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Opportunities to Build Disaster-Resilient Shelter and Settlements: Lessons Learnt from a Housing Architecture Design Competition

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Abstract: Housing and settlements are facing greater challenges toughed by rapid urbanisation and a changing climate in Vietnam. To date, there seem to lack of overall solutions for resilient housing to address future risks posed to housing and the promotion of long-term resilient shelter. Current interventions tend to put more focuses on physical improvements with limited attention to other aspects such as socio-economic and governance issues. This paper reviewed the outcome of a design competition organized in Vietnam in May 2013 in the lens of disaster resilience to examine key assumptions from the competition and generate key potential lessons for future housing implementations. An examination of the first-prize winning project in addition to a literature review against three key dimensions: physical, social, and institutional have enabled the generalisation of three key assumptions for this paper: (i) Local expertise and knowledge on risk reduction is valuable for building disaster resilient housing, (ii) improving local awareness and supporting local economy are key essential parts to raise resilience, and (iii) applying planning and construction regulations through building permits is significant to ensure a resilient housing system. These findings also generate some policy implications related to the demand of improving governance mechanisms related to local construction, programs to stimulate local economy and raise public awareness on future disaster risks and resilience.

Key words: disaster risk reduction, architectural design, resilient housing.

1. Introduction

Over a quarter of the whole country has been urbanised [1] the Vietnam's urban population is likely to reach 46 million by 2020 that covers nearly half of the national population [1]. Strong urbanisation process has pressed greater pressures on meeting housing demands [1], particularly in suburban or peri-urban areas of cities (Fig. 1). The urbanisation process has also seen mass imports of new housing styles, construction methods, and materials that, later on, influence and change home built environment. Local perceptions and practices on housing construction have been gradually altered in accordance with changing living needs [2]. In the locations prone to climate risks, such as flood or storm zones, lack of incorporating safety-related principles in building structures can be widely found and becomes on of main causes of increased housing vulnerability. Realising this worsen scene, the national government and aid agencies have undertaken many plans and actions for disaster risk reduction but the most recent disasters have not seen a significant decline in damage and losses, particularly in housing [3]. In early 2013, ISET in collaboration with Hue University and Da Nang Architecture University organised a housing design competition to call for ideas in response to climate risks and effects of urbanisation in Central Vietnam, with a focus on Da Nang, one of the most vulnerable cities in this region. This paper aims to examine the outcome of this competition, particularly on the first-prize project, to

identify major design-related issues and to generalise some key assumptions for future implementations of disaster resilient housing.

In Vietnam, increasing concerns are given to the capability of local housing and settlements, particularly in hazard prone areas, in response to climate threats, especially storms and typhoon [4, 5]. Recent disasters (e.g. typhoon Xangsane in 2006 and Ketsana in 2009) have witnessed dominant proportions of masonry shelters in damage and losses [5-7]. This fact was believed to have a link with limited understandings of local people and builders on how to properly create safe buildings with new materials (e.g. cement, brick, or steel) and new construction methods (Fig. 2) [8]. According to the first-prize winner, due to economic constraints and limited awareness of disaster preparedness, people seemed to prefer the use of immediate or short-term measures in response to disasters (i.e. using sandbags on roof, or anchoring roof structures to the ground) whereas long-term strategies (i.e. applying safety-related standards from initial constructions) were in absence. In an era of climate change with the estimated increasing occurrence of climate events [9], these short-term solutions are unlikely to help local communities avoid disaster damage and losses. In addition, issues of human comfort seem to be neglected in masonry houses recently built by people. According to most competition participants, capturing natural light and intensifying natural ventilation, the two effective solutions for the hot-humid climate in Central Vietnam, seem to be absent in the visited local houses.

The above discussion has indicated some key weaknesses of local housing in terms of climatic responsiveness and disaster resilience in Central Vietnam. Participants believed that risky conditions to future disasters and climatically uncomforted living spaces of local housing were driven by non-physical factors beyond, of which, limited awareness of people on disaster risk reduction, lack of technical supports

Fig. 1 Rapid urbanisation has generatednew housing risks to future climate in Vietnam.
(http://ashui.com/mag/tintuc-sukien/vietnam/3845-nha-o-do-dan-tu-xay-tai-cac-do-thi-chiem-toi-90-phan-tram.html, accessed August 2013)

Fig. 2 Unsafe masonry houses to disasters and lack of natural light of living spaces (@Author).

for a safe and climate-responsive construction, and limited governance for resilient housing system are the most common [6]. This paper, therefore, examines this relationship through an examination of the design competition's outcomes and the first-prize winning project to generalise some key assumptions to potentially assist decision- and policy-makers in planning and designing appropriate housing programs and strategies for extremely climate-risk exposed regions of Vietnam in the future.

2. Overview of the 1st Prize Winning Project

The competition took place in February 2013 in Vietnam to seek housing-design ideas for the context of climate change and urbanisation, with a focus on Da Nang City. The 1st prize was given to the project that addressed a high response and adaptation to the local contexts in the light of disaster resilience. The main outcome of this project is the three housing options: tube (nhàống), three-compartment (nhàbagian), and twin double-storey house

(nhàghépđôi) (Table 1) that were developed from existing local housing forms. These models were highly praised thanks to their functional and spatial appropriateness to people's lifestyles and their high potentials to replicate in a wider region. In addition, according to the assessment panel's comments, these solutions were financially affordable to low-income families and offer them safer and more comfortable living places.

This project has addressed three outstanding points related to three issues: site planning, building design, and construction technology forraising disaster resilience for housing (Fig. 3). Firstly, settlement patterns are taken into account with an emphasis on

Table 1 Three housing models proposed in the 1st prize project [10].

Tube House	Three-compartment House	Twin double-storey House
		

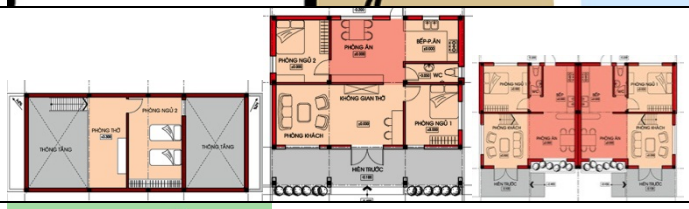
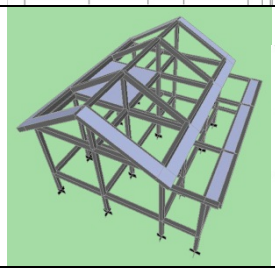
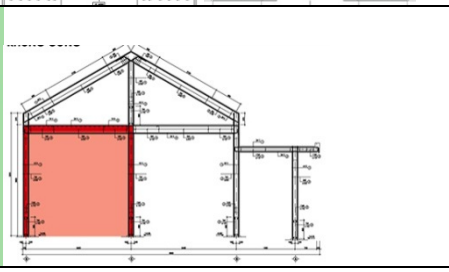
Site planning Non-parallel or zigzagging roads and buildings	
Building Design Simple building forms (rectangular or square) high-sloping or pitch roofs	
Construction Technology All building parts are securely connected *(left)* Safe failure by using a solid room in the house *(right)*	 

Fig. 3 Key Resilient Design Features addressed in the wining project [10].

using non-parallel or zigzagging roads and unequal distribution of houses to split wind flows into smaller ones to reduce wind effects pressed on buildings. Secondly, simple building forms (e.g. rectangular or square) and high-sloping or pitch roofs are employed as a key principle to design individual houses for storm risk reduction. And thirdly, construction technology for resilient shelters needs to follow two fundamentals: (i) all building parts from the top to the bottom need to be securely connected together by reinforced-concrete beams and pillars and (ii) there must be a solid strong room, known as a safe failure, made by reinforced concrete in each house for escape in case of calamitous typhoons.

3. Analytical Framework

This paper was structured following a sequential process to generate key lessons learnt from the competition (Fig. 4). The first-prize winning project plays a key role as the backbone of this paper to generalise findings and implications. Information and data collected from the submitted design projects, particularly the first-prize winner, were analysed to come up with some possible assumptions. These assumptions were subsequently reviewed in relevant literature to consolidate their validation before generalizing key findings and recommendations.

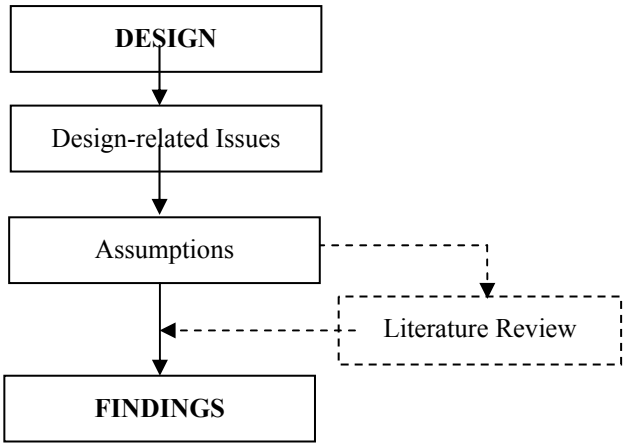


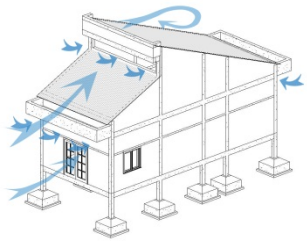
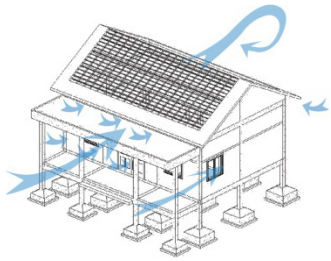
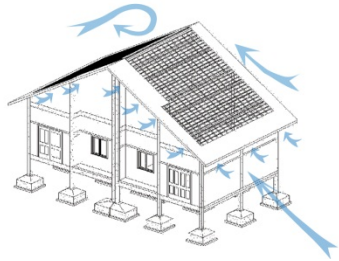
Fig. 4 Analytical framework to generalise assumptions from the design competition.

4. Design-related Issues

The examination of the1st prize project through its drawings and written explanations enabled the determination of design-related issues potentially useful for future developments of climate resilient housing. It ranges from physical (e.g. unsafe conditions of existing local houses) to social (e.g. economic constraints of low-income families) and administrative aspects (e.g. lack of safety-related building codes or construction standards in hazard prone areas) factors.

Physically, as the first fundamental requirement of climate resilience, the design addressed the use of safety-related measures for storm risk reduction such as the addition of posts and beams into building structures or strong connections for roof reinforcements (Table 2).Improvement of technical aspects for disaster risk reduction (DRR) was already emphasised in numerous texts [11-14] as one of core aspects for DRR interventions. According to the team, the proposed design was totally based on the lessons learnt from local experiences through their field visits. What they found interesting from the local context was the domination of three housing forms (tube, three-compartment, and twin double-storey as in Table 2) that were relatively appropriate to people's lifestyles and community settings [10]. In terms of storm reduction, building shapes of these forms are effective to reduce wind pressures. Thus, their approach was just adding some construction techniques to existing housing forms to increase their technical stability based on two core structural principles mentioned earlier. The respect to and integration with local knowledge in DRR solutions was already highlighted in literature as, in combination with new or scientific knowledge, a pathway to achieving sustainable DRR [15, 16]. The physical issues of housing designs mentioned above also indicated that local knowledge and experiences are still plentiful in local communities in Central Vietnam but necessitate experienced and skilled persons to capture and interpret them into resilient housing solutions effectively.

Table 2 Resilient structures to storm events given by the 1st prize design [10].

Tube House	Three-compartment House	Twin double-storey House
		

Socially, the project has figured out four major challenges to the promotion of climate resilient housing in the context of Central Vietnam. First are economic constraints generated by unstable livelihoods, high rates of unemployment, and temporary low-paid jobs of local people associated with a worsened changing climate [10]. This issue was already discussed by many authors in literatures who believed it as one of the biggest obstacles to the achievement of resilience [11, 17]. In Central Vietnam, particularly with poor and low-income groups, economic difficulties make them put DRR as the secondary priority behind basic needs of living such as food, healthcare, or school fees for children. The second challenge addressed by the project was the limited awareness of local people on climate change and the importance of climate risk reduction for a long-term development [10]. This has made them underestimate the actual danger of climate hazards and prefer immediate or short-term responses. According to the 1st prize project's author, people often think of disaster preparedness and risk reduction when they receive announcements of a coming hazard on mass media and they rush to using quick and simple measures to respond to it such as putting sandbags on roofs, or moving valuable items to safe places in house, or evacuation in case of big events. The third one is the limited skills of local builders, usually masons, in building safer and more resilient shelters. As Da Nang experienced strong typhoons just since 2006 [18], the time the typhoon Xangsane seriously destroyed the city, skills and techniques of local builders for safety purposes seem to be currently inadequate and are likely to reproduce risks to future hazards in new construction [10]. Finally, lack of communication and consultation with in-field experts and professionals (i.e. local architects and engineers) is the fourth major challenge to poor and low-income groups in building resilient shelters. Their housing construction so far is still mainly on their own without technical guidelines or instructions for disaster resilient construction. The challenges mentioned above have been identified by the team and realised as the key obstacles to a wider application of their housing designs in reality.

Administratively, even indirectly addressed in the project, it could be inferred that there seem to be a lack of local governance for an environment of safe construction. So far, no building codes and construction regulations related to DRR have been applied in the project site [10]. According to the project team, building permits are also not required for most local practices of housing construction, specifically for the single-storey shelters. People freely decided their housing forms and construction according to their needs and financial capacity [10]. And for the poor and low-income groups, many unsafe conditions could be found in their houses as no technical supports and no regulatory requirements for safe construction given to them. This limited governance really influences housing vulnerability and may undermine efforts of building a resilient

housing system to climate change in the future. In literature, limits of governance and management have been realised as a complementary catalyst to the increase of climate risks in human society [19-21].

5. Key Recommendations

5.1 Existing Local Construction Practices Remain Valuable to the Achievement of Climate Resilience

Based on the findings related to physical design-related issues, it can be assumed that local practices of housing construction are likely to reach a resilient construction. The project site, Da Nang, actually do not have long history of disaster risk reduction, first seen a strong typhoon since 2006 [18], compared with other places of Vietnam. However, the findings of the 1st prize project related to valuable local experiences existed in construction practices in Da Nang support the assumption that local experiences in other places having similar or longer times of coping with disaster in Vietnam is substantial and valuable to the future development of climate resilient housing. Referring to some successful cases of post-disaster housing reconstruction done by DWF in Vietnam, maximising the use of local knowledge in their rebuilt homes became one of the key success factors [14]. On the other side, the failure of flood-resistant houses provided by IFRC in 2000 in Vietnam was believed to result from limited uses of local resources, particularly local available materials and construction techniques [22]. This helps reconsolidate the assumption that local practices of housing construction can be viewed as a firm foundation for the promotion of climate resilient housing options in Central Vietnam.

5.2 Improving awareness of at-risk households and communities and stimulating local economy development arethe essential elements tobuild climate resilient housing.

Findings of social issues related to the design proposals help to intensify the assumption that climate risk reduction need to be extended beyond physical aspects and to social enhancements such as raising local awareness and sustain local economy. In Central Vietnam, people still underestimate climate threats and its increasing severity in future times although some public awareness raising activities are in place. For low-income groups, disaster preparedness is not as important as basic needs of living [6]. For medium and high income ones, fashionable construction through focuses on decorations and details are preferable to safe construction [18]. Adequate economic resource allows people to build a resilient housing, afford the hire of built environment professionals and think of long term development.

5.3 Bridging Gaps between At-Risk Low Income Groups and In-Field Professionals, Especially Architects and Engineers

This issue has been raised by the competition and can be seen as a common problem in reality of Vietnam. Vulnerable communities in this country often belong to poor and low-income classes [6, 11, 23] where economic constraints inhibit their accessibility to professional services for better housing design and construction. Recent literature is also increasingly concerned with the role of built environment professionals in disaster risk reduction [24, 25] in which professional expertise and skills are needed to assist at-risk communities to cope with future disasters [26]. To do this, it requires mutual and interactive learning and sharing processes among at-risk people, communities and in-field professionals through communication and consultation activities indoor and outdoor.

5.4 Applying Safety-Related Codes and Criteria for Local Construction Helps to Increase Climate Resilience

Governance-related issues in DRR have been focused in literature but expose in different forms according to different local contexts. In Indonesia,

they are limited to the problems of social conflicts, national security, decentralisation of top-down policies, and lack of political commitment [21]. In Senegal, governance issues are scoped down to the constraints posed by topographical and geographical difficulties of vulnerable locations, unclear land tenure, extremely poor people, limited healthcare, and environmental degradation [19]. In New Zealand, higher levels of disaster governance were applied with the involvement of national legislations and government acts [20]. And in Vietnam, as inferred from this competition, it is more in form of missing building codes and zoning or planning criteria for climate risk reduction in hazard prone areas (e.g. floodplains or cyclone exposed areas in Central Vietnam). Based on our previous researches and practices in the field of post-disaster housing reconstruction in Vietnam, this governance-related problems can be found almost everywhere throughout Vietnam [6, 23]. Current governance mechanisms for civil construction tend to focus on central urban districts while limited considerations for peri-urban and rural areas, the places are, in fact, more vulnerable to climate risks. Therefore, improving local construction practices through the application of safety-related regulations in form of building permits helps to create an enabling environment for resilience performances and enforce a future resilient housing system in Vietnam.

6. Conclusion

Based on the examination of a housing design competition and a review of relevant literature, this paper has come up with three important assumptions to assist future developments/interventions on climate resilient housing in hazard prone areas of Vietnam. While the first assumption tends to highlight the value of local construction practices and expertise in disaster risk reduction and management, the second and third ones appear to signify the involvement of a broader resilient context where measures for economic development, improved public awareness and effective governance are critically crucial. These three assumptions can be valuable lessons that potentially inform further researches and practices in terms of building resilient housing and settlements in the extremely climate-risk exposed areas in Vietnam.

The value of this competition is not only the delivery of design products for resilient housing but also a good initiative to raise awareness of a wider range of local stakeholders including administrative officers, scholars, practitioners, and professionals working in architecture and construction sector. The first-prize winning author was also invited by the Da Nang City's Women Union to share their lessons, insights, experiences and design outcomes with a broader community of the city to assist current local housing programs.

The findings of this paper have also generated some policy implications for local authority to issue appropriate legal frameworks and supportive programs to improve local construction and to build safer and more resilient communities, particularly with the low-income and highly disaster prone ones.

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