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Alternatives to Long Distance Resettlement for Urban Informal Settlements Affected By Disaster and Climate Change

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Abstract

Planned or managed resettlement is increasingly being seen as a logical and legitimate disaster risk reduction and climate change adaptation strategy for urban informal settlements in many developing country cities. Our understanding of the 50+ year history of "Development-induced Displacement" (i.e. resettlement for resource extraction or development project purposes) strongly suggests that resettlement, particularly long distance resettlement, often triggers significant, negative impacts for resettled communities. We now understand that long distance resettlement should be seen as an option of last resort. Under most climate change scenarios, informal settlements in coastal, or riverside locations are expected to be impacted negatively by climatic change, and thus the question of whether or not to resettle (despite the negatives associated with this) still arises. This paper will present several emerging and innovative alternatives to long distance resettlement, including the so-called "vertical resettlement", amphibious and floating housing, "near-site" resettlement, and in-situ climate change adaptation/upgrading. These alternatives collectively allow for a local "re-imagining of informal settlements" rather than simply "resettlement". The research methods used in this paper include a review of secondary data (n=20), and limited primary field research involving resettlement site observation and several key informant interviews (n=2).

Keywords: resettlement, climate change, near-site resettlement, floating houses, amphibious houses, in-situ upgrading, vertical resettlement

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1. Introduction

Planned relocation or 'managed resettlement' is increasingly being seen as a logical and legitimate disaster risk reduction and climate change adaptation strategy for informal settlements in many developing country cities. Resettlement is seen as an aspect of 'retreat', one of four general adaptation options to climate change induced sea level rise and flooding (the others being 'protect', 'avoid' and 'accommodate') [16]. Many developing country cities are ranked very high in terms of vulnerability to disasters, and

are predicted to be affected negatively by future climate change making their future vulnerability to hazards even greater than today [7]. In a global ranking of populations of coastal cities which are vulnerable to climate change, the top 17 out of 20 are all located in developing countries [7]. Much of this vulnerability is concentrated in urban informal settlement communities which generally feature high risk sites (e.g. floodplains, steep slopes or low-lying coastal areas), a lack of formal urban or community planning, housing designed and built by semi-skilled or uncertified designers/builders, and generally offering poor drainage [2]. Under these conditions, it is expected that resettlement will be a part of the CC adaptation plans for many cities in developing countries:

> *The relocation of people living in areas prone to natural hazards may be necessary in the case of sudden-onset events, acute environmental degradation and the longer-term effects of climate change. The fact that disasters related to climate change are becoming ever more frequent suggests that relocation will be used more often in the future to protect people from their impacts* [13, p.17].

The more than 70 years history of resettlement for development or disaster/environmental purposes, referred to as 'development induced displacement and resettlement' (DIDR) and 'environmentally induced resettlement' (EIR), has revealed significant negative impacts of long distance resettlement. Long distance resettlement is often pursued due to the challenges of finding locally available, affordable land, especially when the proposed resettlement involves urban populations. Most commonly, long distance resettlement successfully reduces or eliminates the existing vulnerability to disasters and environmental hazards [1]. At the same time the resettlement process can: increase economic vulnerability by compromising livelihoods, disrupt or destroy community social capital, create conditions which lead to conflict (e.g. ethnic conflict between the resettled residents and the locals who were already living near the resettlement site), and may introduce new environmental vulnerabilities or hazards (e.g. diseases which were not present in the old community site) [1]. Many researchers and development aid agencies, including the World Bank, have recognized the problems that long distance resettlement can trigger:

> *Relocating a population, its economic activities, and its social networks and relations, as well as its natural physical and built environment (buildings, infrastructure, and facilities) is a complex process with significant impacts—direct and indirect—on the population and on governments. A resettlement process may become an opportunity for comprehensive improvement in the*

> *quality of life of the population, even exceeding the direct objectives of disaster risk reduction. But if not duly planned or conceived as a complementary action integrated into a comprehensive risk management strategy, it may lead to ineffective and unsustainable processes that create frustration for families and governments alike* [1, p.17]

For these reasons, long distance resettlement is viewed by many researchers and practitioners as 'a solution of last resort' [4, 17]. This then creates a conundrum: disaster and climate change risks can be reduced through resettlement, but we know long distance resettlement triggers many severe negative impacts, so how should risk reduction and climate change adaptation professionals proceed?

This research examines viable alternatives to the long distance resettlement of informal settlement communities which are currently facing or could face future risks of disaster from environmental hazards. The paper mainly concentrates on informal settlements which are prone to coastal, riverine and/or pluvial flooding since flood risks are expected to be affected significantly by future climate change. Through a review of secondary data (n=20: journal articles, technical reports, conference presentations and popular news articles), and limited primary field research involving resettlement site observation and several key informant interviews (n=2), this paper presents several emerging and innovative alternatives to long distance resettlement, including: 1) "near-site" resettlement; 2) in-situ climate change adaptation/upgrading; 3) "vertical resettlement", and; 4) amphibious and floating housing. This paper contends that these four alternatives collectively allow for a "re-imagining of settlement" rather than simply "resettlement", and by avoiding long distance resettlement the four approaches help to maintain livelihoods, access to urban amenities such as transportation, and existing social capital in informal settlements.

2. Alternatives to Long Distance Resettlement

2.1. Near-site resettlement

Near-site resettlement (also sometimes called 'in-city' or 'on-site' resettlement [17]), can be defined as efforts to relocate at-risk residents and communities as close as possible to their original communities. Typically, informal settlement dwellers have been attracted to their original community site due to a combination of factors such as low cost or free land, affordable or 'self built' housing, access to affordable transportation, a lack of bureaucracy surrounding home building, supportive social networks, and

livelihood opportunities [3]. Near-site resettlement can help to simultaneously reduce hazard/disaster risks while preserving some of the positive factors that attracted residents to these communities in the first place. For example, whereas long distance resettlement might cause informal settlement residents to lose their source of livelihood and their access to affordable transportation, and might disrupt their social networks, near-site resettlement could allow for the preservation of all three of these factors since the community members, and general location and features of the urban landscape surrounding the resettlement site will still be familiar to residents. Research by Sattherthwaite et. al. [14, p.27] in multiple informal settlements reveals that residents are generally willing to relocate short distances: “Most inhabitants of informal settlements would move to (more) formal settlements if these better met their needs and capacities to pay”.

Near-site resettlement is conditional on finding a nearby site which is suitable and affordable, while also being less risky from a hazards and climate change perspective. As one example of this, Taylor summarizes the process that was used in the city of Solo/Surakarta in Indonesia following the catastrophic flooding in 2007. Approximately 993 households were resettled from the floodplain of the Bengawan River (also called Bengawan Solo River) which flows through the city.

> *In November 2007, seasonal rains brought large-scale flooding to the Bengawan River, resulting in damage to 6,368 homes. Given the high cost of providing emergency services and the more than US$ 27,000,000 in damage caused by the flooding, Mayor Joko Widodo decided to attempt to relocate those in areas of high risk to safer locations. Since such flooding had repeatedly caused damage for a number of years, it was decided that moving settlements out of harm’s way would be the safest option. This relocation programme has been considered a success, as nearly 1,000 houses have been relocated and families that have moved generally feel satisfied with their new locations and living situation*. [18, p.626-627].

Most of the resettled residents did not have secure tenure in their former, risky homes located on the floodplain, so they were offered disaster or resettlement compensation which allowed for the purchase of land, and many chose to purchase land within several kilometres of their former homes. In some cases, collective purchases of larger plots of land near the former floodplain communities were made which allowed multiple families to relocate as a group, preserving social capital. Several of these larger resettlement communities were very close to the original flood-prone site, which helped to preserve livelihoods and allowed residents to go on with their lives very much as before but

without the constant risk of flood [10, 11]. One of these sites is the community of “Pucang Mojo” which is approximately 5 kms from the original floodplain communities and is built well above the highest expected flood stage. See **Figures 1** and 2 to compare the original flood-prone site with the resettlement site.

Figure 1: Informal Settlements located on floodplain (yellow line = approximate innundation level in 2007) Photos: Doberstein 2016

Figure 2: Resettlement community “Pucang Mojo” (approximately 5 kms from original floodplain site) Photos: Doberstein 2016

This case demonstrates that near-site resettlement can work in cases where land is available nearby, where there is political will to fund and coordinate resettlement, and where residents of flood-prone communities are confident that their livelihoods, access to urban amenities and social capital will be preserved in the new resettlement site.

2.2. In-situ upgrading

Decisions to resettle informal settlements residents on safer sites vs. ‘reimagining’ communities in place via in-situ upgrading are highly context-dependent [2]. In cases where it is not technically feasible or financially affordable to resettle communities away from risky sites or to protect communities via engineered works, risk reduction

and climate change adaptation specialists may find in-situ upgrading is the best option available. In-situ upgrading has been used for decades in many developing countries as a strategy to improve the living conditions of informal settlements, so the use of this approach for risk reduction and climate change adaptation purposes is just a recent variation on a proven approach. In-situ upgrading, sometimes referred to simply as "upgrading", is defined by Sattherthwaite et. al. [14, p.19] as follows:

> *Upgrading is a term given to government measures to improve the quality of housing structures and the provision of housing and community-related infrastructure and services (such as piped water, sewers and storm drains) to settlements that are considered to be (or officially designated as) 'slums' or informal settlements. Upgrading (also includes) community-driven upgrading...and upgrading undertaken by local government-community organization partnerships.*

When used specifically for disaster risk reduction or climate change adaptation purposes, especially related to hydrometeorological hazards, in-situ upgrading refers to actions that can be taken to decrease informal settlement dwellers' vulnerability and improve their resilience to disasters and the effects of climate change. Depending on the risk context of the community, these actions may include [13, 14]:

- Facilitating secure tenure for residents
- Widening and deepening drainage canals
- Removing river obstructions (e.g. encroached housing, illegal construction waste, illegal docks and water diversion structures, etc)
- Elevating homes
- Elevating and improving communal infrastructure (e.g. walkways, bridges, access roads, schools, communal workspaces, water, electrical and sewer pipes, etc)
- Covering drainage ditches and canals (human health risks)
- Improving waste management
- 'Softening' surfaces in the settlement (e.g. porous pathways/roads)
- Adding storm water storage/management features
- 'Hardening' surfaces that are being eroded during hazardous events (e.g. coastal edges, riverbanks).
- Using the upgrading process to improve local livelihoods

As shown in **Figure 3**, the in-situ upgrading process is also an opportunity to address other development needs in the community and often, both hazard and development-related needs can be addressed simultaneously.

Figure 3: In-situ upgrading for disaster risk reduction and climate change adaptation, Sao Paolo, Brazil Source: Smith 2008

2.3. Vertical resettlement

Vertical resettlement is an offshoot of in-situ upgrading in that the approach attempts to improve the living conditions of existing communities (including reducing hazard and climate change risk) by freeing up space and upgrading housing through 'resettling/building vertically' rather than horizontally [6, 22]. Typically, informal settlements are dominated by one to three story low-rise dwellings, and since space for housing is usually at a premium (and there may not be any overall settlement planning body) there are usually very few open, green or communal spaces, and community infrastructure and access is usually very substandard.

The vertical resettlement concept has been most fully developed in Mumbai, where Gill and Bhide [6] have identified five key steps toward the verticalization of informal settlements:

1. Informal settlements covering a large land area are identified by municipal government planners for possible 'verticalization' (Note: As explained below, land values in the immediate vicinity must be high for the approach to work out financially).

2. Local community organizations and settlement leaders are approached, and participatory community meetings are held in order to explain the concept. These organizations and leaders are then asked to coordinate some form of official community feedback, including a possible vote to participate (voting is not mandatory, but is one option).

3. If residents agree to participate, land ownership is transferred to private residential developers who engage in a process of building both market-based and social 'vertical housing' (i.e. medium to high-rise buildings). Profits from the sales of the market-based housing covers at least a portion of the cost of the social housing for former low-rise informal settlement dwellers (i.e. Municipalities may wish to contribute funds in order to provide incentives for private developers).

4. As construction proceeds, residents are moved into the vertical social housing and the old low-rise informal houses are demolished and refashioned into communal space, green space and additional vertical housing/apartments.

5. Throughout the process, possible hazards and future climate change risks are identified and mitigated through the ongoing construction process (e.g. low-rise riverfront homes which were prone to flooding are removed, and elevated high-rise replacements are built in a location not subject to the same flood risk).

One Mumbai vertical resettlement project in operation from 2004-2012 yielded impressive results [6, p.7]: "Since 2004-05 more than 65,000 apartments have been constructed under this scheme and 45,000 families have moved into these apartments". Gill and Bhide [6] go on to explain that the vertical resettlement approach works best in cities with both large populations of informal settlement dwellers and high land values:

> *The main driver of the model is the high cost of land in Mumbai. An average slum that occupies 10 square meters of land costs less than a 100 dollars to build, but occupies land valued at between US $100,000-200,000. The pay-off from (vertical) resettlement of these slums in a manner that helps reduce the total footprint of the slums is, therefore, huge. The model is therefore feasible primarily in densely populated metropolitan areas with expensive land where recovery of land through the implementation of this model can yield significant returns.*

The main advantage of the vertical resettlement approach is that, through the verticalization process, informal settlements can be reconfigured and re-imagined to reduce disaster and climate change risks while concurrently dealing with wider housing and

community development concerns. See **Figure 4** for an image (hypothetical) of what the conversion from low-rise to high-rise housing process might look like in the middle of the verticalization process.

Figure 4: Vertical resettlement: hypothetical mid-process image [19].

2.4. Floating and amphibious housing

Many informal settlements face repeated or chronic flooding problems, including those located in low-lying coastal areas (i.e. coastal flooding, typhoons/hurricanes), on flood-plains (i.e. riverine flooding), or in low-lying areas of densely populated cities (pluvial flooding), and these communities in particular may warrant a floating or amphibious housing 'resettlement' solution. Floating housing has been used successfully for many years in areas where access to water is an integral part of local livelihoods (e.g. Lake Tonle Sap in Cambodia, and Ha Long Bay in Vietnam). However, the majority of informal settlements in coastal areas feature houses built on stilts over the water (e.g. Tondo in Manila, Philippines. See **Figure 5**) rather than floating houses. During extreme weather events such as typhoons, high onshore winds, or so-called "king tides" (the combination of high tides, storm surges, and sometimes nearby riverine flooding) these stilt house communities can face significant flooding and housing damage. Accordingly, profes-sionals who are looking to reduce disaster risks and foster climate change resilience in

coastal or lagoonal informal settlements should also consider the option of 'resettling' residents of stilt homes into floating homes (see **Figure 6**), either by retrofitting existing homes with the necessary buoyancy, or by moving residents into new-build floating homes. Floating home approaches are already being explored as possible climate change adaptation strategies in Ho Chi Minh City and Cape Town [8].

Figure 5: Tondo, Manila Stilt Homes and Stilt Homes Damaged by Typhoon Rammasun (2014) Photos: Willaert 2010; Los Angeles Times 2014

Another related approach, amphibious housing (see **Figure 6**), involves the design of homes which normally rest on the ground, but during flood events have been designed to float. English et. al. [5, p.2 emphasis added] provide further details on this innovative housing approach:

> *Amphibious architecture refers to an alternative flood (risk reduction) strategy that allows an otherwise-ordinary structure to float on the surface of rising floodwater rather than succumb to inundation. An amphibious foundation retains a home's connection to the ground by resting firmly on the earth under usual circumstances, yet it allows a house to float as high as necessary when flooding occurs. A buoyancy system beneath the house displaces water to provide flotation as needed, and a vertical guidance system allows the rising and falling house to return to exactly the same place upon descent.*

Like floating homes, amphibious housing can be designed as a retrofit to existing informal settlement housing, or as new build construction. Bouyancy can be achieved through the addition of any durable floating material, from expanded polystyrene ('styrofoam'), to purpose-made pontoons, to empty barrels/drums, to capped and sealed empty drink containers and water bottles. This raises the enticing possibility of enhancing existing livelihoods commonly found in informal settlements (i.e. waste-picking) through the systematic search for and diversion of buoyant materials (i.e. waste Styrofoam, containers and bottles) for floating and amphibious house use.

Figure 6: Floating home on Tonle Sap, Cambodia, and Amphibious Home in the Mekong Delta, Vietnam Photos: Vann 2016; Tien 2018

3. Discussion

Each of the four alternatives to long distance resettlement reviewed in sections 2.1-2.4 allow for the maintenance of existing social capital, livelihoods, and access to urban amenities such as local transportation, while reducing the risks of natural hazards and future climate change at the existing settlement. This is an important contribution to the current discourse on 'climate migrants' and 'climate change resettlement' which often assumes long distance movements, and in many cases, the total transformation of the communities being resettled.

This paper contends that these four alternatives to long distance resettlement allow for a context-sensitive approach to disaster risk reduction and climate change adaptation which is important because the risk profiles of informal settlements vary considerably from one settlement to the next. Some informal settlements may be located on relatively low-value land which is unattractive for private developers, and in that case, the 'vertical resettlement' approach would likely be bypassed in favour of one of the other three options. Likewise, some coastal informal settlements may be too exposed to periodic high winds or damaging waves and currents to allow for the safe use of a floating/amphibious housing approach to resettlement, and so one of the other three approaches may end up being more viable. There is also the opportunity to combine more than one approach in any one community – in-situ upgrading might be an appropriate solution for one part of the informal settlement, while near-site resettlement might be an appropriate solution for another part of the same community.

It is important to note that each of the four alternatives just discussed require a funding mechanism. Funding is needed for the near-site resettlement option in order to purchase appropriate land near the original informal settlement, to build appropriate housing on that land, and to assist residents to move their household goods to the new site.

Similarly, funding is needed for the in-situ upgrading option in order to cover the costs of settlement upgrade planning, infrastructure and housing upgrading, land purchase and registration, and investing in the creation of new or enhanced livelihoods for settlement residents. The funding requirements for the vertical resettlement option were alluded to in section 2.3, but it is worth stressing yet again that this option, if planned carefully, essentially 'pays for itself' through the profits that developers earn on the market housing portion of the redeveloped settlement (i.e. a portion of the profits earned on market housing are diverted to fund the social housing portion). Lastly, funding is also needed to cover the cost of the floating or amphibious housing option – it has been estimated that building an amphibious home instead of a traditional 'slab on grade' home adds about 10% to the overall cost [5], and of course retrofitting an existing house to become a floating/amphibious house requires funding. Sources of funding which might cover the near-site resettlement, in-situ upgrading, and floating/amphibious housing options include:

- local municipal government;
- aid agency grants;
- climate change adaptation funding (e.g. The Adaptation Fund);
- disaster risk reduction funding (e.g. NGOs, UN agencies, bilateral/multilateral aid donors), and;
- 'matching' programs whereby informal settlement residents, municipal governments, state/federal governments and aid agencies all share in a portion of total program costs.

However, despite these possibilities most researchers examining funding mechanisms for proactive DRR and CCA conclude that the need for funding greatly outstrips available opportunities for funding, and there is still a marked tendency for funding agencies to invest in disaster response rather than proactive risk reduction. A 2013 ODI study examining 20 years of aid funding (1991-2010) found that just 12.7% ($13.5 billion out of $106.7 billion spent on disasters) was for proactive DRR actions [9, p.5]. Clearly there is significant scope to re-orient funding from a culture of 'endure and then fix disaster damages' to 'reduce disaster potential'. Climate change adaptation funds coming on stream in the last 10 years have helped fill this gap somewhat, but there is still a need for additional funding to cover proactive risk reduction in at-risk locations such as many informal settlements.

4. Conclusions

This research concludes that there are multiple viable alternatives to long distance resettlement when informal settlements are threatened by disaster risk and climate change, and that re-imagining these settlements more or less in place, rather than resettling them over long distances, might reduce the overall negative impacts of the 'resettlement' process. The research also concludes that careful attention to funding must be paid in order to ensure the costs of local resettlement can be covered without unduly burdening residents.

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