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Long-term satisfaction of resettled communities: An assessment of physical performance of post-disaster housing

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Abstract

Sri Lanka experiences regular natural hazard-related disasters: flooding, landslides, cyclones and droughts. These events cause devastating effects in terms of human casualties, disturbing settlements and damaging properties. Besides human casualties, one of the most visible and striking effects of these disasters is the destruction of houses: as a result, there is a requirement for post-disaster housing reconstruction. Post-disaster housing delivery can be either assistance in rebuilding original dwellings or permanent relocation to resettlement schemes. Under any of these circumstances, implementation of relocation schemes must ensure that the beneficiaries are ultimately satisfied in order to safeguard performance of such construction initiatives in the long term. The purpose of this study is to quantitatively assess and compare the long-term satisfaction of the relocated communities in relation to physical performance of the housing reconstruction projects. In addition to a literature review carried out on key performance indicators (KPIs) to investigate the long-term performance of post-disaster housing reconstruction, a survey was carried out with the occupants of flood-, landslide- and tsunami-induced relocation projects in Sri Lanka. The empirical evidence revealed that resettled communities in all three case studies were mildly satisfied in the long term in terms of physical performance of the relocation. Furthermore, provision for alteration and expansion, orientation and layout of the house, the number of rooms, and lighting and ventilation were found to be important factors that require special attention with regard to planning and design for long-term physical performance of post-disaster housing because these were found to statistically correlate with overall satisfaction across the three case study projects.

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Keywords: Long-term performance; physical performance; community satisfaction; post-disaster housing; reconstruction

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1. Introduction

Housing is usually the most valuable asset for people and is one of the worst affected sectors in most disasters. In particular, during rapid-onset events, housing is usually the element that is most extensively damaged or lost, and often represents the greatest share of loss in the total impact of a disaster on the national economy [1]. These events necessitate the rebuilding of houses and the affected communities. Accordingly, damaged and/or destroyed houses require reconstruction. In some instances, communities need to be relocated in new housing schemes. Housing reconstruction needs to adopt a more holistic approach, combining the rebuilding of houses with that of livelihoods. Under any of these situations, a long-term view needs to be taken in order to safeguard performance of such construction initiatives in the long term.

Previous research highlights that many reconstruction projects have failed due to housing that does not respond to the needs of the relocatees, for example, relocation may have negative consequences such as loss of livelihood, disruption of daily routine, interruption of social networks, and conflict with host communities. In other words, relocation deals with the principle issue of the 'moving away of people's lives', which implies moving away from places where people are accustomed to live and work, among many other aspects [2]. The reconstruction process should be considered as a development opportunity and create access to different types of innovative solutions. These innovations should lead to a reduction in vulnerability for occupants and thereby enhance resilience within the affected communities.

As part of a study investigating the long-term performance of post-disaster housing, recipient satisfaction relating to the physical performance of post-disaster housing was investigated. While physical performance was investigated along with the other aspects such as satisfaction relating to socio-economic factors, environmental and infrastructure/public services, this paper specifically focuses on the physical performance of post-disaster housing. The paper intends to provide an insight for policymakers relating to the physical factors that must be considered in order to ensure the long-term performance of post-disaster housing reconstruction projects in future.

1.1. Post-occupancy evaluation of physical performance of post-disaster housing

The literature highlights that a lack of longitudinal studies on post-occupancy evaluation leads to the failure of many post-disaster housing projects. Therefore post-occupancy evaluation is vital in order to: ascertain the tendency of a programme to be successful; identify the positive and negative impacts on housing occupants; and further identify what phases of the programme could be improved in order to maximise the satisfaction level of the occupants. There are therefore many approaches towards evaluating these aspects.

Generally, post-occupancy evaluation is used for assessing the satisfaction level of users/occupants in a specific area or for creating an architectural design rationale. Post-occupancy evaluations are human, context based and explore issues that may not normally be strongly considered by built environment professionals. The following indicators in terms of physical performance were examined in various studies: plan layout; size of house; size of interior spaces; number of spaces; number of floors; usability of spaces; interior heating and ventilation; quality of indoor air and humidity; cleaning and maintenance; type of construction; quality of interior and exterior materials; and workmanship [3]. KPIs need to be assessed in order to investigate the long-term performance of post-disaster housing reconstruction projects. Indicators for physical evaluation refer to: quality of interior spaces; needs and technical characteristics of the house; plan layout; and materials from a dweller's perspective.

In their study of owner-driven and donor-driven post-tsunami housing, Ingirige, et al [4] used the indicators of architecture/aesthetic, quality/strength and durability, functionality, space availability, availability to influence design, and flexibility relating to future changes, to measure performance of housing. Barakat [5] recognises that housing design needs to be sensitive to people's cultural or religious needs, their expectations about the proper function of housing and their social requirements. Authorities should mobilise the affected communities in target locations to create housing reconstruction committees in order to identify safe relocation sites.

One of the most crucial decisions to be made with regard to post-disaster housing is whether to rebuild damaged houses in their existing locations or resettle disaster-affected families to new sites [6]. Construction of new settlements involves a great deal of effort and requires the highest level of investment. The choice of location, site selection and

settlement planning, the choice of construction method and materials and the choice of design are all considerations that must be addressed when planning new settlements [7].

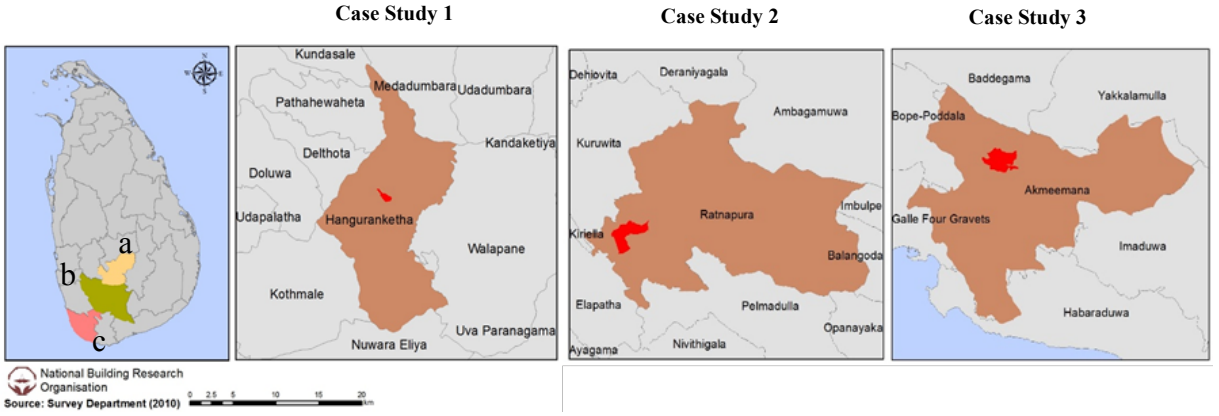
2. Method of Study and Study Locations

This study is based on empirical quantitative and qualitative findings from three post-disaster relocation projects in Sri Lanka. Data collection was carried out via: household questionnaire surveys; focus group discussions; key informant interviews; and observations. Of the total housing units, 20% random samples were selected from each location for the household questionnaire survey. Accordingly, the questionnaire survey was carried out among 120 housing units in three case study locations. The questionnaire consisted of open and multiple response questions on the physical aspect of the occupants before and after relocation. Focus group discussions were held with experts who were involved in post-disaster housing provision, whereas key informant interviews were used with officials from the Divisional Secretariat and Grama Niladaris.

The case study locations are in the Galle, Nuwara Eliya and Rathnapura districts of Sri Lanka that had been affected by tsunami, landslides and floods, respectively. Table 1 below provides basic information about the three case study locations and Figure 1 provides maps of the locations.

Table 1: Basic information about the three case study projects

Description	Case Study 1	Case Study 2	Case Study 3
Disaster type	Landslide	Flood /Landslide	Tsunami
District	Nuwara Eliya District	Rathnapura District	Galle District
DSD	Hanguranketha DSD	Rathnapura DSD	Akmeemana DSD
Funding approach	Owner Driven	Owner Driven	Donor Driven
Floor area	20 perch	6/10 perch	10/15 perch
Target units	250	246	145
Time period	2007–2009	2003–2005	2005–2006
No. of survey participants	40	50	29



Key: a - Case Study 1 - Hanguranketha b - Case Study 2 - Rathnapura c - Case Study 3 - Akmeemana

Figure 1: Map of Sri Lanka showing locations of the three case studies

With regard to the household questionnaire survey, the level of satisfaction of the occupants a decade after the disaster was measured against what they had received in respect of the physical aspect. In relation to the physical aspect, respondents were asked to rate their level of satisfaction based on the 5-level Likert scale (4: Highly Satisfied; 3: Satisfied; 2: Dissatisfied; 1: Highly Dissatisfied; 0: Do not know/not sure).

As mentioned previously, a literature review was carried out in order to identify the criteria to ascertain the physical performance of settlement. Table 2 below provides the selected criteria to which the level of satisfaction was related.

Table 2: Selected physical criteria to assess the level of satisfaction of occupants

Physical Performance	
Plot size	Level of privacy
Size of house	Ease of cleaning/maintenance
No. of rooms	Provisions for alterations/expansion
Lighting and ventilation	Sanitary facilities
Quality of building materials	Location of settlement compared to previous
Quality of workmanship	Distance to city centre
Orientation of the house	

Source: Authors, 2017

The data were analysed, together with the empirical evidence from the household survey in the respective case study sites. In this paper, we seek to present the findings in relation to user satisfaction with regard to the physical performance of the house itself.

3. Findings and Discussion

3.1 Long-term satisfaction of housing recipients

Table 3 below demonstrates user satisfaction levels across the three case studies. Given the way in which the scores were allocated using the Likert scale options, a score of 2.5 can be considered as the cut-off point for satisfaction/dissatisfaction.

Table 3: Level of satisfaction of occupants with regard to physical aspect

	Rathnapura			Hanguranketha			Akmeemana			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
Plot size	2.50	50	.580	2.66	41	.693	2.72	29	.649	2.61	120	.639
Size of house	2.76	50	.591	2.73	41	.549	2.48	29	.574	2.68	120	.580
No. of rooms	2.68	50	.621	2.71	41	.559	2.48	29	.509	2.64	120	.577
Lighting and ventilation	2.74	50	.600	2.80	41	.401	2.72	29	.528	2.76	120	.518
Quality of building materials	2.56	50	.675	2.68	41	.567	2.03	29	.626	2.48	120	.673
Quality of workmanship	2.82	50	.482	2.80	41	.459	2.10	29	.673	2.64	120	.605
Orientation of the house	2.82	50	.523	2.90	41	.374	2.79	29	.726	2.84	120	.534
Level of privacy	2.54	50	.646	2.90	41	.374	2.97	29	.325	2.77	120	.530
Ease of cleaning/maintenance	2.70	50	.647	3.00	41	.224	2.79	29	.559	2.83	120	.529
Provisions for alterations/expansion	2.54	50	.613	2.68	41	.567	2.62	29	.677	2.61	120	.612
Sanitary facilities	2.70	50	.735	3.10	41	.300	2.90	29	.489	2.88	120	.582
Location of settlement compared	3.14	50	.670	3.24	41	.624	2.90	29	.900	3.12	120	.724

to previous dwelling												
Distance to city centre	3.02	50	.622	3.27	41	.501	2.79	29	.940	3.05	120	.696
Overall satisfaction (including other aspects of assessment)	3.04	50	.755	2.93	41	.519	3.00	29	.655	2.99	120	.655

3.2 Occupancy rates of original recipients

It was noted by the Divisional Secretaries and Grama Niladharis that several houses had already been sold or rented by the first owners. In some cases, they had moved back to their original settlements. This observation is particularly noticeable in Rathnapura, where only 53% of the original relocatees remained in the settlement and 47% of the relocatees had already moved away. Only 21% and 27% of relocatees had moved away from the Hanguranketha and Akmeemana settlements, respectively. According to information gathered from the key informants and the focus group discussions, the reasons for migration were: education; employment; distance to livelihood activities; dissatisfaction with current location when compared to previous location(s); inadequate space for cultivation; and dissatisfaction with the existing surrounding environment.

As noted by Da Silva, et al [8], initial occupancy rate in post-disaster housing projects is a proxy for quality or acceptability for beneficiaries. Similarly, rate of occupancy of original recipients can be a proxy for long-term satisfaction of the recipients. While a certain level of transfer of ownership is to be expected, given the changes in circumstances such as economic status and employment, a considerably higher rate could be an indication of the level of dissatisfaction or the property being provided not meeting the requirements of the recipients. This seems to be the case, particularly in Project 2. Launched in 2003 to relocate flood victims in the Rathnapura district, Project 2 is the oldest of the three projects surveyed and relates to the pre-tsunami era. Following the Boxing Day tsunami in 2004 and the subsequent huge housing projects to house those affected, both policy and practice on post-disaster housing have seen extensive transformation. A higher percentage of original occupants remaining in their houses as a result of the two housing projects relating to the post-tsunami period could be an indication of the fact that the process has now become more occupant friendly.

3.3 Housing design

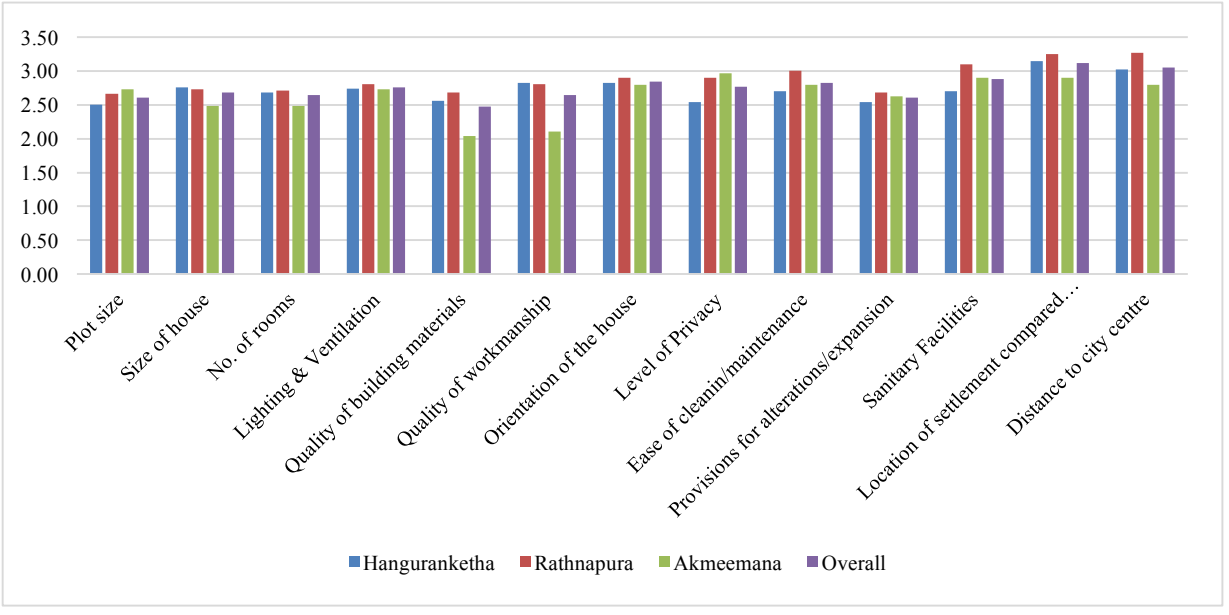


Figure 2: User satisfaction level relating to house design in the three case studies

Housing design is a key factor relating to long-term satisfaction. Occupants' satisfaction level on house design was studied by analysing the level of satisfaction on: plot size; size of the house; number of rooms; lighting and ventilation; quality of building materials; quality of workmanship; orientation of house; level of privacy; ease of cleaning/maintenance; availability of space to carry out livelihood activities; provisions for future alterations; and the availability of sanitary facilities.

The survey results from the three case studies show that all respondents were satisfied with the plot size of the house. Other than in Rathnapura (with a mean value of 2.5) respondents in the other study locations (with a mean value of 2.72 in Akmeemana and 2.66 in Hanguranketha) were satisfied with plot size of house and number of rooms. Interestingly, the Rathnapura project had the highest plot size among the three case study sites, but reported a slightly lower level of satisfaction. Respondents in all three case study locations were satisfied with ventilation in the houses.

The lifespan of a house depends on the building materials used for its construction. Therefore, when evaluating the physical condition of a house it is important to assess the satisfaction level of the occupants with regard to the building materials used. Analysis revealed that respondents in the settlements in Hanguranketha (a mean value of 2.68) and Rathnapura (a mean value of 2.56) were satisfied with the building materials used to construct their houses. Furthermore, the majority (a mean value of 2.03) of respondents in the China friendship village in Akmeemana were dissatisfied with the building materials used to construct their houses. Occupants have since replaced many parts of their houses in order to upgrade the quality. In addition, only the respondents in Akmeemana were dissatisfied (a mean value of 2.10) with the quality of workmanship of the house. Respondents in all three locations were satisfied with the orientation of the house (a mean value of 2.9 in Hanguranketha, 2.82 in Rathnapura and 2.79 in Akmeemana).

Privacy is one of the important factors relating to a house. When compared with the other two relocation projects, the satisfaction level relating to privacy is somewhat less in the Rathnapura settlement (a mean value of 2.54). The majority of respondents here complained about the selling of illegal drugs, which has led to robberies in the area.

Of particular importance, respondents in all three settlements were satisfied with the ease of cleaning/maintenance of their houses (a mean value of 3.0 in Hanguranketha, 2.79 in Akmeemana and 2.7 in Rathnapura). However, all respondents in all three case studies were dissatisfied with the space available to carry out livelihood activities (a mean value 2.17 in Hanguranketha, 2.2 in Rathnapura and 2.38 in Akmeemana).

With regard to the time spent carrying out alterations and expanding their houses, in all three case studies all respondents were satisfied with the opportunity to do this. Consequently, people have carried out such alterations as building walls, creating shaded areas from the sun, changing interior materials, changing the ceilings and installing drains. Respondents stated that the alterations created more space to enhance privacy and to upgrade the quality of their houses. Moreover, all respondents in all three case studies are satisfied with the availability of sanitary facilities at the settlement (a mean value of 3.1 in Hanguranketha, 2.9 in Akmeemana and 2.7 in Rathnapura).

Figure 3: Examples of modifications carried out by occupants in post-tsunami houses

3.4 Correlation with overall satisfaction

Participants were also asked to indicate their overall level of satisfaction relating to their current dwelling unit (including other aspects investigated: physical, social, economic, infrastructure and public services). As shown in Table 4 below, these responses were positive in all three case study projects. Correlation analysis demonstrated that

the physical aspects of orientation and layout of the house, provision for alterations, number of rooms and lighting and ventilation statistically correlated with overall satisfaction.

Table 4: Correlation between overall satisfaction and satisfaction on physical aspects

	Correlations	Correlation to Overall Satisfaction
Plot size	Pearson Correlation	.072
	Sig. (2-tailed)	.431
Size of house	Pearson Correlation	.170
	Sig. (2-tailed)	.063
No. of rooms	Pearson Correlation	.215*
	Sig. (2-tailed)	.019
Lighting and ventilation	Pearson Correlation	.192*
	Sig. (2-tailed)	.036
Quality of building materials	Pearson Correlation	.009
	Sig. (2-tailed)	.922
Quality of workmanship	Pearson Correlation	.056
	Sig. (2-tailed)	.543
Orientation of the house	Pearson Correlation	.284**
	Sig. (2-tailed)	.002
Level of privacy	Pearson Correlation	.164
	Sig. (2-tailed)	.074
Ease of cleaning/maintenance	Pearson Correlation	-.004
	Sig. (2-tailed)	.963
Provisions for alterations/expansion	Pearson Correlation	.243**
	Sig. (2-tailed)	.007
Sanitary facilities	Pearson Correlation	.108
	Sig. (2-tailed)	.242
Location of settlement compared to previous	Pearson Correlation	.162
	Sig. (2-tailed)	.078
Distance to city centre	Pearson Correlation	-.073
	Sig. (2-tailed)	.429

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

N is 120 for all correlations

4. Discussion and Conclusion

In general, respondents expressed their satisfaction with a wide number of aspects surveyed. The sample approached in the study consisted of those who had been the victims of a disaster event and had received a permanent house as part of the selected project. There is obviously an element of bias here because the least satisfied recipients may have already left their houses. However, the survey provides a good account of the satisfaction levels of those who are still occupying their houses, thereby providing an indication of the level of performance of the housing project.

Although the level of satisfaction was positive relating to many of the aspects, it was not strong in the majority. For example, although the recipients were in general satisfied about plot size, provision for alterations, size of the house and number of rooms, the level of satisfaction was minor when the Likert options were statistically analysed.

The significant number of houses destroyed and damaged by a catastrophic natural disaster generates demand for permanent resilient housing. The prime aim of this paper is to examine the user satisfaction level on the physical performance of post-disaster housing in the long term. In terms of physical aspect, the majority of the respondents in all three settlements were satisfied overall. Orientation and layout of the house and provision for alterations/expansion showed a significant correlation with overall satisfaction. Furthermore, satisfaction relating to the number of rooms and lighting and ventilation were found to correlate with overall satisfaction about the house. While the sample size is relatively small, the findings indicate that these factors statistically correlate with the overall satisfaction of housing recipients in the three selected case study sites. Based on the evidence from these three case studies, these aspects seem to require special attention in order to enhance the overall satisfaction level of recipients, and thereby to improve the occupancy levels of the original recipients in the long term. Provision for alterations/expansion is significantly important because this will enable the occupants to expand/alter their homes to suit their changing needs and to improve the house initially awarded; often on a tight budget. Orientation is likely to be linked to the ability for expansion.

More significantly, when questioned about their level of engagement during the planning and design stages of the case study projects, only a very limited number of recipients stated that they were granted the opportunity to engage in the process or had been consulted. This means that the recipient requirements may not have been appropriately captured during planning, design and construction of the houses. This may have resulted in the considerable number of houses to be vacated by the original recipients across the three case study projects and lower levels of satisfaction. Therefore, active community involvement in the process from the very beginning of the process is a key requirement for future housing projects.

It is clear that recipient requirements need to be clearly identified and addressed from the beginning, as opposed to just providing ‘a house’. It is also worth remembering that most of the recipients have had permanent houses before and therefore have a certain expectation level, as opposed to social housing where the recipients may not have previously had permanent accommodation.

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