constraints of vulnerable groups form one of the biggest obstacles to building a resilient housing system in Central Vietnam. Financial shortages of low-income households make them view housing safety as a secondary priority in development and, thus, rarely incorporate safety-related measures in housing construction or renovation; as seen in the case studies, where the self-built houses have more unsafe conditions than the donor-built ones.

### 7.3.2 Acceptable Levels of Safety for Cost Efficiency

It was argued that the use of safe construction techniques usually triggers an increased construction cost and, hence, affects low-income people’s decisions on whether to use safety measures for their housing. According to the interviewed architects, rates of cost increase are dependent on the physical conditions of each house, but, in most cases, will not increase by much if proper designs are delivered. It was said that additional costs for incorporating safety-related measures are closely linked with the safety level(s) that the house targets, such as the wind level 12 on the Beaufort scale (for storm resistance) or the one-metre-high water level (flood protection). The higher the safety level, the higher the housing construction cost.

Practically, it is not possible to build a very strong house to withstand all storms, including the catastrophic but uncommon typhoons such as Typhoon Haiyan in 2013, because costs to build such houses surely exceed the economic capacity of low-income families. Even within the donor-built houses that received full financial support from the donors, the highest wind level targeted for technical safety is the level 12 (on the Beaufort scale) *(Table 7.3).* With the storms crossing the level 12 (e.g. super Typhoon Haiyan in 2013), evacuation is the only, last option to avoid human loss and protect household items, because all the donor-
built houses were likely to collapse, as stated by the local authority representatives. As noted by one staff in LT:

*Constructing a very strong house with a high construction cost is not feasible as incomes of local households are relatively low and they cannot afford such costs.*

*(FGD 1)*

### Table 7.3: Appropriate levels of safety for low-income housing in Central Vietnam

<table>
<thead>
<tr>
<th>Storm</th>
<th>Flood</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ Wind level 12 on the Beaufort scale.</td>
<td>→ Higher than the annual average flood level.</td>
</tr>
<tr>
<td>→ Alternative solutions for storms stronger than that level (e.g. strong boxes inside the house).</td>
<td>→ Alternative solutions for floods greater than that average level (e.g. using personal boats or flood shelters nearby).</td>
</tr>
</tbody>
</table>

There are two additional reasons to justify the application of the wind level 12 in designing storm-resilient housing. Firstly, it is conformable to the current Vietnam construction standards, where the wind level 12 is aimed at in the structural stability of civil buildings, including residential. Secondly, this came from the reality that the houses designed for wind level 12 had little or no significant damage after previous typhoons whose winds were recorded at level 12 and above.

However, concerns still exist about the likelihood of structural destruction of the houses that are designed for this wind level if stronger typhoons happen and no alternative solutions for such typhoons are in place. In this sense, the ‘strong boxes’ found in the self-built housing (discussed in Section 7.1.1.1) can be a good response since it helps avoid unexpected damage, particularly human loss, but costs not much for finance in construction. As reported by some self-built owners in LT and HHB, additional costs associated with the use of such ‘strong boxes’ range from 5 to 10% of the total cost, because only the RC beams and pillars were added to the structure of a functional room of the house (e.g. bedroom, WC).
For flood protection, acceptable levels of safety are dependent on the geographical location of the house, low or high, so it is impossible to come up with a standard level as in storm risk reduction. The case study findings indicate that flood-resilient housing had its floor higher than annual average flood levels of the involved area, combined with alternative measures for floods higher than annual flooding. For example, in TN, besides the construction of a flood shelter under the main house’s roof, almost all households have at least one boat for evacuation in case of catastrophic floods.

**7.3.3 Maximized Use of Local Resources**

Economic responses to post-disaster housing in the case-study areas are also seen through using local materials and local labor for construction. Various forms of local resource utilization were found in the case studies. In LT, self-built owners made cement blocks by themselves while in IAB, family members were fully involved in the housing construction. In HHB, self-built owners borrowed several workdays from others (normally their relatives, neighbors or friends) for housing reconstruction, and returned these in a similar form, as said by one self-built householder:

> Because we had too little money to hire masons, we had to borrow 50 workdays from our neighbors and friends and, afterward, worked for their housing construction for the same number of borrowed workdays as a payment.

*(Hi 10)*

Through this way, self-built households in HHB could effectively support each other to finish their post-disaster houses even without sufficient finance.

With limited financial capacity, self-built housing owners find all possible ways to take advantage of their physical strength or capabilities for cost reduction, from making materials (in LT and IAB) to joining construction works (in LT, IAB, and TN). Some self-built householders said that money spent out of their pockets was only for purchasing materials and, sometimes, for hiring some local workers in building important parts of the house, such as the foundation or roof. For other easier work, such as digging foundation holes, site cleaning, or mixing mortar, family members were fully mobilized.
On the other hand, the construction of donor-built housing shows less cost efficiency compared to their self-built counterparts. Although almost similar investments were made on the housing construction, the size of donor-built houses was generally smaller than of the self-built. It was explained that, despite the efforts of implementing agencies in providing low-cost housing after disasters, the cost ineffectiveness of donor-built houses still exists due to the employment of building contractors outside the community for the practical construction (in HHB) and the use of new and costlier materials and construction techniques (in HHB and IAB). As explained by one donor-built owner in HHB:

> The use of many players outside the community increased the cost. In future projects, if possible, people here would only need the design from architects and then self-organise all construction works with local builders. Local authority and sponsors can supervise our works anytime to ensure the quality.

(HI 2)

In general, maximizing the use of local materials is always one of the criteria in selecting housing designs, because it helps lessen associated transportation costs (if not locally available), maintain common local construction practices, and intensify the participation of local people in construction works.

7.3.4 The Provision of Just Sufficient and Flexible Spaces

It was deduced from the fieldwork that the provision of optimum but flexible living spaces also contributes to the economic efficiency of safe housing. It is obvious that the larger floor area the house has, the costlier the construction will be, and large houses are hard to find in the case-study areas. Instead, narrow living spaces were commonly seen both in donor-built and self-built housing, in which the usable area of each room is just enough for the most important need that the room serves (e.g. bedroom only sufficient for putting one bed). According to one donor-built household in LT:

> I have no complaint on the narrow living spaces being used in my house as long as it meets our minimum needs of eating and sleeping. Every day, from early morning to late evening, we have to go to work outside (not at home).

(HI 3)
However, such narrow spaces are flexible in that other functions can be carried out if needed. It was found that, except for bedrooms, other functional rooms in the house were not fixed to any one single purpose. For example, in LT, HHB, and TN, living and dining functions are often interchangeably used in the same space (Figure 7.15), frequently at the front of the house and in connection with the front veranda. This space is also used for family events such as an ancestor’s death anniversary, where many people are invited. The provision of such flexible living spaces helps reduce the number of rooms inside the house and, hence, reduces associated construction costs.

![Figure 7.15: The front space of a house in LT where most living activities occur](image)

### 7.3.5 Cost Effectiveness of Building Operation, Maintenance and Future Extension

As discussed in Section 7.2.2, the lack of climate responsive strategies in housing design for natural light and cross-ventilation intensification has led to increased costs for operating lighting and cooling devices such as electric fans and lamps. It was reported by some households that their monthly electric bills often cover a considerable amount of their monthly incomes. In some houses, the kitchen and eating area use lamps all day, and this can be quite inconvenient if there is a power cut for repairing the system (happens frequently in some areas).

Regarding the cost of building maintenance, good construction quality and the selection of appropriate types of materials can help reduce costs for later building maintenance. Good construction quality can lessen the process of material deterioration triggered by weather conditions. For example, all five donor-built houses in HHB faced problems of water leaking from the roof, while no similar errors could be found in the self-built ones. These water-leakage problems make
steel roof purlins rust quickly, accelerate the deterioration of wall plaster and bricks, and reduce their wind-resistant capacity. Three out of five donor-built owners in HHB reported that they had already replaced new roof purlins for their houses and that the walls were repainted several times in the past due to this problem.

In terms of selecting materials for reduced maintenance costs, the fieldwork indicated that the more local materials are used, the less building maintenance costs will be. As seen in LT and TN, the full use of local materials has allowed an easing of building maintenance later, since all materials used for repair or replacement works are easily found from local shops with very little or no transportation fee. Meanwhile, in IAB, the use of new materials (reinforced concrete) in the donor-built houses, even if good for safety purposes, is not replicated by people because, if used, they would have to pay an extra cost for transportation from the district center (around a 10-km distance).

Another aspect found from the case studies is the spatial extension of initial construction. More than half of the surveyed houses had extensions after initial construction (Figure 7.16). Various forms of the spatial extension were seen throughout the case studies, from adding more rooms next to the main house to enlarging existing living spaces. Costs for spatial extensions were also different from household to household depending on the size of extended spaces and the types of materials used.

In IAB and TN, housing extensions were easily made thanks to abundant empty spaces surrounding the house; whereas, in HHB and LT, spatial expansions were difficult due to limited areas of the residential plots, improper site planning in each plot, and unsuitable spatial arrangement from the initial construction. Three out of ten self-built houses surveyed in HHB and LT, due to being located adjacent to the fence on the back while there was much empty space provided at the front, blocked their spatial extension towards the back to accommodate sub-functions such as a toilet or storage (not suitable if being located at the front). Instead, many parts of these houses were demolished to leave space for extensions to the front side and, of course, it costs more money to rebuild them. In addition, the placement of kitchen and toilet(s), the solid structures, on the expandable directions (i.e. next to an empty space outside) triggers a cost increase of future extensions, because many valuable parts are demolished (i.e. kitchen shelves,
cabinets, toilet facilities). This shows a close linkage between initial designs of housing including building site planning and the cost of future spatial extensions.

<table>
<thead>
<tr>
<th>In IAB:</th>
<th>Extension was made to the main house to house the kitchen and dining</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2010</td>
<td>(Reconstructed after typhoon)</td>
</tr>
<tr>
<td>In 2014</td>
<td>(Future extension)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In HHB:</th>
<th>Extension was made for adding the veranda</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2007</td>
<td></td>
</tr>
<tr>
<td>In 2014</td>
<td></td>
</tr>
</tbody>
</table>

Figure 7.16: Housing extension made after initial construction

7.3.6 **Design Imperatives for Cost Efficiency of Low-income Disaster-Resilient Housing**

The discussion above has pointed out the four key design responses for economic efficiency of safe housing for low-income groups in Central Vietnam. These are (i) **acceptable levels of safety for cost efficiency**, (ii) **maximized uses of local resources**, (iii) **the provision of optimum and flexible spaces**, and (iv) **cost effectiveness for the building operation, maintenance, and future extensions**.
In terms of acceptable levels of safety, the case study findings have shown that, within low-income groups, the wind level 12 on the Beaufort scale (for storm resistance), and water levels higher than annual average flood levels of the region (for flood protection), are the most appropriate standards to base safe housing designs on, thanks to their economic suitability to low-income families. In response to catastrophic events stronger than those standard levels, alternative low-cost solutions (i.e. the use of ‘strong boxes’ inside the house instead of building a very strong but costly house) are recommended, to avoid unexpected damage and loss, particularly human loss.

Related to local resource utilization, the design that maximizes the use of local materials and local labor in housing construction is essential to ensure the cost efficiency of resilient housing solutions. It is more meaningful to low-income families who currently face economic difficulties but occupy a predominant proportion of the population in disaster-prone areas of Central Vietnam.

In relation to the optimum and flexible spaces, it is necessary to build functional rooms that contain no redundant or unwanted spaces. This helps reduce the size of the house and, thereby, cuts down associated construction costs. In addition, the case studies showed that the flexible use of rooms inside the house, where multiple functions were used in each room, is essential to reduce the number of desired rooms and, then, the size of the house, for cost efficiency.

Regarding the cost reduction of building operation, maintenance, and future extensions, the case studies indicated that design responses need to integrate climate responsive strategies for reducing energy costs, and anticipate the expandable directions of the house for the future to arrange functional spaces appropriately. In the hot-humid region of Central Vietnam, maximising the benefit of natural light, particularly indirect sunlight and cross ventilation for living spaces, is crucial to reduce ongoing energy costs from the use of electric devices (fans, lamps) and to prevent the growth of moss and mould, the main reason for the accelerated process of material deterioration. This helps minimize maintenance costs and prolong the lifespan of the house. In addition, the discussion also highlights the importance of having a proper site plan and spatial functional organization from the beginning, for cost efficiency of future housing extensions, in the sense that fewer building parts need to be demolished.
7.4 Social Responses

7.4.1 Spatial Solutions for Cultural Appropriateness of Safe Housing

It was found from the fieldwork that the spatial arrangement of the house makes a significant contribution to the success of housing outcomes. In the surveyed houses, the suitability of spatial arrangements to people’s ways of living is closely linked with user satisfaction and degrees of household acceptance towards design solutions. There are various forms of spatial suitability for family needs within the case studies; but in most cases, self-built house owners are more satisfied than their donor-built counterparts, thanks to their freedom in deciding functional arrangements and associated spatial layouts of their housing.

In donor-built housing, forms of spatial suitability to people’s ways of living are frequently decided by an external party, architects as seen in the case studies, and varied among the case studies. In LT, the traditional form of three-compartment housing, locally called Nhà Ba Gian, dominated the spatial layout of most donor-built houses. Three out of five houses surveyed followed the form of Nhà Ba Gian. The architect involved noted that this housing form is one of the most common traditional types of housing in Central Vietnam, known as Rường houses, where the internal space is divided into three compartments (Figure 7.17).

This three-compartment layout offers a balance of physical and spiritual needs of people’s lives, in the sense that the middle space serves a worship purpose while the side spaces are used for sleeping and the front mixed space for living and general family activities. As observed, both donor-built and self-built owners have used the three-compartment structure as the main house, whereas the sub house adjacent to the main house, locally called Chái, is used for extended living spaces (i.e. sleeping) and sub-functions (i.e. kitchen and toilet) (Figure 7.18).

![Figure 7.17: Typical floor-plan (left) and 3D illustration of three-compartment houses in TTH](image-url)
In IAB, the vernacular form of housing-on-stilts, locally called *Nhà Sàn*, is applied in all the donor-built houses visited. As mentioned before, mountainous people here prefer living in on-stilt houses whose floors are separated from the ground to avoid wild animals. The use of this local type in donor-built housing has provided beneficiaries with familiar living spaces, where space above is used for the main functions (e.g. living, sleeping or kitchen) and the space below for sub-functions (e.g. keeping farming tools and livestock) (Figure 7.19).

**Figure 7.18**: Some three-compartment houses surveyed in LT

**Figure 7.19**: The harmony of a donor-built house to the existing local housing pattern (on-stilts)
In HHB, a type of tube house, locally called Nhà Ống, was used for donor-built housing. The tube house has become the most common type of housing associated with the rapid urbanization process of this ward. Eight out of ten houses surveyed, both donor-built and self-built, follow the form of the tube house. According to key informants, this housing type is a typical representation of urbanization, in which its tube form geometrically conforms to rectangular residential lots in urbanized areas. The tube houses often have one side much longer than the other, usually more than two times, with the division of living spaces into three main parts: a family (living) room at the front, 1-2 bedrooms in the middle, and a kitchen and a toilet at the back (Figure 7.20). This spatial layout is widely adopted by people since most of the newly constructed houses favor the form of tube housing with similar spatial and functional arrangements.

However, even in the same form of tube housing, donor-built owners show their lower satisfaction towards their homes compared to self-built ones, because of the limited usable area of their houses. Donor-built house owners stated that strict conformation to a standard design resulted in this problem, since actual spatial demands of beneficiary families were considered less or even neglected. As one donor-built owner said:
My house with two small bedrooms is not enough for my children. We cannot put a double bed in a small bedroom and so, they have to sleep on the floor instead.

(HI 2)

Different from HHB, in TN, although the design of donor-built housing was standardized from the beginning, the practical construction was flexible and primarily based on the real situation of each household and the condition of their existing old house. In all five donor-built houses surveyed, the flood-resistant shelter was built in the form of upgrading one part of the existing old house to a double story structure (Figure 7.21), the idea that was not found in the standard designs. The construction of such double-storey structures not only helps improve the flood-resistant capacity of the house but also provides more spaces for living. As observed, all five donor-built houses use the double-storey structure as part of their main house, in which kitchen, dining, and toilet are frequently placed downstairs, and sleeping, studying, or storage are located upstairs.

|---------------------------|---------------------------|

Figure 7.21: A donor-built house provided by Ministry of Construction in TN showing its respect to the existing building structure

7.5 Conclusion

This chapter has identified three important design principles for low-income disaster-resilient housing in Central Vietnam, namely, technical, economic and social. Overall, the case studies indicate that the donor-built reconstruction approach was good at addressing technical measures for the safety purposes,
while the self-built one allowed the delivery of more suitable housing solutions in terms of local social and economic responsiveness (Figure 7.22).

![Diagram of Housing Reconstruction]

**Figure 7.22:** Strengths of donor-built and self-built housing reconstruction in relation to the technical, economic and social dimensions

It was found that these three design principles (*technical*, *economic* and *social*) have a close linkage in practical housing construction (Figure 7.23). The existence of one principle is interdependent on the other(s), and vice versa, in shaping the desired resilient housing outcomes. For example, in LT and HHB, it is not possible to eliminate the front veranda from the house even it is the most vulnerable part to storms, because this space is socially essential to the people’s everyday life, being where their social activities (i.e. talking with neighbours or friends) take place (*technical-social* relationship). Such interdependence between these design principles needs to be addressed in designing disaster-resilient housing in response to the specific context of the involved community, to increase local acceptance and adoption towards resilient housing outcomes.
**Figure 7.23:** Summary of three key design principles for low-income disaster-resilient housing within the context of Central Vietnam

Technically, the two aspects of disaster safety and climatic responsiveness need to be concurrently considered. This chapter has identified the acceptable levels of safety for housing that are financially affordable to vulnerable communities in Central Vietnam. Namely, the storm level 12 on the Beaufort scale and the flood level higher than the annual average levels of the involved region are the selected levels of safety essentially followed by resilient housing designs. For events beyond these levels, alternative cost-effective solutions are recommended, such as the use of ‘strong boxes’ inside the house (for catastrophic storms) or personal boats (for catastrophic floods) to reduce damage and loss, especially human loss.

In response to storm events, the discussion leads to three core technical principles: (i) the strong connection between building parts, (ii) the simple building form and roof shape, and (iii) the structural separation of sub-spaces (e.g. veranda, balcony) from the main house. In dealing with flood risks, the use of a heightened
floor(s) higher than the average annual flood levels of the region involved is suggested. It was also highlighted that resilient housing designs need to address flood and storm risks concurrently, to better respond to a changing climate and an uncontrolled urbanisation that potentially generate multiple hazards to low-income communities (e.g. some areas previously affected by storms were now facing flood risks, and vice versa).

In addition, technical principles for disaster-resilient housing need to include a responsiveness to the local climate. In Central Vietnam where the hot-humid climate dominates, design strategies that intensify natural light (i.e. indirect sunlight), and natural cross-ventilation inside the house, are crucial to making the house more comfortable in unfavourable seasons (i.e. hot and wet seasons). It was argued that natural disasters only happen for a few months of the year, while the severity of the hot-humid climate is experienced by households throughout the year.

*Economically,* three key responses of housing designs are found from the case studies. Namely, the selection of acceptable levels of safety for low-income housing, the maximizing of the use of local resources in construction, and the cost efficiency of building operation, maintenance, and spatial extensions, are the key considerations in this matter.

*Socially,* the fieldwork findings showed that spatial fitness to functional needs of local households is the key to the success of housing designs. Different communities will have different living needs and expectations, physically and socially, and design solutions are required to respond to such demands to ensure user’s acceptance and satisfaction. In the areas where residential housing has strong and unique characteristics, such as the ‘on-stilt’ way of living of mountainous people in IAB, respect for their lifestyles and keeping their housing forms are essential to familiarize people with newly constructed houses and provide them with a sense of ownership and empowerment.
8.1 Introduction

The analysis of *three design principles for resilience* (technical, economic, social) in the last chapter indicates that developing disaster-resilient housing goes well beyond only building safer houses to strengthen resilience in the affected communities. Disaster-resilient housing needs to be viewed in a broader picture where technical issues are integrated with economic, social and environmental dimensions. This chapter, therefore, proposes a *Framework for Disaster-Resilient Low-Income Housing* to assist designers in generating and shaping resilient housing design options for the context of Central Vietnam. The development of the framework is closely linked to the three themes of the research, namely (i) *community consultation*, (ii) *role of built-environment professionals*, and (iii) *design principles for resilience*.

In terms of *community consultation*, the findings on ways of consultation and stakeholders involved (presented in Chapter 5) shaped the guidelines on how to conduct community consultation in the framework. In relation to *the role of built-environment professionals*, the findings on the role of architects (presented in Chapter 6) framed the guidelines on the process of designing DRH, and key considerations for involving building designers in the design, construction and post-occupancy stages. Regarding *design principles for resilience*, the findings on the three design principles for housing resilience enhancement purposes (presented in Chapter 7) formulated the guidelines on conceptual and technical designs for DRH in the framework. In general, the synthesis of the findings from the three themes above indicates the necessity for establishing a *framework for disaster-resilient low-income housing* in Central Vietnam that can support designers/builders in developing resilient housing solutions. It is also the target of this chapter to develop such a framework, in accordance with the main findings of the research on the above three themes.
8.2 Overview of the Framework for Disaster-Resilient Low-Income Housing in Central Vietnam

As mentioned before, the Framework for Disaster-Resilient Low-Income Housing was closely linked to the three themes of the research, in which contents and guidelines addressed in the framework were primarily generated from the findings of this study on these three themes. Specifically, the framework developed in this chapter consists of two main parts:

❖ **Part 1: The Conceptual Framework** (presented in Section 8.2), where five major considerations for the design of disaster-resilient housing are provided. They comprise (1) technical safety, (2) spatial response to functional needs, (3) design response to aesthetic needs, (4) cost-effective construction and renovation, and (5) environmental sustainability. These considerations are the key design factors for building the resilience of low-income housing in Central Vietnam. As discussed in the previous chapters, these factors have a significant contribution to the improvement of low-income housing in terms of technical (disaster safety, local climate responsiveness), economic (cost efficiency of construction and renovation) and social (cultural appropriateness of functional living rooms to people’s lifestyles) dimensions (Figure 8.1).

❖ **Part 2: The Operational Framework** (Section 8.3), where the practical guidelines for generating and shaping design ideas and solutions for disaster-resilient housing within the context of Central Vietnam are provided. Specifically, a checklist of actions on how to conduct (1) community consultation, (2) site planning, (3) building design, (4) construction, and (5) post-occupancy evaluation are provided to assist the design and construction of safe and resilient housing (presented in Table 8.5). This checklist is a summary of the design principles and recommendations for disaster-resilient housing that were derived from the fieldwork findings (Chapter 5, 6 and 7) and the literature review (Chapter 2). This checklist can be used as practical guidance for architects and building designers in seeking resilient design options for low-income housing. If most of the items in the checklist are met, the house will be more likely to be resilient to future disasters, responsive to the living needs
and housing aspirations of low-income people, appropriate to the local context, cost-efficient, and environmentally friendly.

The reason for dividing the framework into two components, *conceptual* and *operational*, is to ensure the understanding of designers/implementers of what is actually meant by disaster-resilient housing within the context of Central Vietnam (conceptual); and, then, how to identify or shape associated design options (operational).

There are few publications addressing the meaning of a framework-based approach for safe and resilient housing. Among these (e.g. DFID & Shelter Centre, 2010; Fien et al., 2008; Jha et al., 2010; DWF, 2011) are also various approaches and perceptions on housing improvement and development where the specific context of the region/community involved and the perceptions of the authors influenced the outcome of the framework. Fien et al. (2008) conceptualized the housing framework for Australian indigenous communities into six components, and viewed these components as the sequential steps of the design, construction and post-occupancy management process of indigenous housing. On the other hand, Jha et al. (2010) and DWF (2011) framed safe housing design into issues that need to be considered by designers, such as disaster-resistance capacity, local resource utilization, or the need for modular, flexible and expandable designs (Table 8.1). Therefore, the framework proposed in this chapter focuses on both the conceptual and operational aspects of building disaster-resilient housing, rather than examining each of them separately, to provide a comprehensive understanding of how to define and develop disaster-resilient housing.
Table 8.1: Various perceptions of different authors on housing framework

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<tr>
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<tbody>
<tr>
<td><strong>EFFICIENCY</strong> as a key focus</td>
<td>1. Coordination</td>
<td>1. Consultation at decision-making stages</td>
<td>1. Settlement planning</td>
<td>1. Ten technical principles for cyclone-resistant construction</td>
</tr>
<tr>
<td></td>
<td>3. Assessment</td>
<td>3. Housing design</td>
<td>3. Housing design</td>
<td>3. Engineering drawings to assist and guide on-site construction</td>
</tr>
<tr>
<td></td>
<td>4. Implementation</td>
<td>4. Integration of education &amp; training into the design, construction &amp; maintenance plans</td>
<td>4. Need for flexibility, modular design, expandability, incremental housing</td>
<td>5. Design development, construction and project management</td>
</tr>
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</table>

Key Components

1. Coordination
2. Strategy
3. Assessment
4. Implementation

In Central Vietnam, there appears to be an absence of comprehensive frameworks for disaster-resilient housing that can integrate all aspects of the housing into one system, especially for low-income groups. DWF and Save the Children UK have among the best practices of post-disaster housing reconstruction in this region (Ahmed, 2011; Anh et al., 2014), but their housing design guidelines still mainly focus on technical improvements for safety purposes (e.g. the ten key principles of cyclone-resistant construction), with limited consideration given to socio-economic and environmental dimensions. The framework presented in this chapter, therefore, takes into consideration a comprehensive range of factors. The framework aims at providing a set of practical principles and recommendations for the design, construction and post-occupancy management of disaster-resilient housing for low-income people in disaster-prone areas of Central Vietnam.
8.3 Conceptual Framework for Disaster-Resilient Housing

This section discusses the first part of the framework, the *conceptual framework*, for conceptualising the development of disaster-resilient housing in Central Vietnam. The purpose of this *conceptual framework* is to provide an in-depth understanding of which aspects can contribute to and strengthen the resilience of low-income housing. The field investigation of the post-disaster housing interventions in this region has revealed an absence of precise conceptualisations of disaster-resilient housing and a lack of methodological approaches to translate resilient housing ideas into actual design projects.

In Central Vietnam, disaster-resilient housing has appeared as a new notion to most locals, and been commonly viewed as ‘safe housing’, where technical improvements are focused on. This perception is likely to lead to limited attention to other important aspects of resilient housing besides technical safety, such as the cost effectiveness, cultural appropriateness or aesthetic responsiveness of safe housing. Although these non-technical aspects have no effect on the technical resilience of the house, the cost effectiveness and cultural inappropriateness of housing products may lead to the dissatisfaction and lack of acceptance of such households. This may make households exclude safety-related measures from their house structures. To this extent, the *conceptual framework* is likely to improve current understandings of safe housing and clarify which meanings disaster-resilient housing concepts could bring to this area.

Based on the fieldwork findings presented in Chapters 5, 6 and 7, the *conceptual framework* for disaster-resilient low-income housing within Central Vietnam is framed into five factors: (i) *technical safety*, (ii) *spatial response to functional needs*, (iii) *design response to aesthetic needs*, (iv) *cost-effective construction and renovation*, and (v) *environmental sustainability*; in close relation to the issues of community consultation and BEP engagement, as the operational components of the *conceptual framework* (Figure 8.1). The five factors above are viewed as the conceptual components of the *conceptual framework*, since the concept of DRH addressed by this thesis primarily derives from these factors.
Figure 8.1: Conceptual Framework for Disaster-Resilient Housing within Central Vietnam

A. Design Factors

A.1 Technical Safety
- Acceptable levels of safety for housing of low-income people (e.g., wind level 12 for cyclone-resistant construction)
- Structural calculations based on the acceptable level of safety.
- Prepared solutions for catastrophic events (e.g., ‘strong box’ inside the house or disaster shelter within community).

A.2 Spatial Response to Functional Needs
- Meeting spatial demands of basic living needs: living, sleeping, cooking, eating, WC.
- Internal spatial organisation appropriate to the social life of inhabitants.

A.3 Design Response to Aesthetic Needs
- External building form responsive to local housing forms and/or existing housing patterns.
- Roof shape responds to social aspirations of local residents.
- Building decoration, if any, fits with local wishes and beliefs.

A.4 Cost-effective Construction & Renovation
- Maximised use of local materials and labour in construction.
- Consideration to future building repairs and renovations to ensure cost efficiency.

A.5 Environmental Sustainability
- Climatically responsive design strategies to minimise negative effects of local climate (e.g., the hot and humid climate in Central Vietnam).

B. Community Consultation
- Household level
- Community level

C. The Involvement of Built-Environment Professionals
- Technical support & training
- Field experience
- Working in a multidisciplinary team
A. Design Factors

A.1 Technical Safety

Technical safety of the house is always one of the first priorities for the design of disaster-resilient housing, since it helps protect people and property from future damage and loss. Designing safety measures for residential housing seems to be simple, but, in fact, requires a sensitive and comprehensive approach to not only ensure disaster safety but also respond to socio-economic and cultural backgrounds of the householders. The interviews of donor-built house owners revealed that many safety measures applied by the implementing agencies, even though satisfactory in terms of technical performance, were not widely used and replicated by people afterward due to their inappropriateness to local social beliefs and economic conditions. Therefore, the use of technical safety measures for a given group or community needs to be carefully managed with local residents, to ensure its responsiveness to their social, economic and cultural contexts.

This research indicates that achieving technical safety for low-income housing in Central Vietnam requires the house structure to be capable of withstanding common disasters (e.g. annual floods or storms) as well as avoiding or minimising unexpected damage and loss caused by catastrophic but uncommon events (e.g. Typhoon Xangsane in 2006, Ketsana in 2009 or Nari in 2013). However, the design of a very strong house that can resist catastrophic but uncommon events is economically impractical for low-income people, because the construction cost will surely exceed their financial capacity. Instead, it is essential to identify an acceptable level of safety for their housing that is not only technically safe but also financially responsive to the economic situation of low-income families. The findings on Design Principles for Resilience presented in Chapter 7 show that such acceptable levels of safety will consist of both preventive measures for common disasters and responsive measures for calamitous but uncommon events. In summary, this research frames the technical safety of disaster-resilient housing into the following aspects:

➔ Acceptable levels of safety for low-income housing

The study indicates that, for low-income housing in Central Vietnam, the wind level 12 on the Beaufort Scale (World Meteorological Organisation, 2012) is the most appropriate level of storm safety; while, for flood
protection, a water level higher than the annual average flood level of the region involved (dependent on the geographical conditions of each location) is the best option. These acceptable levels of safety for flood and storm resilience have been widely applied in recent post-disaster housing reconstruction projects in Central Vietnam, and have functioned quite effectively in recent climate events. For example, all storm-resistant houses provided by the ISET in 2012 in Da Nang with the building structure designed for the wind level 12 (on the Beaufort Scale) remained intact after the Typhoon Nari in 2013 (Phong, 2013).

**Prepared solutions for catastrophic events**

The design of disaster-resilient housing is also required to prepare solutions for disasters stronger than the acceptable levels of safety above (e.g. wind level 13 or above). For low-income people, this study recommends the use of low-cost measures to tackle such calamitous disasters, to avoid unexpected damage and loss, particularly human loss, while achieving economic efficiency. The case studies have introduced two solutions for catastrophic typhoons (exceeding the wind level 12) and historical floods. For coping with catastrophic typhoons such as the super Typhoon Haiyan in 2013, the use of a ‘strong box’ inside the house where family members can take refuge, or the construction of public storm shelters within the vulnerable/at-risk communities, are suggested. This ‘strong box’ can be built in the form of upgrading an existing room inside the house (e.g. bedroom, toilet or store) through adding strong elements (e.g. concrete beams and pillars) to its structure; while the public storm shelters can be built at the geographical centre of at-risk/vulnerable communities and used for communal cultural centres, schools, or other kinds of public buildings (e.g. administrative offices for local authorities) in normal times. In response to big floods, the use of family boats available at each household is recommended to evacuate family members and valuable assets to higher places nearby (e.g. multi-storey buildings).

A.2  Spatial Response to Functional Needs
In the design of disaster-resilient housing, meeting spatial demands of the specific living needs refers to the arrangement of functional rooms (e.g. family room, bedrooms, kitchen and toilet), the determination of their sizes (width, length and height), and their spatial relation through lobbies, ‘buffer’ spaces or corridors. These make meeting spatial needs different from satisfying aesthetic needs where the focus is to improve the external and internal appearance of the building. The spatial design of low-income disaster-resilient housing is also a challenge for architects and building designers because it may lead to user’s satisfaction or dissatisfaction regardless of there being perfect technical measures for disaster safety. Achieving a spatial response to actual living needs of low-income households requires architects or building designers to thoroughly understand their everyday life and how they use their houses for their common living activities before deciding the spatial layout of their housing. Namely, it is essential to address the following points:

➔ *Meeting the basic living needs* of a low-income family such as living, sleeping, kitchen and toilet, and to ensure the familiarity of the spatial layout with the family’s ways of living.

➔ *The spatial design of low-income disaster-resilient housing* is also required to provide the occupants or householders with a sense of familiarity, ownership, and empowerment. The case studies show that, in Central Vietnam, the cultural appropriateness of safe housing is only achieved once its spatial layout is responsive to the spiritual and social life of the family. Specifically, spiritual needs of households such as religious praying or ancestor worship spaces should be addressed in the spatial arrangement of their housing. For example, the construction of three-compartment houses in Loc Tri by the NGO DWF did satisfy households because the DWF houses offer a culturally appropriate living space, where the altar placed at the middle compartment is used for ancestor worship, while the two side compartments are used for daily living activities (e.g. sleeping, eating).

### A.3 Design Response to Aesthetic Needs

Although housing for low-income people is usually restricted in development due to financial shortages, the survey of low-income households in vulnerable areas of Central Vietnam has illustrated a relation between the aesthetics of safe houses
and user’s satisfaction. Specifically, building form, roof shape, and in some cases, building decorations, are often the biggest concerns for low-income households in terms of their aesthetic needs, when being interviewed. Therefore, the design of disaster-resilient housing needs to address:

- **The responsiveness of the external building form to local housing forms and/or existing housing patterns:** This condition can be achieved by using the same building form(s) as of local housing, or other building forms that are visually harmonious with the existing housing forms or patterns.

- **The responsiveness of the roof shape to social aspirations of local people:** This condition can be achieved by using the same roof shape(s) as of local houses, or other roof shape(s) visually harmonious with the existing roof shapes of local houses.

- **The responsiveness of building decorations, if any, to local wishes and beliefs:** This condition can be achieved by using the same decoration(s) of local houses, or other decorations that are not contradictory to the local social norms and people’s beliefs.

The respondents said that it is more likely to give households a sense of familiarity and ownership if the building form and roof shape of the house respond to the existing local housing forms or patterns. In their responses, site planning seemed to play a very limited or no role in satisfying their aesthetic needs towards their housing. There are some exemplary practical examples where new housing types different from local housing forms were unused or rejected by local people, even though those houses were securely reinforced for disaster resistance. As observed in the case of Ia Broai, the use of on-floor houses in an area dominated by on-stilt houses resulted in the former not being accepted by local people.

**A.4 Cost-effective Construction & Renovation**

Maximizing the utilization of local resources for housing construction is always one of the first priorities in selecting housing design options. This research indicates that, in Central Vietnam, using local materials and local labor, wherever and whenever possible, is crucial to achieving cost-effective construction and
renovation, one of the key factors for the success of low-income disaster-resilient housing. Specifically, the design of disaster-resilient housing needs to address the following points:

➔ **Using local materials and local labor:** It was found that using local materials can be in the form of using available materials that households have accumulated through the years, and/or using common types of local materials that are easily found in materials shops nearby. Meanwhile, using local labor refers to the engagement of family members in simple tasks (i.e. digging foundation holes, cleaning the site) if possible, and the use of local construction workers for other skilled works (i.e. beams and pillars formwork, wall plastering or roof installation). There are various ways of involving local labor between communities that architects or building designers are required to understand before delivering resilient-housing designs. In some places, using local labor is in the form of either hiring local masons (paid work) or borrowing workdays between households (unpaid work).

➔ **Cost-effective renovation:** The findings of this study also indicate a strong relationship between cost efficiency and future spatial extensions. Seven out of forty houses visited faced difficulties in extending their living spaces after initial construction because many parts of the existing house had to be demolished to leave space for expansion. Consequently, associated costs increased dramatically and exceeded the financial capacity of households. Therefore, resilient housing designs need to consider this issue from the beginning, to reduce the cost of future spatial extensions or renovations.

A.5 **Environmental Sustainability**

The survey of the post-disaster houses in Central Vietnam has revealed the importance of climatically responsive strategies to the improved living conditions of occupants. In Central Vietnam, disasters happen only for a short time, frequently from September to November, while adverse impacts of the hot-humid climate (e.g. heat, high humidity, dampness) are experienced throughout the year. Although these impacts have no direct effect on the resilience of the house against natural disasters, such impacts may badly affect the health of the occupants, who
are often the key actors for disaster response and preparedness in households. In addition, the high temperature and dampness inside the house generated by the climatically unresponsive designs may accelerate the deterioration process of building materials, reduce their load-bearing or disaster-resistant capacity, and shorten the building lifespan. Therefore, integrating design strategies that respond to the local climate is crucial for not only bringing climatic or human comfort but also for contributing to the long lifespan of the house.

B. The Value of Community Consultation

To achieve the five key design factors for disaster-resilient housing mentioned earlier, this study highlights the incorporation of community consultation into the design process to capture and share necessary information and knowledge for safe housing outcomes. It was found that community consultation is essentially conducted at the community and household levels to understand the grassroots status of an at-risk or vulnerable group(s), and their actual needs and expectations of housing, as well as to improve local awareness on disaster preparedness and safe construction.

This study has identified five key considerations for community consultation, and eight anticipated outcomes if these considerations are addressed in practice (see Table 8.3). Community meetings (CMs) and separate household interviews (SPHs) appear to be the two main forms of consultation to capture and share information and knowledge at the community and household levels, for developing resilient housing designs. It was noted that contents for CMs must be consistent with SPHs, to avoid gaps and overlaps and ensure information and data required for housing design development are sufficiently captured. In addition, participants for these CMs and SPHs are also importantly influential in the success of community consultation, and need to be clarified from the beginning to ensure a significant contribution or input of involved actors to the improved design of disaster-resilient housing. This study has identified four key participants for CMs, and two for SPHs, in which vulnerable households, local builders, and involved BEPs play a central role throughout the consultation process. In terms of the outcomes potentially achieved from community consultation, the study highlights the understanding of locally socio-economic and cultural contexts, the identification of local resources and constraints for practical construction,
people’s beliefs and/or biases towards housing, and actual living needs and associated spatial demands of vulnerable households. These anticipated outcomes are more likely to be achieved by community consultation if the five key considerations mentioned in Table 8.2 are carefully addressed in CMs and SPHs.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Anticipated Outcomes</th>
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<tbody>
<tr>
<td>Community meetings (CMs) are organized in two ways: indoor and outdoor; to</td>
<td>→ Agreements on budget scales, targeted groups, project goals, sources of materials</td>
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<tr>
<td>fully understand the local context at the community level and make initial</td>
<td>and labor, timeframes for design and construction, involved actors.</td>
</tr>
<tr>
<td>agreements for next steps.</td>
<td>→ Clarification of roles and responsibilities of involved actors.</td>
</tr>
<tr>
<td>Separate household interviews (SPHs) are necessarily combined with CM to</td>
<td>→ Local social aspirations, beliefs and/or biases towards housing.</td>
</tr>
<tr>
<td>capture household-level information for shaping design solutions.</td>
<td>→ Possible contributions of the community and vulnerable households to the</td>
</tr>
<tr>
<td></td>
<td>project (e.g. labor, materials, money, supportive mechanisms).</td>
</tr>
<tr>
<td>Contents of CMs and SPHs must be consistent with and supportive of the</td>
<td>→ Potential obstacles or difficulties faced in project planning and</td>
</tr>
<tr>
<td>outcome of housing design(s).</td>
<td>implementation.</td>
</tr>
<tr>
<td>Vulnerable households, BEPs or resource persons, local builders and</td>
<td>→ Socio-economic conditions, cultural and religious backgrounds of targeted groups,</td>
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<tr>
<td>commune/ward’s committees for flood and storm control, are the key</td>
<td>locally contextual issues concerning housing construction.</td>
</tr>
<tr>
<td>participants for CMs.</td>
<td></td>
</tr>
<tr>
<td>Vulnerable households and architects or building designers are the key</td>
<td>→ Functional and spatial needs of vulnerable households.</td>
</tr>
<tr>
<td>participants for SPHs.</td>
<td>→ Spiritual and cultural needs of vulnerable households.</td>
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</table>

**C. The Involvement of Built-Environment Professionals**

The survey of post-disaster housing in Central Vietnam also recognized a meaningful contribution of built-environment professionals (BEPs), particularly
architects and engineers, to improving the design of safe housing. Their contribution is diverse, and frequently ranges from introducing innovative or new ideas for disaster resilience, as seen in the case of Hoa Hiep Bac and Ia Broai, to improving local experience and construction techniques for better risk reduction, as observed in Loc Tri and Tan Ninh. Hence, this study considers the involvement of BEPs as a complementary part of the conceptual framework to ensure the achievement of all design factors for disaster-resilient housing addressed in the framework.

Architects, engineers and building designers who are responsible for designing disaster-resilient housing are, therefore, required to actively engage in the design process of housing, from consulting with the targeted group/community and external parties, to developing and finalizing suitable housing designs. Their engagement is not only to capture local information and data for housing design developments but also to update and share innovative or new knowledge and expertise on disaster preparedness and safe housing construction (see Considerations in Table 8.3). These considerations were, in fact, derived from the survey of post-disaster housing in Central Vietnam, with the support of qualitative discussions and interviews with local architects and engineers who were used to engage in post-disaster housing reconstruction and develop design options for resilient housing.

It was also found that the role of BEPs in developing disaster-resilient housing is extended to working with local construction teams and/or hired contractors, to ensure a proper translation of resilient housing designs into practical construction. The professional engagement of BEPs is clearly seen through their technical assessment of local housing against disaster preparedness and basic living standards, their identification of local constraints and resources for construction, and their delivery of architectural and technical drawings of disaster-resilient housing and construction monitoring plans (see Anticipated Outcomes in Table 8.3).
Table 8.3: Key Considerations and Anticipated Outcomes concerning The Role of BEPs

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Anticipated Outcomes</th>
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<tr>
<td>Ensuring the consistency of contents between CMs and SPHs.</td>
<td>→ Assessments of the local housing against disaster safety, living standards and housing development.</td>
</tr>
<tr>
<td>Being the facilitator or part of the facilitating team in CMs and SPHs.</td>
<td>→ Assessments of possible local constraints on and contributions to housing construction.</td>
</tr>
<tr>
<td>Collecting all information on local disasters, local experiences on housing construction, local resources, and constraints for safe housing development.</td>
<td>→ Architectural plans including site plan, floor plan(s), elevations, sections, and details.</td>
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<tr>
<td>Sharing new knowledge and expertise on DRR and disaster-resilient construction.</td>
<td>→ Engineering drawings including structural and technical plans for on-site construction.</td>
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<td>Acquiring relevant permits for on-site construction if required.</td>
<td>→ Planning and building permits</td>
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<tr>
<td>Working with the construction team to properly transfer the design into practice.</td>
<td>→ A timeframe and a monitoring or supervision plan for actual construction.</td>
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<td>Supervising construction, checking and taking over the completed houses.</td>
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**Linkages within the Conceptual Framework**

The above discussion on the *conceptual framework* for disaster-resilient housing has outlined a strong link between the five key design factors for disaster-resilient housing mentioned in Section A, community consultation (Section B), and the engagement of BEPs (Section C). Information exchange and knowledge sharing through community meetings and separate household interviews, and the proper engagement of BEPs, particularly architects and engineers, in the design process, have a critical influence on the attainment of five key design factors for disaster-resilient housing. For example, to achieve the cost efficiency of safe housing construction, a design factor of disaster-resilient housing, it is necessary to consult with the target group and households to capture their economic situation, what
contribution they can make, and what design options suit their financial capacity. On the other hand, to ensure the technical safety for the house (another design factor of disaster-resilient housing), BEPs need to thoroughly understand common and uncommon disasters impacting on local housing, which parts of local houses are commonly destroyed, what local construction techniques can do in response to such hazards, and what level of safety is economically suitable for the target groups/households. Hence, to achieve the outcome of disaster-resilient housing, it is essential for involved actors, particularly responsible architects and building designers, to have a balanced consideration of all five design factors mentioned in Section A in the light of community consultation (Section B) and the involvement of BEPs (Section C).

8.4 Operational Framework for Disaster-Resilient Housing

The **conceptual framework** for disaster-resilient housing discussed in the last section has outlined five key design factors for disaster-resilient low-income housing, and highlighted the necessity to incorporate community consultation and BEPs’ inputs into the design process. As presented in the **conceptual framework**, five key design factors for disaster-resilient low-income housing comprise (i) technical safety, (ii) spatial response to functional needs, (iii) design response to aesthetic needs, (iv) cost effective construction and renovation, and (v) environmental sustainability. To achieve these design factors in practice, it is crucial to have principles and guidelines to guide and shape resilient housing design options. Such principles and guidelines are provided in the **operational framework** developed in this section. This functions as the second part of the framework for disaster-resilient low-income housing in Central Vietnam (Figure 8.2).

The **operational framework** is, in fact, the synthesis of the findings of the research, in which important stages of the design process for DRH within the context of Central Vietnam are identified through the fieldwork done in this region, supported by the literature review. Such stages comprise (I) community consultation, (II) site planning, (III) building design, (IV) construction, and (V) post-occupancy evaluation. These are the sequential steps of designing DRH that are considered as the core components of the **operational framework**. These components can enable the translation of the findings of this research into real-
world practice, and support the establishment of a checklist where principles and
guidelines for designing disaster-resilient low-income housing within Central
Vietnam are provided (see Appendix E).
Figure 8.2: Operational Framework for Disaster-Resilient Housing within Central Vietnam

**STEP 1: Community Consultation**
- Consultation required for decision making.
- Community meetings (CMs) and separate household interviews (SPHs) are the two main forms of consultation to capture and share information and knowledge between actors.
- Contents between CMs and SPHs must be consistent and supportive to housing design outcomes.
- Vulnerable communities and households should be placed at the centre.

**STEP 2: Site Planning**
- Site planning and settlement patterns responsive to main natural hazards faced.
- Consideration to building disaster shelters within the community for evacuation in case of calamitous events.
- Consideration for open and green spaces within the community.

**STEP 3: Building Design**
- Structural stability for common disasters.
- Consideration of alternative solutions in case of calamitous events.
- Meeting spatial demands of basic living needs.
- Meeting aesthetic needs of inhabitants.
- Environmental sustainability.
- Cost-effective construction and renovation.

**STEP 4: Construction**
- Ensuring a good construction quality within the estimated cost and timeframe.
- Unexpected changes in construction need to be consulted on with responsible designers and end-users before decision.
- Environmental sustainability.
- Cost-effective construction and renovation.

**STEP 5: Post-Occupancy Evaluation**
- Assessment of the physical status of the house after a period of use (e.g. durability and stability of structural elements).
- Assessment of spatial and structural changes and/or additions to the original house.
- Key lessons learnt for future housing designs.
I. **STEP 1: Community Consultation**

The checklist presented in Table 8.4 has provided housing implementers and building designers, especially architects and engineers, with guidelines on how to conduct community meetings and separate household interviews properly in the consultation process. However, it should be noted that the success of community consultation is also dependent on other issues generated from the real situation of each case that need to be clarified in specific matters, as follows:

- Which forms of consultative discussion (community meetings or separate household interviews) to be used, who are required to be involved, when it is implemented (before, during or after the design phases), and what contents or issues need to be captured and shared. These aspects were already mentioned in Chapter 5 on the theme of community consultation.

- Examining the design process of post-disaster housing in Central Vietnam has found that the housing design process commonly experiences two main stages: *conceptual* and *technical*. The *conceptual* design is used to generate design ideas, building forms, preliminary spatial organizations, overall principles for disaster reduction, and cost estimation; while the *technical* design is for finalizing these design aspects into working drawings for on-site construction. Therefore, these two design phases (*conceptual* and *technical*) should be integrated with CMs and SPHs to ensure that the design of disaster-resilient housing is responsive to the living needs and housing aspirations of the occupants and appropriate to the local context. CMs are frequently organized before and after the *conceptual design*, while SPHs are usually carried out before and after the *technical design* (Figure 8.3).
Within the context of Central Vietnam, to enable effective community consultation, two requirements need to be met in implementation:

- **The use of experienced or professional persons to facilitate community consultation**: The facilitator could be either an architect who is academically trained for building design or a resource person who is not academically educated but possesses much field experience. Sometimes, these two players (architect, resource person) can work together in organizing and facilitating community consultation.

- **The determination of suitable times to conduct CMs and SPHs**: During the design process of housing, there are always some stages that require more
information or data to improve the design, and building designers need to be aware of this fact to decide an appropriate time to consult with relevant parties/stakeholders. It could be one, two or more times for CMs and SPHs, dependent on the specifics of each case, and the amount of information and data required for next steps and other context-specific aspects.

- The effective use of community and household feedback in housing design and construction: The limited use of community feedback in implementation has been widely known as one of the main causes of unsuccessful housing products (see Ganapati & Ganapati, 2009; Innes & Booher, 2004), and this is clear from the case studies of this research. Therefore, an adequate and proper use of community feedback in the design of disaster-resilient housing is essential, alongside the employment of experienced facilitators and the determination of suitable times for conducting community meetings and separate household interviews.

II. STEP 2: Site Planning

There are three key considerations derived from this study that the site planning of disaster-resilient housing need to consider, to reduce disaster impacts on individual buildings at the settlement planning stage:

- The identification of a suitable settlement pattern that is responsive to the main or common hazards faced by the targeted group or community: In cyclone-affected areas, the non-parallel or zigzag arrangement of individual houses should be applied, to split wind flows and thus reduce wind forces on each building within the settlement. In flood-drainage zones, it is essential to consider room or space for water and unblocked or unimpeded waterways.

- The construction of public disaster shelters at the geographical centre of vulnerable groups or communities: These shelters are the evacuation places for people during disasters. These shelters could be either existing public buildings such as schools or administrative buildings nearby, or newly constructed buildings for disaster risk management purposes.
- *The provision of open and green spaces for the urbanizing areas:* Rapid urbanization and increasing housing needs may reduce the greenery area and public open spaces if no attention is paid to this issue. Identifying the area of public green and open spaces should be based on the current planning and construction regulations, the geographical conditions of the region involved, and the socio-economic and cultural backgrounds of the community.

### III. **STEP 3: Building Design**

Designing individual houses that are resilient to natural disasters and responsive to local social, economic and cultural conditions is one of the most important tasks to enhance the resilience of low-income households and communities. Architects and building designers who are responsible for or directly involved in designing disaster-resilient housing within Central Vietnam are required to address the five key design factors in the conceptual framework (Section 8.2): (1) the technical safety of the house, (2) the spatial response to functional living needs of the householders, (3) the design response to the householders’ aesthetic needs, (4) the cost efficiency of building construction and renovation, and (5) the environmental sustainability. Namely, it is necessary to address the following points:

- **Providing spatially sufficient and technically safe living spaces for low-income households in harmony with their socio-economic and cultural conditions:** In the housing law promulgated by the National Assembly in 2005, housing for low-income people is classified in the group of social housing where the required minimum floor area per house is 30 square metres (Vietnam’s National Assembly, 2005). Hence, this standard should be followed in proposed design options for low-income disaster-resilient housing within Central Vietnam.

- **Meeting the basic living needs of low-income households:** This study has indicated three basic living needs of low-income families in Central Vietnam: living, sleeping, and kitchen & toilet. These three living needs were clearly observed in almost all the low-income families surveyed by this study, and seemingly did satisfy the householders when being asked.
In the survey of some donor-built post-disaster houses, there were some problems regarding spatial design that make the occupants unsatisfied, such as the absence of some living functions inside their house (e.g. no cooking area, no toilet). It was also found that there appears to be an order in the spatial arrangement of these three living functions in which the living is commonly at the front while the sleeping and kitchen & toilet are placed in the middle and at the back of the house.

- *Meeting the aesthetic needs of low-income households*: Consulting with the householders to address their housing aspirations, cultural perspectives and associated aesthetic needs, in housing designs, is important to ensure user satisfaction. This study shows that the aesthetics of disaster-resilient low-income housing in Central Vietnam is likely to be satisfactory if the building form harmonises with the existing local housing forms or patterns, the roof shape responds to the aspirations of the occupants, and the building decorations (if any) fit with local wishes and beliefs, as illustrated in Figure 8.4.

![Figure 8.4: Three aspects of aesthetic response for disaster-resilient housing](image)

- *Responding to the local climate*: Based on the survey of the real houses in Central Vietnam and the review of tropical hot-humid architecture literature (e.g. Heerwagen, 2004; Lomas, 2006), two key design strategies for the hot-humid climate are identified: (i) the prevention of direct sunlight (capturing indirect sunlight) for internal living spaces of the house; and (ii) the intensification of natural cross ventilation inside the house. The first strategy helps lighten internal living spaces with a
comfortable natural light (indirect sunlight), and the second one contributes to the reduction of heat and dampness inside the house in sunny and rainy seasons. Specifically, the housing design needs to address eight climate responsive strategies (strategy 1-8) within the two main aspects (I and II), as follows:

- **ASPECT I: Preventive direct sunlight (capturing indirect sunlight)**
  - Strategy 1: Use semi-open spaces to create a ‘buffer zone’ between the inside and outside of the house.
  - Strategy 2: Use sun-shading devices for openings to prevent direct sunlight.
  - Strategy 3: Use shade-providing trees on the eastern and western sides.
  - Strategy 4: Use the obscured glass for roof windows.

- **ASPECT II: Intensify natural cross ventilation**
  - Strategy 5: Use on-wall openings to the outside.
  - Strategy 6: Use on-roof openings.
  - Strategy 7: Use a court yard.
  - Strategy 8: Facing the house towards the southeast direction.

(Details of these strategies are provided in Appendix F)

- **Cost-efficient construction:** The use of local materials and labor is crucial to avoid the import of new materials and labor outside the community, reduce associated costs, and create more jobs for locals. In addition, the use of local workers in housing construction also helps to improve local awareness on disaster preparedness, and gives them a sense of ownership and empowerment, one of the key successes of the disaster-resilient housing.

- **Cost-efficient spatial extension:** As mentioned, the cost efficiency of disaster-resilient housing is also closely linked to future spatial extensions, in which appropriate design of the house from the beginning may lead to low cost of spatial extension(s) later. Therefore, resilient housing designs need to determine a proper position of the house on the land and a suitable spatial arrangement of functional living rooms, so that future spatial extensions are not blocked or impeded by the existing house structure.
(Figure 8.5). These considerations should be addressed in the original design of the house through either instructive drawings or written guidelines, wherever applicable.

- **Cost-efficient building maintenance:** Building maintenance includes the repair and replacement of downgraded or damaged building parts and elements. To ensure cost efficiency, it is necessary to maximize the use of local materials and labor for all repair or replacement works, to reduce maintenance cost. To achieve this condition, it requires the original or initial design of the house to maximize the use of local materials and labor in the proposed design options.

**IV. STEP 4: Construction**

The examination of post-disaster housing in Central Vietnam also informs several considerations for the actual construction of disaster-resilient housing. In particular, the practical construction of disaster-resilient housing needs to address the following points:
- **Conforming to the original architectural design(s):** It is suggested that the on-site construction must follow the original architectural design(s). If one or more parts of the house need to be adjusted or changed during construction and are different from the original design(s), these must be carefully examined and agreed by responsible parties (commonly the building designer, the owner of the house and the builder).

- **Ensuring the construction quality:** The construction of disaster-resilient housing is also required to ensure a good construction quality in accordance with the requirements of the original design(s). In addition, the actual period of construction is also needed to fit with the timeframe or the construction plan set from the beginning.

V. **STEP 5: Post-occupancy Evaluation**

For various reasons, frequently the shortage of resources and supportive mechanisms, post-occupancy evaluation is often less considered or even neglected in safe housing construction projects in Central Vietnam. Most projects were ended right after the handover of safe houses to beneficiary households. However, the survey of post-disaster houses after a certain period of use (5 to 10 years after initial construction, as seen in the study areas) has shown the necessity of conducting a post-occupancy evaluation to derive lessons to be learned for future housing implementations. In reality, there is always a difference between the current house and its original form built from the beginning. This difference is commonly seen through the spatial extension of the original house and/or the repair or replacement of some building parts (e.g. walls, roof, doors or windows) and/or structural elements (e.g. beams or pillars). These changes are commonly made by homeowners without technical instruction or advice from professionals and experts in terms of disaster preparedness, and therefore potentially produce new risks to future disasters. Thus, post-occupancy evaluation is necessary to avoid this problem, and needs to address the following points:

- **The participation of two key actors,** end-users (householders) and building designers (architects and/or engineers and/or resource persons), in the post-occupancy evaluation. These two actors are often the key persons to
decide the design and construction of the house and, therefore, the best persons to understand strengths and weaknesses of the existing house.

- A full assessment of post-occupancy problems or matters related to disaster preparedness, living standards, changing needs, and housing aspirations, to derive key lessons learned for future housing interventions.

8.5 Who will use the Framework?

Based on the conceptual and operational framework presented above, a wide range of stakeholders are involved in the design, construction, and management of disaster-resilient housing. In specific, four groups of stakeholders are likely to benefit from the framework: (1) government authorities, (2) non-governmental organizations, (3) built-environment professionals, and (4) at-risk communities, as described in Table 8.4.

Table 8.4: Key stakeholders potentially benefiting from the framework

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Guidance</th>
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| Governments/Authorities       | • This stakeholder often plays a leading role in planning and implementing actions for disaster response and recovery at regional and local levels. Especially, the People’s Committees of provinces/cities, districts, and communes/wards function quite effectively in mobilizing local and external resources for coping with and recovering from disasters.  
• In terms of housing, their roles are commonly seen through managing local construction practices by building permits (for urban areas), reminding people to reinforce their homes (e.g. putting sandbags on roof), evacuating people living in extremely unsafe houses, preparing safe places for evacuation for emergencies, and calling for external help for post-disaster housing recovery and reconstruction.  
• The framework is useful for this group to better understand what the issues are for developing disaster-resilient housing, who are necessarily involved, which design criteria are appropriate, and what local resources are needed to deliver proper decisions, policies, and administrative or supportive mechanisms for managing and supporting local housing development. |
| Non-Governmental Organizations (NGOs) | • This stakeholder is increasingly becoming one of the key actors in disaster risk reduction and housing vulnerability reduction in Central Vietnam.  
• Post-disaster housing reconstruction in recent years has seen a significant engagement of NGOs, such as Development Workshop France, Red Cross, Save The Children or Habitat for Humanity, who often play the role as donor representatives, technical consultants and/or leading implementers.  
• The framework provides them with a comprehensive vision for disaster-resilient housing, what factors need to be focused on, and how to implement the construction in practice. Accordingly, a checklist for the outcome of disaster-resilient housing designs is provided in the *operational framework* to assist them in generating and shaping resilient housing design options. |
| Built-Environment Professionals (BEPs) | • Built-environment professionals include planners, architects, engineers and surveyors who are involved in or responsible for the design and construction of disaster-resilient housing.  
• In the context of Central Vietnam, architects and engineers appear to show their dominant roles in safe housing development, while planners and surveyors demonstrate a very limited or no contribution.  
• The outcome of the framework for disaster-resilient housing is particularly meaningful for architects and engineers, to guide them in planning a design project for safe housing, organizing consultative discussions with at-risk communities and external parties, and generating and shaping design measures for disaster-resilient housing.  
• Design concepts, principles, and guidelines on safe and resilient housing given in the framework will be a useful practical reference guide for architects and engineers to underpin their active engagement in future safe housing projects in Central Vietnam, especially for low-income people. |
At-risk Communities

- The most important actors that can benefit from the framework for disaster-resilient housing is at-risk communities who are currently living in disaster-prone areas of Central Vietnam, especially local builders and vulnerable households who are directly involved in local housing construction.

- The concept of disaster-resilient housing, what factors decide the success of safe housing, and practical instructions and guidelines for building safe houses, given in the framework, will improve their understanding of the importance of disaster-resilient construction, what resources are needed for implementation, the way to achieve a disaster-resilient house with limited financial capacity, and other locally social or institutional constraints.

- However, in most cases, it is important to have someone or an intermediate party to convey the meaning of the framework to this group, because some professional and technical terms used in the framework may restrict their full understanding.

Informing Educational Curriculum at Universities

- The framework for disaster-resilient housing could also inform educational curriculum at universities that currently have training programs for BEPs.

- Presently, issues of disaster risk reduction and safe housing development are still addressed in a limited way or even neglected in training programs for BEPs in Vietnamese universities, while needs for BEPs’ engagement are anticipated to increase in the future to assist local construction practices in better coping with natural disaster.

- Therefore, the framework for disaster-resilient housing presented in this chapter can be a useful learning material for architecture and construction students in Vietnamese universities, to equip them with basic and advanced knowledge for their future professional practice on safe and resilient housing.

8.6 Conclusion

This chapter has provided a comprehensive framework for disaster-resilient housing within the region of Central Vietnam. This framework consists of two main parts, the conceptual framework, and the operational framework; and provides an in-depth understanding of the meaning of disaster-resilient housing and how to develop design options for disaster-resilient housing in practice.

In the conceptual framework, five key design factors for disaster-resilient housing, in line with the methods of community consultation and BEPs’ involvement, are provided, based on the main research findings presented in the previous chapters.
The five design factors comprise (1) technical safety, (2) spatial response to functional needs, (3) design response to aesthetic needs, (4) cost-effective construction and renovation, and (5) environmental sustainability. In the current housing literature, these design factors and issues of community consultation and BEP’s engagement appear to be addressed separately in different publications, without considering their relationship and interdependency specifically. In Central Vietnam, this problem is exacerbated since the link between these design factors, community consultation and the role of BEPs has been not examined sufficiently, or is even neglected in recent studies. Therefore, the outcome of the conceptual framework, with the five key design factors for disaster-resilient housing and specific methods of community consultation and BEPs’ engagement, is a meaningful contribution to filling this gap.

In the operational framework, the provision of five key stages, along with practical instructions and guidelines for the design of disaster-resilient housing, is a useful guidance to support and shape future design practices on safe and resilient housing in Central Vietnam. The five key stages comprise (I) community consultation, (II) site planning, (III) building design, (IV) construction, and (V) post-occupancy evaluation; each of which comprises key instructions for practical implementation. In the aftermath of a disaster, where chaotic and disordered situations caused by the disaster are likely to result in limited or no attention to other aspects of housing (e.g. social and cultural appropriateness), this operational framework plays a meaningful role in guiding the planning and implementation of post-disaster housing recovery and reconstruction, to avoid such neglect. Recent design guidelines for safe housing (i.e. handbooks given by UNEP and SCAT (2007) or Jha et al. (2010)) are still generic, and mainly focus on general principles and instructions. For the specific context of each region, such as Central Vietnam, there appears to be an absence of specific or detailed guidelines to assist architects or building designers in delivering resilient design options for housing, particularly for low-income people. Ahmed (2011), through an intensive review of post-disaster housing literature, has concluded that it is crucial to involve integrated or comprehensive models or frameworks to tackle safe housing issues. Within this sense, the framework presented in this chapter has provided an overall vision and a practical guidance for the improved resilience of low-income housing in the disaster-prone areas of Central Vietnam.
It can be inferred from this chapter that there is a strong link between the conceptual and operational framework, to the extent that the achievement of the operational framework is dependent on the conceptual framework and vice versa. For example, the key considerations and anticipated outcomes addressed in the operational framework are primarily derived from the design factors for disaster-resilient housing identified in the conceptual framework through community consultation and the involvement of BEPs; or, the conceptual framework for disaster-resilient housing is only achieved once the key stages of the operational framework are strictly followed in implementation. The relationship and interaction between the conceptual and operational framework, therefore, establishes the Framework for disaster-resilient low-income housing within Central Vietnam, based on which, design ideas and solutions for low-income disaster-resilient housing can be generated and shaped.

This chapter also identified four key stakeholders who can benefit from the framework for disaster-resilient housing: (1) government authorities, (2) non-governmental organizations, (3) built-environment professionals, and (4) at-risk communities. These four stakeholders are currently the most active actors in disaster preparedness and safe housing development in Central Vietnam. Each of these has a certain role in the course of disaster management and safe housing construction and, therefore, uses the framework in different ways to reach the ultimate goal of enhancing the resilience of local housing and settlements. Some of them may also interact and work together in the same manner to ensure the best outcome of disaster-resilient housing.
Chapter 9: Conclusion

9.1 Introduction

As presented in Chapter 1 (Introduction), this thesis aims to answer the following overall research question:

What are the appropriate forms of disaster-resilient housing for disaster-prone areas of Central Vietnam?

This question was first generated from the author’s working experiences in the field of post-disaster housing reconstruction in Central Vietnam, and subsequently, consolidated by the findings from the literature review (Chapter 2). In Central Vietnam, the concept of ‘disaster-resilient housing’ is still perceived in a limited way, and tends to be viewed as ‘safe housing’ where physical improvements for safety purposes are the focus. Searching for a comprehensive solution to housing vulnerability reduction, as presented in this thesis, is a requisite for shortening this gap in the literature and in practice. In this sense, the thesis has identified three core components that underpin the development of disaster-resilient housing, and established a framework to inform and shape future design practices for safe housing in the region.

In current housing research, the issue of disaster resilience is not often mentioned, although the concept of resilience has been extensively examined in recent disaster-risk-management studies (e.g. Boon et al., 2012; Tyler & Moench, 2012; Keating et al., 2014). Disaster resilience is still a new notion in the current housing research community, and the clarification of which aspects or components represent this notion and decide its formation and development is still problematic. In Central Vietnam, this gap is widened since there appear to be no studies done on disaster-resilient housing so far. Hence, the study on disaster-resilient housing based in this region, as presented in this thesis, is a valuable contribution to filling this gap. Three key components identified by this thesis that are crucial for developing disaster-resilient housing in Central Vietnam are:

- community participation, consultation and communication (i),
- the role of built-environment professionals (ii), and
- design principles for disaster-resilient housing (iii).
These components become the key themes of this thesis, which were identified in the literature review (Chapter 2) and the field investigation of four case studies based in Central Vietnam: Hoa Hiep Bac, Loc Tri, Ia Broai, and Tan Ninh (Chapters 4, 5, 6 and 7). These case studies comprise similar and different characteristics that represent the natural and social conditions of the wider region of Central Vietnam. The investigation of safe housing provision there, as presented in this thesis, has provided in-depth insights, which offer a reliable database for future planning, design, and construction of disaster-resilient housing in this region. This chapter synthesizes and interprets the findings of this study, as given in Chapters 5, 6 and 7, as well as developing recommendations for future research on housing and disaster risk reduction in Central Vietnam.

Emerging from the literature review (Chapter 2) and the case studies investigation (Chapters 5, 6 and 7) are the following five key observations (see a – e below) that link post-disaster housing and the potential to build a resilient housing system. Post-disaster housing reconstruction plays a significant role in the development of communities because it helps to improve pre-disaster fragile conditions, lessen future damage and loss brought by disasters, and maintain people’s common ways of living. In fact, this link has been increasingly mentioned in the literature (e.g. Acher & Boonyabancha, 2011; Keating et al., 2014; Davis, 2011) but not adequately addressed in practice, especially in the region of Central Vietnam where safe housing interventions are still narrowed to response and recovery rather than identifying opportunities for long-term development. The five key observations that show the link between reconstruction efforts and the possibility of building a resilient housing system are:

a) The physical design of the house;
b) The difference between local (self-built) and new (donor-built) methods of construction introduced by implementing agencies;
c) The sharing of information between actors towards safe housing improvements;
d) The input of built-environment professionals;
e) The satisfaction of users (households) towards their improved homes.
9.1.1 Three core components for housing-resilience improvements

Among a variety of concepts of ‘resilience’ given by many authors cited in Chapter 2 is a perception that highlights the importance of disaster risk reduction to the long-term development of groups and communities exposed to disasters (e.g. Davis, 2011; Keating et al., 2014). This perception is close to the core aim of this research, where identifying the potential to build a resilient housing system through examining post-disaster housing interventions is the central target. The present thesis argues that strategies for reaching this target need to consider three different but interrelated aspects:

✓ **Regular and mutual consultation and communication between vulnerable groups and in-field professional/governance parties;**

✓ **Technical support from BEPs for designing resilient housing;**

✓ **Strategic design interventions to improve housing conditions physically and socially.**

These three aspects are closely linked with the five observations mentioned above, and became the backbone of this study, underpinning the conduct of the literature review and case study investigation. Regular consultations and mutual ways of communication have shown their significance to the improved flow and sharing of information between vulnerable groups and external parties whose knowledge, experience and expertise can support better risk reduction. In the surveyed communities, one-way communications and one-off consultations show their strong influence on the limited sharing of information and knowledge between actors, and restrict the dissemination of innovative concepts or ideas on resilient housing to the wider public. BEPs engagement, particularly the support from architects, is integral to the implementation of such consultation and communication, the incorporation of innovative ideas in disaster preparedness, and the balanced use of local and new knowledge in promoting resilient housing. Strategic design interventions for resilient housing are, in fact, the outputs of shared learning dialogues between vulnerable groups and in-field professionals, which are mainly in the form of tangible construction measures in practice. From this perspective, the three key themes of this thesis mentioned earlier (i, ii, iii) have emerged and function as the core components of developing disaster-resilient housing in Central Vietnam.
9.1.2 The framework as a practical guide for developing disaster-resilient housing

The output of a framework for disaster-resilient low-income housing, as presented in Chapter 8, provides a comprehensive vision for the design-related aspects of low-income housing in disaster-prone areas of Central Vietnam and other similar regions in the Asia Pacific. This framework is the synthesis of the key empirical findings of this study relating to design problems of safe housing in this region, and contains six core components, namely (1) resilience as the central focus, (2) consultation for decision making, (3) settlement planning, (4) housing design, (5) construction implementation, and (6) post-occupancy management and lessons learnt. Each of these components comprises the key considerations and recommendations for implementers in seeking appropriate housing forms against natural disasters (see more details in Chapter 8). The most important part of this framework is the focus on disaster resilience, and the vision of this term in a broader lens where building ‘responsive and adaptive’ rather than ‘predictive and preventive’ capacities for residential housing is highlighted. This framework functions as a practical reference guide for all actors involved in the field of housing and disaster management in Central Vietnam, especially architects and engineers, in finding the best housing design options.

This chapter consists of three main sections. The first section interprets the findings of the study regarding each of the core themes above. The second section presents the theoretical and policy implications derived from the study; and the third section mentions the limitation of the study and provides recommendations for future research in the field of housing and disaster risk management.

9.2 Findings and Interpretations

The main empirical findings of the study are presented in Chapters 5, 6 and 7 in response to the three research themes of this thesis, as following:

✓ **Theme 1**: Community consultation and communication;
✓ **Theme 2**: The role of built-environment professionals;
✓ **Theme 3**: Design principles for resilience.

The findings within each theme are also the answers found from this study in response to each of the three research questions generated from the main research question, as shown in Table 9.1. Namely, this study has identified:
 ✓ two key forms of community consultation (*community meetings, separate household interviews*),
 ✓ four key actors (*vulnerable households, local construction workers, BEPs, local committees for disaster management*),
 ✓ three underlying supportive mechanisms for shared learning dialogues (*technical, financial, legal*),
 ✓ the importance of BEPs’ engagement and their potential roles, and
 ✓ three strategic design responses (*safety considerations along with climate responsiveness, cost-effective strategies, spatial solutions for cultural appropriateness*).

**Table 9.1: The link between research questions, research themes, and research findings**

<table>
<thead>
<tr>
<th>Main Research Question</th>
<th>What are the appropriate forms of disaster-resilient housing for disaster-prone areas of Central Vietnam?</th>
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</thead>
<tbody>
<tr>
<td><strong>Sub Research Question</strong></td>
<td><strong>Research Theme</strong></td>
</tr>
<tr>
<td><strong>Question 1:</strong> What are the appropriate forms of community consultation and communication for disaster-resilient housing promotion?</td>
<td><strong>Theme 1:</strong> Community consultation and communication</td>
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<tr>
<td><strong>Question 2:</strong> How can built-environment professionals assist the development of disaster-resilient housing?</td>
<td><strong>Theme 2:</strong> The role of built-environment professionals (BEPs)</td>
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Architects play a significant role in developing disaster-resilient housing

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<tr>
<th>Question 3: What are appropriate design responses for disaster-resilient housing?</th>
<th>Theme 3: Design principles for resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety considerations need to be considered with a climate responsive design</td>
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<tr>
<td>Acceptable levels of safety, maximized use of local resources, and designs for low-cost building operation, maintenance and future housing extension, as the key strategies for cost-effective housing</td>
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<td>Spatial solutions for cultural appropriateness of disaster-resilient housing</td>
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9.2.1 THEME 1: Community Consultation and Communication

This section presents the interpretation of the findings in response to the first research question (Question 1 in Table 9.1). The most significant finding of the study relating to this theme is the identification of four forms of consultation and communication, four key stakeholders involved, and three supportive mechanisms, which are not sufficiently addressed or even not mentioned in the current literature. Community meetings and separate household interviews have been found to be the two effective interdependent forms of consultation; while informal local sharing dialogues and broadcasting are found to be complementary ways of communication that significantly assist information sharing for the design of disaster-resilient housing. Previous studies tend to highlight the importance of communication and consultation for disaster risk management, but still lack detailed considerations for formulating and shaping the way of reaching effective consultative discussions in practice.

The sharing of information and knowledge between relevant stakeholders, in the form of community meetings and separate household interviews on a regular basis, has been highlighted by this study as one of the core aspects of successful housing implementation. In disaster-affected communities of Central Vietnam, housing construction is still performed by people without support from external parties (i.e. local architects or engineers), and commonly lacks safety-related measures and design strategies for the longer term. The survey of both donor-built and self-built housing has emphasized the need for the involvement of external
parties in decision making and consultation processes, to meet design imperatives posed for safe and resilient housing.

**Finding One: Community meetings and separate household interviews are the most appropriate form of consultation to tackle design problems of disaster-resilient low-income housing**

The study argues that designing disaster-resilient housing demands the capture of sufficient information between stakeholders through appropriate forms of consultation and communication. In disaster-prone areas of Central Vietnam, stakeholder consultation is frequently not found in the formation of housing for low-income people, due to socio-economic constraints, limited governance, and lack of supportive mechanisms for mutual communication. The survey of local housing construction there sees the absence of consultative discussions and shared learning dialogues in the formation and development of design ideas and the selection of construction methods.

The survey of donor-built housing has identified two forms of consultation that can be useful for decision-making in the design process of safe and resilient housing: *community meetings* and *separate household interviews*. In the surveyed communities, these forms of consultation were implemented to different degrees, which is closely linked to the effectiveness of the housing outcomes. *Information sharing* and *full participation* are the two forms of community consultation that strongly influence housing design outcomes and user satisfaction later. Specifically, *information sharing*, in which people were invited to listen to announcements and give answers to questions, shows limited support to the success of safe housing designs compared to *full participation*, where people are encouraged to discuss the housing solutions. The more active the participation of vulnerable groups in *community meetings* and *separate household interviews*, the more successful the housing solutions will be.

In the reality of Central Vietnam, *community meetings* are the most common ways of local discussion and dialogue to share information between community members (households, village heads, local authorities, and mass organizations) and collaboratively find solution(s) for a given issue or problem. Such *community meetings* are frequently organized by local authorities, community-based
organizations, or village/quarter heads, and usually focus on general socio-economic issues of a group or the whole community. In terms of safe housing improvement, this form of consultation appears to be missing in planning and implementation, except for some recent reconstruction projects funded by outsiders (donors) that applied this consultation form in seeking design options.

The findings of the study regarding community meetings presented in Chapter 5 have identified the importance and necessity of this form of discussion to contextualize the issue of safe housing construction at a broader scale, for the design of disaster-resilient housing later. In particular, community meetings should be conducted from the beginning phase of housing design, with the participation of all stakeholders involved to contextualize the issue of safe housing and identify opportunities and challenges for housing design and construction interventions. This form of consultation is also needed at the middle stages of the design, to capture further opinions and feedback from stakeholders towards initial design concepts and ideas, before finalizing them into working drawings for construction.

Separate household interviews are a complementary form of consultation to the above community meetings, to assist the identification of design solutions for disaster-resilient housing. Similar to community meetings, separate household interviews are also familiar to most people in Central Vietnam, since they used to join similar talks in the past through aid or humanitarian projects. These are focused discussions between vulnerable/at-risk households and in-field professionals or technicians (i.e. designers, architects, DRR resource persons), to search for spatial, functional and technical measures for safe housing based on household needs and capacity, captured from these discussions. Separate household interviews need to be organized based on community meetings; and information shared in both forms of consultation must be consistent and mutually reinforcing in the establishment of design solutions for disaster-resilient housing.

Finding Two: Vulnerable households, local construction workers, built-environment professionals (BEPs), local committees for disaster management (CFSCs), and NGOs are the key actors in building safe and resilient housing

In Central Vietnam, housing construction for low-income groups often sees the dominant engagement of two actors: households and local construction workers.
They work closely in the selection of housing design(s) and construction methods, namely: building form and spatial layouts of the house are frequently decided by households; while construction techniques are suggested by construction workers. However, the findings of this study indicate that, in disaster-affected areas, the engagement of these two actors is not enough to achieve the desired resilient housing outcomes if built-environment professionals (BEPs) and local CFSCs are not involved (see Chapter 5).

Specifically, the engagement of BEPs and local CFSCs in the consultation process can provide new knowledge and expertise on DRR and resilient housing design and construction, which are commonly not fully understood, or even not known, by most locals. In support of BEPs, design imperatives that respond to people’s living needs, socio-economic capacities, cultural conditions, and safety standards can be captured and addressed properly.

In the disaster-affected communities surveyed by this study, local CFSCs are effective only for early warning and immediate response to a coming hazard (storm, flood), while BEPs appear to be absent in most cases except for safe housing projects funded and implemented by outsiders (donors, consultant agencies). What local CFSCs can do is based on an action plan for disaster response adopted from higher administration levels (district, city levels), where evacuation and rescue actions predominantly appear. In terms of housing risk reduction, they often remind people to temporarily reinforce their houses (i.e. putting sandbags on the roof) just before a forecasted event (frequently within one week before its arrival), rather than help them prepare safe homes from the beginning through regular awareness-raising initiatives and technical training through the year. Since local CFSCs function as the pioneer forces side by side with the affected groups and households, the present study suggests a more proactive engagement of local CFSCs (not reactive, as in the current situation) in housing risk reduction, through organizing more regular consultations and shared learning dialogues among stakeholders.

Another important actor in the process of building DRH is NGOs, locally and internationally. It was found by this study that NGOs can bring new ways of thinking, new concepts on resilient housing, and new methods of construction, which may be useful for improving local housing resilience. However, in the context of Central Vietnam, NGOs often engage in safe housing construction
when funding is available which can pay them for their participation (e.g. staff salary, admin cost, office cost). As found in the case studies, especially within the donor-built reconstruction approaches, the involvement of NGOs (i.e. Save the Children, Red Cross) was merely one-off and ended when the project was completed. Therefore, this study suggests to find ways or mechanisms to enable a regular participation of NGOs in developing DRH, to ensure an effective transfer of new or innovative ideas on resilience building to the in-need stakeholders, groups, and communities.

In Central Vietnam and possibly other similar regions, vulnerable households often engage in the consultation process in the manner that they are asked to answer questions rather than to discuss the chosen housing solutions. This is commonly found in the donor-built housing projects, as experienced in the case studies, where the construction of safe houses is usually funded by a donor outside the beneficiary group or community, and the voice of local people is relatively limited. Therefore, the present research suggests that vulnerable/at-risk households should be placed at the center of the consultation process, to enable them to actively engage in and share all opinions, thoughts and suggestions for better resilient housing outcomes.

**Finding Three: Technical, financial and legal supportive mechanisms as the necessary conditions for enabling regular consultations and shared learning dialogues**

In self-built housing construction, there is a lack of shared learning dialogue between vulnerable groups and external parties; while, in donor-built construction, consultation is still limited to one-off discussions. This is because of the lack of supportive mechanisms beyond the continuity of consultations and shared learning dialogues. Expressions of this problem can be seen in the case-study communities where vulnerable households freely decide their housing designs without consultations and discussions with in-field professionals and governance parties.

The study has identified three forms of supportive mechanisms that can be deployed to underpin and enable more regular consultations and shared learning dialogues between vulnerable groups/households and external parties. These
forms comprise the technical, financial, and legal. Technically, it is the provision of support to help local actors deliver, operate and maintain safe housing interventions in harmony with socio-economic and cultural conditions. Financially, it is the design of financial programs such as micro-credit programs to fully or partially assist low-income households in accessing professional services for better design and construction outcomes. Legally, it is the promulgation of appropriate policies or legal frameworks that enable regular and mutual communication and consultation between vulnerable groups and external parties for better design outcomes of the disaster-resilient housing. It is suggested that these three streams of supportive mechanisms need to be significantly linked and mutually supportive to ensure the efficiency of shared learning dialogues.

In addition to these supportive mechanisms, there is a need for mandating resilient housing guidelines and ensuring such guidelines are followed by relevant stakeholders, particularly vulnerable groups and technical parties. This may support the validation of technical, financial and legal mechanisms deployed in building a resilient housing system in Central Vietnam, especially within the low-income population. For example, to intensify the involvement of BEPs in the construction of Nha cap 4 houses (as discussed in previous chapters), the construction of such houses needs to be legalised through building permits or other similar forms. In general, identifying suitable forms for mandating resilient housing guidelines and assigning tasks to pertinent parties for DRH development are questions for future studies to further investigate.

9.2.2 THEME 2: The Role of Built-Environment Professionals (BEPs)

The findings within this theme are presented in Chapter 6 of this thesis. This section discusses the interpretation of these findings in response to the second research question, Question 2 in Table 9.1. One of the key findings of this study relating to this theme is the indication of the meaningful role of BEPs in developing disaster-resilient housing in Central Vietnam. In the current literature on disaster risk reduction, the role of BEPs is not much mentioned, and frequently comes from the viewpoints of researchers based in developed countries. The findings of this study relating to the role of BEPs, based on the investigation of housing design and construction in a vulnerable developing country (Vietnam),
make a significant contribution to the current literature in that they add new insights on the role of BEPs to the whole body of knowledge on disaster risk reduction.

**Finding Four: The value of technical assistance from local BEPs**

Although local housing construction practices in disaster-prone areas of Central Vietnam has a limited presence of BEPs, the findings of this study, presented in Chapter 6, have shown a potential role to be played by BEPs in improving the current situation of local housing and strengthening the resilience of local housing to future climate hazards. The better technical performance of donor-built, rather than self-built, housing, thanks to the support of local architects and/or engineers, is clear evidence for this statement. Their contribution is not only to add professional knowledge and expertise to safe housing design developments but also to translate social, economic and cultural demands of local families into tangible spatial and technical solutions.

The survey of donor-built housing has indicated specific contributions of local architects and engineers to improving local housing construction practices. This was clearly seen in the surveyed communities where local BEPs were in charge of safe housing design and construction (e.g. in Loc Tri and Hoa Hiep Bac), in that new elements for better housing reinforcement (i.e. continuous beams, roof bracings) are increasingly used by local people.

**Finding Five: Economic constraints of vulnerable households, lack of understanding of safe housing, and lack of incentive schemes to sustain innovative ideas, are the key obstacles to BEPs engagement**

One of the original findings of this study concerning the role of BEPs is the identification of three main barriers to the involvement of BEPs: (i) economic constraints of vulnerable households; (ii) misunderstandings of local actors on safe housing; and (iii) lack of incentive mechanisms to sustain innovative design ideas.

In Central Vietnam, vulnerable households mostly belong to poor or near poor groups whose incomes fluctuate around the national poverty line. Their economic
difficulties make them view meeting safety requirements as secondary priorities in housing construction, after basic living functions (i.e. sleeping, eating). In addition, economic constraints hinder vulnerable households from employing architects and/or engineers for better design outcomes, because they are afraid of paying extra costs for design services. Without control and governance from local authorities for safe construction, they are free to decide the design of their homes based on their available experiences without further consultation with professional bodies for risk reduction. This explains the non-significant decline of housing damage and loss in recent disasters regardless of some safe housing construction projects done in the region.

Another obstacle to BEP involvement is the misunderstanding of local actors on safe housing, in most local communities of Central Vietnam. There is a dominant school of thought in the surveyed communities wherein concrete houses are considered to be the only type of building that can resist natural disasters. Other houses made by bricks or other materials, which currently dominate most types of local housing, are viewed as unsafe structures. Ironically, the cost to build a concrete house exceeds the economic capacity of most vulnerable households who have low incomes. The presence of donor-built brick houses designed by BEPs in recent housing reconstruction projects has not been enough to influence local perceptions on safe housing, except when they are witnessed through a real disaster. This leads to the underestimation by most locals of the role of BEPs, and makes them uninterested in using local architects and engineers for housing design and construction.

The third barrier to BEP engagement found from this study is the lack of incentive schemes to sustain innovative design ideas. In the surveyed communities (Hoa Hiep Bac and Ia Broai), the lack of further uptake of new forms of safe housing and new construction techniques introduced by the architects is clear evidence for this statement. There was limited or no attention from the public to maintaining and promoting such innovative or new knowledge and expertise, even if these revealed an efficiency in the next disasters.

**Finding Six: Architects play a significant role in the promotion of disaster-resilient housing**
In Central Vietnam, architects are mainly involved in the design of housing for middle- and high-income people, who live in urban areas, and their housing construction often requires a building permit. For low-income people, living in peri-urban and rural areas that are frequently disaster-prone, such as the study areas of this research, their housing construction still sees a limited engagement of architects due to the main barriers mentioned above. However, the study argues that, to better cope with future disasters and maintain a stable household development, housing designs for low-income people indeed necessitate professional support from architects. Different from engaging in housing construction for middle- and high-income groups, where delivering design drawings is the main task, architects being involved in low-income housing construction in disaster-prone areas requires a wider role. Specifically, they are required not only to design technically safe and locally suitable housing but also to improve local capacities through delivering technical training and awareness-raising initiatives, and to identify new possibilities for future developments or transformations. These findings coincide with the findings of some recent literature (e.g. Aquilino, 2011; ACHR, 2012) where architectural inputs, such as through housing design solutions, are confirmed to be crucial in building local capacity, and which propose viable scenarios for the better future of communities living in vulnerable areas.

9.2.3 THEME 3: Design Principles for Disaster-Resilient Housing

The findings within this theme were discussed in Chapter 7 of this thesis. This section presents the interpretation of these findings in response to the third research question, Question 3 in Table 9.1. The most significant findings of this study relating to this theme are the exploration of the three interconnected design principles for disaster-resilient housing: technical, economic, and social. There are numerous publications proving these issues as the necessary factors for successful housing implementation, but not many of them detail these issues in terms of specifics. This gap is exacerbated within the context of Central Vietnam, where the number of studies done on the field of disaster-resilient housing is still modest, and the link between these three factors (technical, economic, and social) is addressed in a limited way or even neglected by the research community.
Finding Seven *(technical)*: Safety considerations need to be considered with climate responsive design

Safety is always the first consideration in housing design for disaster-prone areas, to prevent damage and loss caused by disasters. However, the excessive focus on safety, as seen in some recent housing interventions, potentially leads to the underestimation of other aspects of housing that are also important to people’s lives. The survey of several safe houses provided by NGOs in Central Vietnam indicates that climatic responsive strategies such as the use of natural light and ventilation appear to be less considered or even not addressed in housing designs, and consequently, result in the climatic discomfort of occupants. Disasters only happen within a couple of months in the year; but the adverse impacts from the local climate are experienced throughout the year and badly affect people’s lives, health, and productivity.

In Central Vietnam, where a hot and humid climate dominates, addressing climatic responsive designs is more important, to reduce the heat (in summer) and high humidity (in winter) generated by this unfavorable climate. Design solutions for capturing indirect sunlight and intensifying natural cross-ventilation for internal spaces of the house are recommended to meet this demand. The present study suggests that housing designs for disaster-prone areas of this region need to combine the purpose of safety with the local climatic responsiveness at the same time, to minimize disaster damage and loss as well as to bring human comfort for occupants.

Finding Eight *(economic)*: Identifying acceptable levels of safety, maximizing the use of local resources, and designing for low-cost building, maintenance, and future housing extension, are the key considerations for the economic efficiency of disaster-resilient housing

There is limited attention in the literature relating to identifying acceptable levels of safety for housing against disasters. Identifying acceptable levels of safety is addressed by this study as one of the most important factors for the success of resilient housing designs. It is clearly seen that, the higher level of safety the house has, the higher the construction cost. While most vulnerable households have low incomes, the identification of acceptable levels of safety for their
housing is essential, to fit with their limited economic capacity and enable them to use safety-related measures in housing construction. In Central Vietnam, where storms and floods are the most common natural hazards, the present study has indicated that storm level 12 on the Beaufort scale, and the flood level higher than the annual average flood levels of the region, were the acceptable levels of safety for housing (see Chapter 7). In cases of stronger events that cross these levels, the study suggests the use of alternative low-cost solutions, such as the improvement of one room of the house to be a ‘strong box’ for storm resilience, or the use of family boats to evacuate for flood resilience.

In terms of using local resources for housing construction, the findings of this study coincide with the findings of many authors (e.g. Chang et al., 2010, 2011; Jha et al., 2010; IFRC & SKAT, 2012) who view the maximised use of local labour and local materials as one of the first priorities to bring about economic efficiency in safe housing. There have been several safe housing projects implemented by international agencies in Central Vietnam (i.e. Save the Children UK in Da Nang) where an overdependence on construction contractors outside the community hindered the participation of local labor forces and triggered a high cost of housing products. This resulted in reduced size and narrow living spaces of safe houses, and then, the limited satisfaction of beneficiaries later.

Another finding of this study that is not often mentioned in the literature is the design of housing that addresses future spatial extension to reduce associated costs. Spatial extension after a period of use is a common phenomenon of local housing in Central Vietnam, to meet new living needs and functional demands posed by urbanization and modernization. Most of the surveyed houses in this region have had their living spaces extended in comparison with their initial construction. This is a reality that designers or implementers need to carefully consider, right from the beginning, to tackle this issue in design proposals: namely, identifying the expandable directions of the house in the future, as well as the proper arrangement of functional rooms, which do not block or hinder future spatial extensions, needs to be realized and addressed in household consultations and shared learning dialogues. Many houses visited in the study areas, due to their improper site plans and spatial functional layouts from the beginning, are now facing this problem, which challenges their owners in extending their homes.
because many parts of the existing house will need to be demolished, and the renovation cost will escalate and potentially exceed their economic capacity.

Another aspect suggested by this study is that the design of disaster-resilient housing from the beginning needs to consider the cost efficiency of the building operation and later maintenance. The study argues that a good house design can reduce the costs of running cooling and lighting devices, and of building maintenance, in the future. This helps increase family savings over the years, which can assist other improvements or development efforts of households. This point is also not often mentioned in the literature on housing and disaster, especially for the region of Central Vietnam. The severity of the hot and humid climate in Central Vietnam, such as high temperatures and humidity, triggers the extensive use of electrical energy for operating cooling and lighting devices in households. For low-income households, monthly energy bills often cover a considerable amount of their family budget, and subsequently, affect their other improvement efforts, including the use of safe construction and reinforcement techniques. Finding Seven, mentioned earlier, with an emphasis on the necessity of incorporating climate responsive design strategies, is a good response to this demand, since these climatically friendly designs will lessen the use of building operation systems and associated energy costs later.

Finding Nine (social): Spatial solutions for cultural appropriate disaster-resilient housing

One of the most significant findings of this study is the relationship between functional spatial designs of safe housing and user satisfaction. It has been emphasised that spatial arrangements of functional spaces inside the house that respond to people’s lifestyles bring the cultural appropriateness of housing products, and then, draw a high appreciation and adoption by occupants. This finding is similar to the finding of the literature review presented in Chapter 2, where the cultural appropriateness of spatial and functional layouts has a strong influence on the long-term efficiency of safe housing outcomes (see Ahmed, 2011; Boen & Jigyasu, 2005; Barenstein, 2006; Ganapati & Ganapati, 2009; Karunasena & Rameezdeen, 2010).
In Central Vietnam, there are numerous communities that are characterized by different living cultures and ways of life. People in coastal areas have their unique ways of living distinct from people in plains and mountainous regions, as seen in the case studies of this research. This cultural variation is frequently reflected in the design of their housing, particularly the spatial layout of functional spaces; which closely links with the different forms of their housing such as the three-compartment house (nhà ba gian) of Loc Tri people (in coastal area), the tube house (nhà ống) of Hoa Hiep Bac people (plains), or the on-stilt house (nhà sàn) of the Ia Broai people (mountainous). The survey of post-disaster housing in different areas and communities of Central Vietnam also sees the existence of many safe houses provided by donors that are unused or unoccupied by residents due to the cultural inappropriateness of their functional and spatial layouts to people’s ways of living. Hence, the design of disaster-resilient housing needs to take this issue into consideration, to ensure the long-term effectiveness of housing outcomes.

9.3 Implications for theory

The study has provided a comprehensive answer to the research questions, as presented in the previous sections, and identified three theoretical components and a framework for developing disaster-resilient low-income housing. Three theoretical components comprise (i) community consultation and communication, (ii) the role of built-environment professionals, and (iii) design principles for resilience. The identification of these theoretical components was justified by the literature review and the fieldwork in Central Vietnam, where they show their critical effects for the outcome of disaster-resilient housing. They function as the backbone for developing disaster-resilient housing and building community resilience afterward. This is the original finding of this study which potentially makes a theoretical contribution to the current housing literature.

Current understanding of disaster-resilient housing is still limited, and is frequently equated with the meaning of ‘safe housing’. The concept of resilience is still a debatable notion in the research community, even it has been widely used in recent studies to tackle the problem of disaster risk reduction. Recent theories on disaster risk reduction and management tend to utilize this concept to highlight the importance and necessity of addressing ‘responsive and adaptive’ rather than ‘predictive and preventive’ capacities (IFRC, 2012; UNISDR, 2009, 2013; ISET,
However, current understandings on resilience are still interpreted widely, such as the resilience of a city or community (e.g. Tyler & Moench, 2012; Twigg, 2007; IFRC, 2012); whereas its meaning for a particular sector such as housing, as in this study, has been not yet been often studied. This makes the findings of this study, on the issue of disaster-resilient housing within the context of Central Vietnam, more significant, and makes them a valuable theoretical contribution to the whole body of knowledge on disaster risk reduction and management.

In addition, the establishment of a framework for dealing with the issue of disaster-resilient housing also contributes to the current understanding on housing risk reduction, especially for the region of Central Vietnam. There are a variety of theories guiding design practices for safe construction (e.g. Jha et al., 2010; SKAT & UNEP, 2007; IFRC & SKAT, 2012), but most of them are in the form of providing general and universal principles and instructions. For the context of a region such as Central Vietnam, as examined in this study, there appears to be a lack of context-specific design theories to assist and shape design practices there. The outcome of a framework for developing resilient low-income housing in Central Vietnam is an effort to shorten this knowledge gap and offer a reliable theoretical foundation for future design practices on safe and resilient housing in this region. This framework can be a useful reference for developing new design theories on disaster-resilient housing in other regions or countries that have similar natural and social conditions to Central Vietnam.

9.4 Implications for policy and practice

It could be inferred from the present study that local and external stakeholders involved in the delivery, operation and maintenance of safe housing in Central Vietnam need to be aware of a wide range of foreseen and unforeseen threats in the future, posed by climate change and unsustainable or improper ways of development. Policies and programs for improvement and development in hazard-prone provinces/areas of this region are, therefore, required to integrate with disaster risk reduction strategies, to reduce unexpected damage and loss. A wide range of policy-level interventions can be generated from this study, including:

- The revision of building codes and construction regulations;
- The use of building permits or similar forms to control unsafe practices;
- The revision of planning policies;
✓ The improvement of information-sharing mechanisms at multiple levels;
✓ The clarification of roles and responsibilities of stakeholders;
✓ The intensification of bottom-up approaches in developing resilient housing strategies.

These policy-related interventions will support the construction of an enabling environment, based on which, building a resilient housing system against natural disasters becomes plausible.

In terms of implications for practice, the outcome of the framework for disaster-resilient low-income housing is a practical reference guide for the design, construction, and maintenance of disaster-resilient housing in Central Vietnam. There is a wide range of practical principles and guidelines encompassed in this framework, from settlement planning and housing design to post-occupancy management and alteration, and the conduct of consultations and shared learning dialogues. It is apparent that designers (i.e. architects, engineers) who are responsible for delivering housing design(s) need to follow the principles and guidelines given by the framework to ensure the success of disaster-resilient housing outcomes. Community meetings and separate household interviews are useful methods for consulting with the in-need community and external parties, in seeking design ideas for safe and resilient housing. The findings of this study can also inform and shape future design practices of safe and resilient housing in terms of three interconnected aspects: technical, economic, and social. A balanced consideration of these three aspects simultaneously is needed, to come up with the best design solutions for disaster-resilient housing in Central Vietnam.

9.5 Limitations of the study

Since this research follows the case-study method, to investigate the issue of disaster-resilient housing through the lens of post-disaster housing, there are several limitations encountered by the study associated with this method that need to be considered. Firstly, the selection of research participants per case, even randomly, may not represent the spirit and intention of the whole community, because personal biases of respondents may exist in their responses and feedback. Secondly, findings from the single cases and the comparison between them may contain some biases from the researcher, who was the primary instrument of data collection and analysis. In this research, the architectural background of the researcher and his technical experience in safe housing construction may
sometimes have made him view the studied issues, even if socially inclined, in a physical and technical lens. The findings are, hence, more or less influenced by the sensitivity and integrity of the researcher, although he tried to avoid personal opinions or biases on the studied issues.

In addition, the findings on disaster-resilient housing based on the investigation of post-disaster housing may be insufficient to conclude the development of a resilient housing system because there are also some other approaches and/or implementations for housing development in vulnerable regions/areas that need to be considered, such as housing for middle-income people or social housing programs. Finally, the technical survey of a relatively limited number of houses, ten houses per case, might be not enough to assess the whole situation of residential housing of the wider region involved, because there might be some or possibly many other houses that contain noticeable characteristics different from the surveyed ones.

9.6 Future research needs

Based on the findings of this study, as well as the limitations mentioned above, several implications and recommendations for future research are generated:

✓ It is important for future studies to examine housing interventions other than post-disaster reconstruction, to add more understanding to the housing situation and appropriate ways to build resilient housing systems in disaster-prone areas in Central Vietnam. Types of surveyed houses are then needed to cover a wide range of local housing forms in this region, to provide a reliable dataset for promoting long-term safe and resilient housing.

✓ The survey of post-disaster housing in Central Vietnam also sees the impact of reconstruction interventions on other sectors such as household economies, social relations, community ties and settings, or public infrastructure. Therefore, future studies are needed to investigate the link between post-disaster housing reconstruction and other areas of community stability and development (not housing), such as how reconstruction affects social relations between community members, or what contribution the reconstruction brings to improved community networks or local livelihoods.
Future research is also needed to address the issue of disaster-resilient housing using a broader vision, where institutional and governance issues are tackled. In particular, contextual and intervening conditions underpinning the implementation of safe housing need to be further studied to understand invisible or underlying factors beyond the construction of a resilient housing system in this region.

Future studies are also needed to focus on the ‘buffer’ zones between rural and urban, frequently called peri-urban, in Central Vietnam. These ‘buffer’ zones are the crossroads of rural and urban lifestyles, local and modern ways of construction, old and new types of housing, agriculture-based and industry-based means of livelihoods, and so on; which are likely to exacerbate the ambiguity and uncertainty in implementation, management and operation. These ambiguities potentially may increase housing vulnerability in those zones, if proper ways of housing development are not studied and applied.

The field investigation also sees the presence of DRR resource persons who are not academically trained as professionals (i.e. architects, engineers) but possess much experience in the field. In disaster-affected communities, DRR resource persons play an important role in helping people better cope with disasters, from giving general advice to offering technical instructions on how to build safely. Future studies, therefore, need to concentrate on looking at their roles and contribution to local housing development and the construction of a resilient housing system in Central Vietnam.

It is also recommended that impacts of local climatic events (e.g. localized floods or whirlwinds) on housing and livelihoods also need to be studied. This research indicates that, for some communities or regions in Central Vietnam, the occurrence of local climatic events is quite frequent; but these are commonly uninformed and unannounced to people in advance, because in-charge hydrometeorology centers and early-warning units receive no information about them beforehand. These local climate events, even on a small scale, have triggered considerable damage and loss to housing and livelihoods due to there being no early warnings and preparation for their visits.
Future research could put more focus on the link between urbanization and modernization, and housing vulnerability. The rapid process of urbanization and modernization in many disaster-prone communities of Central Vietnam, along with the import of new housing styles, new materials, and new ways of construction, has gradually changed people’s perceptions on housing and their common construction practices. Housing risks are potentially exacerbated if the improper use of these imported products is undertaken. Therefore, it is important for future studies to figure out how urbanization and modernization may support housing vulnerability reduction and the promotion of a resilient housing system in this region.

The field investigation also sees a strong difference between ethnic minority groups in remote areas and the majority of the regional population in Central Vietnam, in terms of living needs and housing-related perceptions. Future research on such minority groups is, then, necessitated, to find the most appropriate solutions to the improvement and development of their housing while considering disaster resilience.

Future studies are suggested to look at the role of village/quarter heads, local voluntary youth groups, and community-based organizations, in building community resilience, since they are, in most cases, the pioneer forces to respond to and recover from disasters at the grassroots levels in the region of Central Vietnam.

Future studies are also required to investigate incentive schemes or mechanisms to support regular discussions and shared learning dialogues between vulnerable/at-risk groups and in-field professional parties, the dissemination of innovative ideas, and the access of vulnerable communities to local design services (i.e. local architecture offices or construction companies).

To conclude, this thesis has made it clear that promoting disaster-resilient housing is one of the best ways to ensure sustainable development of disaster-prone or -affected households. Community consultation, BEP's engagement, and building design interventions are the three core components to achieve disaster-resilient housing.
Future housing project implementation in disaster-prone areas in Central Vietnam and in other similar regions across Asia, therefore, should be aware of these recommendations and the framework for disaster-resilient low-income housing developed by this research, to ensure the wellbeing and the resilience of exposed groups and communities to future climate threats, particularly storms and floods.
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## Appendices

### Appendix A: Household Questionnaire

<table>
<thead>
<tr>
<th><strong>Respondent Name</strong></th>
<th><strong>Age</strong></th>
<th><strong>Date</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### General Information
- How many people living in your house:
- Main occupation:
- Main disaster (*storm, flood, drought, etc*):
- Biggest impact to family (housing, livelihoods, or other assets):
  - ………………………………………………………………………………………………………………………………….
- Family’s coping strategies:
  - ………………………………………………………………………………………………………………………………….
  - ………………………………………………………………………………………………………………………………….
- Main barrier to building disaster-resilient housing
  - ………………………………………………………………………………………………………………………………….

### Community Consultation
- What forms of communication/consultation was applied by donors/implementers?
  - To what extent, this consultation is effective and ineffective?
- Was community feedback addressed in housing design and construction?
- In future housing implementation, what forms of consultation do you prefer? Which parties/stakeholders are needed?

### The Role of Built-environment Professionals
- Did built-environment professionals participate in the reconstruction process of your housing?
<table>
<thead>
<tr>
<th>What roles they took during the process of housing design and construction?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think local housing construction requires technical assistance from these professionals to build safer homes?</td>
</tr>
<tr>
<td>Design Principles for Resilience</td>
</tr>
<tr>
<td>What design features help to reinforce your house against disaster?</td>
</tr>
<tr>
<td>Which design features showing the responsiveness of your house to local climate?</td>
</tr>
<tr>
<td>Does your house meet everyday needs of your family? To what extents?</td>
</tr>
<tr>
<td>To what extents, your housing construction is cost effective and ineffective?</td>
</tr>
</tbody>
</table>
### Appendix B: Themes and Questions for Focus Group Discussions (for local authorities, local builders & community-based organisations)

<table>
<thead>
<tr>
<th>Respondent Group</th>
<th>No. of participant</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General Information**
- Main disasters in the region:
- What sector most affected:
- What impacts on local housing:

- Economic situation of local households (*mainly low, middle, or high income)*:
- What coping strategies at the community level:

- How is local awareness of disaster:
- Who is the most vulnerable:
- Main barrier to building disaster-resilient housing

**Community Consultation**

<table>
<thead>
<tr>
<th>What forms of communication/consultation was applied by donors/implementers?</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent, this consultation is effective and ineffective?</td>
</tr>
</tbody>
</table>

- Was community feedback addressed in housing design and construction?

- In future, what forms of consultation are appropriate to post-disaster housing reconstruction? Which parties/stakeholders are needed?
<table>
<thead>
<tr>
<th>The Role of Built-environment Professionals (BEPs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did BEPs participate in the reconstruction process? Who participate? <em>(architect, engineer, planner, surveyor)</em></td>
</tr>
<tr>
<td>What roles they took during the process of housing design and construction?</td>
</tr>
<tr>
<td>Do you think local housing construction requires technical assistance from BEPs to build safer homes?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design Principles for Resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td>What design features help to reinforce local housing against disaster?</td>
</tr>
<tr>
<td>Which design features showing the responsiveness of post-disaster housing to local climate?</td>
</tr>
<tr>
<td>Does your house meet everyday needs of local families? To what extents?</td>
</tr>
<tr>
<td>To what extents, post-disaster housing reconstruction was cost effective and ineffective?</td>
</tr>
</tbody>
</table>
### Appendix C: Questions for interviewing Built-environment Professionals

<table>
<thead>
<tr>
<th>Respondent Group</th>
<th>No. of participants</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### General Information
- Main disasters in the region:
- What sector most affected:
- What impacts on local housing:

- Economic situation of local households *(mainly low, middle, or high income)*:
- What coping strategies at the community level:

- How is local awareness of disaster:
- Who is the most vulnerable:
- Main barrier to developing disaster-resilient housing

#### Community Consultation

<table>
<thead>
<tr>
<th>What forms of community consultation appropriate in the local region you are involved?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was community feedback valuable to housing design and construction? To what extent?</td>
</tr>
<tr>
<td>Which parties/stakeholders are needed for community consultation?</td>
</tr>
</tbody>
</table>

#### The Role of Built-environment Professionals (BEPs)

<p>| What roles BEPs can take for post-disaster housing reconstruction? |</p>
<table>
<thead>
<tr>
<th>What roles BEPs can take for developing disaster-resilient housing?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Principles for Resilience</td>
</tr>
<tr>
<td>What design and construction features help to reinforce local housing against disaster?</td>
</tr>
<tr>
<td>Which design and construction features showing the responsiveness of post-disaster housing to local climate?</td>
</tr>
<tr>
<td>Which design and construction features showing the appropriateness of post-disaster housing to local lifestyles?</td>
</tr>
<tr>
<td>To what extents, disaster-resilient housing construction was cost effective?</td>
</tr>
</tbody>
</table>
Appendix D: Guidance Notes for the Framework for Disaster-Resilient Low-Income Housing in Central Vietnam

(known as the Checklist for designing Disaster-Resilient Low-Income Housing in Central Vietnam)

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Guidance</th>
<th>Pertinent Chapter/Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are community meetings (CMs) and separate household interviews (SPHs) used for consultation?</td>
<td>□ Yes □ No</td>
<td>If Yes, discussion themes and issues, if difficult for normal people to understand, are required to be explained in a simple way to allow all participants to fully understand before giving their responses. If No, explain why and in what way community consultation can occur.</td>
<td>Chapter 5/Section 5.2 &amp; 5.3</td>
</tr>
<tr>
<td>Do the following local actors join CMs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Vulnerable/at-risk households?</td>
<td>□ Yes □ No</td>
<td>The facilitator should ensure that all participants actively engage in the discussion and have critical opinions or feedback on discussion themes and issues.</td>
<td>Chapter 5/Section 5.3</td>
</tr>
<tr>
<td>→ Local builders or local construction workers?</td>
<td>□ Yes □ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Village/quarter heads Commune/ward’s committee of flood and storm control?</td>
<td>□ Yes □ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Commune/Ward People’s Committee?</td>
<td>□ Yes □ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Community-based organizations?</td>
<td>□ Yes □ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do the following external actors join CMs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Architect and/or engineer?</td>
<td>□ Yes □ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td>Chapter</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>---------</td>
</tr>
<tr>
<td>→ Resource persons?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Donor representative?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Material suppliers?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Building contractor (if local builders are unavailable or unused for a reason)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have living traditions and common living needs of the target group(s) been addressed in CMs?</td>
<td>□ Yes □ No</td>
<td>□ Yes □ No</td>
<td>Living traditions and common living needs vary among different groups and communities and are frequently reflected in the way they use their housing and settlement.</td>
</tr>
<tr>
<td>Have economic situations/conditions of the target group(s) been addressed in CMs?</td>
<td>□ Yes □ No</td>
<td>□ Yes □ No</td>
<td>Economic situation can be defined through people’s means of livelihoods, sources of income, their earnings and expenses, and their assets and savings.</td>
</tr>
<tr>
<td>Have social and cultural backgrounds/characteristics of the target group(s) been addressed in CMs?</td>
<td>□ Yes □ No</td>
<td>□ Yes □ No</td>
<td>The social and cultural background is often shaped by people’s religions, their social beliefs, biases, aspirations towards their life and their housing.</td>
</tr>
<tr>
<td>Have local resources and constraints for building disaster-resilient housing been considered in CMs?</td>
<td>□ Yes □ No</td>
<td>□ Yes □ No</td>
<td>Local resources are diverse depending on each community. It can be local labor, local materials, local skills, and techniques or local supportive institutional mechanisms.</td>
</tr>
<tr>
<td>Have social norms, aspirations and biases towards housing been considered in CMs?</td>
<td>□ Yes □ No</td>
<td>□ Yes □ No</td>
<td>Chapter 5/Section 5.2.1 &amp; 5.4</td>
</tr>
<tr>
<td>Have impacts of the local climate on housing and inhabitants been considered in CMs?</td>
<td>□ Yes □ No</td>
<td>□ Yes □ No</td>
<td>Climatic impacts can be the hot, cool, and cold faced by inhabitants, the darkness or</td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Are CMs being conducted before the conceptual design of disaster-resilient housing?</td>
<td></td>
<td></td>
<td>CMs are often conducted prior to the conceptual design stage to capture general and universal information for generating housing design ideas. If No, explain why?</td>
</tr>
<tr>
<td>Are CMs being conducted after the conceptual design of disaster-resilient housing?</td>
<td></td>
<td></td>
<td>Usually, CMs are not necessary after the conceptual design stage if information and data are sufficiently captured in previous CMs.</td>
</tr>
<tr>
<td>Do the following actors join SPHs:</td>
<td></td>
<td></td>
<td>The facilitator should ensure that all participants actively engage in the discussion and have critical opinions or feedback on discussion themes and issues.</td>
</tr>
<tr>
<td>→ House owner and/or family members?</td>
<td></td>
<td></td>
<td>Site planning of the house is its position within the plot and its relation to the surroundings.</td>
</tr>
<tr>
<td>→ Architect or building designer?</td>
<td></td>
<td></td>
<td>Identified by this thesis, three basic living needs of low-income households in Central Vietnam are living, sleeping, and kitchen and toilet.</td>
</tr>
<tr>
<td>→ Engineer?</td>
<td></td>
<td></td>
<td>Aesthetic needs of low-income families in Central Vietnam are often associated with</td>
</tr>
<tr>
<td>Has the site planning of the house been considered in SPHs?</td>
<td></td>
<td></td>
<td>ünst of living spaces, or the dampness or dryness inside living rooms.</td>
</tr>
<tr>
<td>Have basic living needs of the family and associated spatial arrangement been addressed in SPHs?</td>
<td></td>
<td></td>
<td>ünst of living spaces, or the dampness or dryness inside living rooms.</td>
</tr>
<tr>
<td>Have aesthetic needs of the family and associated building forms and decorations (if any) been addressed in SPHs?</td>
<td></td>
<td></td>
<td>ünst of living spaces, or the dampness or dryness inside living rooms.</td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td>Answer</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>----------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Has the financial capacity of the household been considered in SPHs?</td>
<td>☐</td>
<td>☑</td>
<td>The financial capacity of the household is their ability to mobilize sufficient money for their housing construction.</td>
</tr>
<tr>
<td>Have technical measures for safety purposes been discussed in SPHs?</td>
<td>☐</td>
<td>☑</td>
<td>Technical measures for safety purposes depend on the type of disaster faced by the household (e.g. storms, floods, landslides) and will be different for different types of disaster.</td>
</tr>
<tr>
<td>Has the cost of housing construction been discussed in SPHs?</td>
<td>☐</td>
<td>☑</td>
<td>The cost of housing construction includes the cost of initial construction, building maintenance, and future spatial extension.</td>
</tr>
<tr>
<td>Has the household’s contribution to the construction been discussed in SPHs? (for donor-built approaches only)</td>
<td>☐</td>
<td>☑</td>
<td>If Yes: what kinds of contribution? Contribution can be the participation of family members in construction works, the contribution of available materials and/or money that the household has accumulated over the years.</td>
</tr>
<tr>
<td>Are SPHs conducted before the technical design of disaster-resilient housing?</td>
<td>☐</td>
<td>☑</td>
<td>SPHs are often conducted before the technical design stage (after the conceptual design stage) to capture specific information and data for shaping design solutions. If No, explain why?</td>
</tr>
<tr>
<td>Are SPHs conducted after the technical design of disaster-resilient housing?</td>
<td>□ Yes  □ No</td>
<td>Usually, SPHs are not necessary after the technical design stage if information and data are sufficiently captured in previous SPHs.</td>
<td></td>
</tr>
</tbody>
</table>
### II. Site Planning

**For cyclone-affected areas, has the site planning addressed:**

- The non-parallel (zigzag) arrangement of individual houses?
- Windbreaks surrounding the settlement?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

The zigzag arrangement helps divide wind flows into smaller parts and, thereby, reduces wind pressures on individual buildings.

**For flood-affected areas, has the site planning addressed:**

- Space or room for retaining and/or absorbing floodwater?
- Unblocked or unimpeded waterways?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Spaces for retaining and/or absorbing floodwater can be open public spaces, green parks, ponds, lakes, rice fields, etc. Waterways can be rivers, canals, roads, paths, etc.

**Has the settlement planning considered the use of public disaster shelters for evacuation?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If Yes, which buildings? Buildings used for public disaster shelters should be:

- Structurally secured buildings are required (e.g. reinforced concrete schools) (for cyclone-affected areas)
- Multi-storey buildings are required (for both flood- and cyclone-affected areas)

**If yes, do these disaster shelters meet the following requirements:**

- At the geographical center of the community?
- Being easily and quickly accessed by vulnerable/at-risk groups and households?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
Has the site planning included open and/or green spaces within the community?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If Yes:
- How are these spaces defined and shaped?
- How do the community benefit from them?
### III. Building Design

<table>
<thead>
<tr>
<th>Has the building design(s) addressed the following specifications for safety purposes:</th>
<th>□ Yes □ No</th>
<th>The most common wind level used for calculating safe housing in Central Vietnam is the level 12 on the Beaufort scale. Prepared solutions can be the use of a strong box inside the house or a secure building nearby.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For cyclone:</strong></td>
<td>□ Yes □ No</td>
<td>The raised floor level is frequently 0.2-0.5 meter higher than the annual average level. Prepared solutions can be the use of lofts inside the house, family boats for evacuation, or multi-storey buildings nearby.</td>
</tr>
<tr>
<td>→ Strong building parts and elements (e.g. foundation, walls, pillars, beams, frames) against the highest wind level experienced in the previous cyclones?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Prepared solutions for super typhoons crossing the highest wind level in the previous cyclones?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For flood:</strong></td>
<td>□ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>→ A raised floor level higher than the annual average flood level?</td>
<td>□ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>→ Prepared solutions for catastrophic floods crossing the annual average flood level (frequently 1-2 meter higher than the annual average level)?</td>
<td>□ Yes □ No</td>
<td></td>
</tr>
</tbody>
</table>

### Chapter 7/ Section 7.2.1

<table>
<thead>
<tr>
<th>Has the building design(s) addressed the following specifications for the spatial responsiveness to the family’s living needs:</th>
<th>□ Yes □ No</th>
<th>To meet the spatial demand, it is necessary to identify the size of living room, bedrooms, kitchen and toilet based on the actual needs of each household.</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ Meeting the spatial demand of three basic living needs: living, sleeping, kitchen, and toilet?</td>
<td>□ Yes □ No</td>
<td>The appropriate spatial arrangement is frequently defined by the suitable placement of functional rooms inside the</td>
</tr>
<tr>
<td>→ Culturally appropriate and familiar spatial arrangement of functional rooms (living room, bedrooms, kitchen and toilet)?</td>
<td>□ Yes □ No</td>
<td></td>
</tr>
</tbody>
</table>

**Chapter 7/ Section 7.3 & 7.4**
<table>
<thead>
<tr>
<th>Specification</th>
<th>Yes/No</th>
<th>Description</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locally appropriate building form?</td>
<td></td>
<td>The building form should be similar to one of the existing local housing forms.</td>
<td>7.3 &amp; 7.4</td>
</tr>
<tr>
<td>Locally appropriate roof shape?</td>
<td></td>
<td>The roof shape should be similar to one of common roof shapes of local houses.</td>
<td></td>
</tr>
<tr>
<td>Locally appropriate building decoration?</td>
<td></td>
<td>Building decoration(s) should be responsive to social beliefs and/or biases of local residents.</td>
<td></td>
</tr>
<tr>
<td>Maximizing the use of local materials and local labor in construction and building maintenance?</td>
<td></td>
<td>Measures for avoiding direct sunlight can be the use of sun-shading devices for doors and windows, semi-open spaces such as...</td>
<td>7.2.2</td>
</tr>
<tr>
<td>Defining an appropriate location of the house within the plot that allows future spatial extensions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifying a suitable spatial layout of functional living rooms which does not block or restrict future spatial extensions?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measures for intensifying natural cross ventilation?

<table>
<thead>
<tr>
<th>☐ Yes □ No</th>
</tr>
</thead>
<tbody>
<tr>
<td>verandas or balconies, or shading trees nearby.</td>
</tr>
<tr>
<td>Measures for intensifying natural cross ventilation can be facing the house towards the southeast, the use of opposite openings with the same sizes, roof windows, stack-effect ventilation, or courtyard.</td>
</tr>
<tr>
<td>The selection of climatically responsive measures should be done in consultation with beneficiary households or end-users.</td>
</tr>
<tr>
<td>IV. Construction</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Has the construction followed the architectural and technical design?</td>
</tr>
<tr>
<td>Does the construction quality conform to design requirements?</td>
</tr>
<tr>
<td>Has the construction time fit within the planned schedule?</td>
</tr>
</tbody>
</table>
### V. Post-Occupancy Evaluation

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there any spatial expansion or change after the initial construction?</td>
<td></td>
<td></td>
<td>If Yes, which functions are used in the expanded or changed space/room(s)?</td>
</tr>
<tr>
<td>Is there any part or element of the house downgraded technically?</td>
<td></td>
<td></td>
<td>If Yes, assess their current status to know whether a repair or replacement is applicable</td>
</tr>
</tbody>
</table>
### Appendix E: Responsive design strategies for the hot-humid climate in Central Vietnam

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Answer</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevent direct sunlight (capturing indirect sunlight)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Use semi-open spaces to create a ‘buffer zone’ between the inside and outside of the house.</td>
<td>□ Yes □ No</td>
<td>The ‘buffer zone’ can be a veranda, balcony, or similar space which is frequently connected with an entrance door of the house (right).</td>
</tr>
<tr>
<td>▪ Use sun-shading devices for openings to prevent the direct sunlight.</td>
<td>□ Yes □ No</td>
<td>Sun-shading devices can be the overhangs above doors and windows (left) or the similar items that can prevent the direct sunlight from entering the house.</td>
</tr>
<tr>
<td>▪ Use shade-providing trees on the eastern and western sides.</td>
<td>□ Yes □ No</td>
<td>If the land is large enough, planting trees on the western and eastern sides of the house to block or restrict the direct sunlight from these directions. These trees must have no destructive impacts on the house if a disaster happens.</td>
</tr>
</tbody>
</table>
- Use the obscured glass for roof windows.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the cases that are unable to capture the indirect sunlight through doors and/or windows, roof windows are encouraged to lighten the internal living spaces. These roof windows should be covered by obscured glass to avoid the penetration of the direct sunlight. If possible, it is better to have roof windows on the north side to avoid the direct sunlight.
<table>
<thead>
<tr>
<th>Intensify natural cross ventilation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>▪ Use on-wall openings to the outside.</strong></td>
</tr>
<tr>
<td><strong>▪ Use on-roof openings.</strong></td>
</tr>
<tr>
<td><strong>▪ Use a court yard.</strong></td>
</tr>
</tbody>
</table>
- Facing the house towards the southeast direction.

If possible, facing the house towards the southeast direction to receive cool breezes in summer and avoid cold wind in winter. Most of the traditional houses in Central Vietnam have their main directions towards the southeast side.