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Reclaiming On-Site Upgrading as a Viable Resilience Strategy-Viabilities and Scenarios through the Lens of Disaster-Prone Informal Settlements in Metro Manila

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Abstract: The Philippines is argued as the only Southeast Asian country where informal settlers' communities have been self-organized and produced discernible impacts on the country's urban policies. As one of the high risk countries, fifty percent of the country's informal settlements are located in danger and disaster-prone areas. However, informal settlement upgrading has not reached its significance in disaster mitigation and community resilience building. At the national level, on-site upgrading is not established in disaster risk management or climate change adaptation strategies, which explains the lack of strategic approaches for local implementation. Metro Manila serves as a suitable backdrop in this sense to study informal settlement upgrading under the condition of high risk and rapid urbanization with a high civil society engagement. This study investigates the underlined reasons why upgrading strategically falls short in addressing disaster mitigation and community resilience building. Theoretically, it questions what on-site upgrading is about. Empirically, two hazard-prone informal settlement communities within Metro Manila are examined with their different risk profiles, community development needs and resilience priorities. The core issues of upgrading are, therefore, differentiated at the settlement level with communities' innate socio-economic and eco-spatial features over time. Meanwhile, the paper heightens the necessity of tackling on-site upgrading at the settlement level and articulating settlements' spatial correlations with the city development, so as to sustain upgrading outcomes. In addition, this study attempts at setting up a range of scenarios conditioned with COVID pandemic fallout. It endeavors to provide another facet of how to deal with adaptation and resilience. This includes the urgent strategy shift in the housing sector and its financial sustainability, innovative mechanisms to manage uncertainty and risks, lessons for post-COVID planning, etc.

Keywords: disaster-prone informal settlements; on-site upgrading; resilience and disaster mitigation; pandemic

1. Introduction

The traditional spatial planning approach tries to spatially separate hazards and vulnerable land-uses [1,2]. This approach is not fully applicable in countries like the Philippines where the law or "rational" plans do not fit the urbanization reality of population agglomeration and rapid development. In particular, informal settlement development often takes place in hazard zones—in those areas where a retreat took place after a disaster as well as in other areas that were never used as a settlement area. Unfortunately, in the global cities of the South, whose population and urban area expand far more rapidly than what cities in "industrialized" countries experienced in the past traditional spatial planning contributes to the risk since the demarcation of hazard zones attracts informal dwellers [3].

As a consequence, many countries have been implemented resettlements schemes and policies including the Philippines [4]. The Sendai Framework of Action itself emphasizes this issue in its Priority 4 where it calls for "(e)nhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation and reconstruction" [5] (p. 22). However, off-site resettlement should always be considered under the restriction of commensurability since any resettlement—even if its voluntary—is automatically linked with a loss of relatedness of a given livelihood and requires large-scale investments in new infrastructures.

Thus, on-site community based upgrading and retrofitting should be taken into account as long as they are linked with resilience building and tailor-made to a given local disaster risk profile. Here, the New Urban Agenda vows to "commit ourselves to strengthening the resilience of cities and human settlements, including through the development of quality infrastructure and spatial planning (. . .), especially in risk-prone areas of formal and informal settlements (. . .) including the rehabilitation and upgrading of slums and informal settlements. We will also promote measures for strengthening and retrofitting all risky housing stock, including in slums and informal settlements, to make it resilient to disasters, in coordination with local authorities and stakeholders"[6] (p. 17). IPCC Fourth Assessment Report (AR4) warned the fact that climate change is very likely to lead to an increase in the frequency and intensity of some of extreme weather events (. . .) [7]. The International Federation of Red Cross and Red Crescent Societies (IFRC) reported this year "The overwhelming majority of disasters in the past ten years (83% of all disasters triggered by natural hazards) were caused by extreme weather- and climate-related events, such as floods, storms and heatwaves", and "The frequency and intensity of extreme weather and climate-related events have been steadily climbing since the 1960s" [8] (p. 4). Meanwhile, the so-called AR5 also identified the existing gap between community resilience building and upgrading [9]. "One of the greatest challenges for climate change adaptation is how to build resilience for the billion urban dwellers who are estimated to live in what are termed informal settlements" [10] (p. 11) and "these settlements face particular challenges in terms of vulnerability to climate change and disaster risk (. . .) [11] (p. 9)". This study views the metropolitan region, such as Metro Manila, bears the brunt of these indicated facts.

Metro Manila is the largest and fastest-growing metropolitan area in the Philippines and encompasses 16 so-called "Local governmental Units" (LGUs). Consequently, any resettlement and upgrading policy should consider the entire metropolitan region. The region has, for decades, attracted migrants from the provinces, not all of whom have found formal housing. The National Economic and Development Authority (NEDA) estimated that there were 2.8 million informal settlers, or 556,526 informal settler families (ISFs), living in Metro Manila. Out of this number, 104,000 families are occupying areas identified as danger zones, such as railroad tracks, garbage dumps, canals, rivers and creeks and other flood-prone areas. Many of these ISFs also live in houses made of light materials, and are therefore particularly vulnerable to natural disasters besides evictions [12].

2. Methods and Evidences

The study is guided by two research questions:

- What made upgrading not a prioritized resilience strategy with regards to disaster mitigation and risk management?
- Why is upgrading not an evidence, instead being an exception, when dealing with community resilience?

Despite recognizing the importance of upgrading to development and disaster risk reduction, there lacks evidence on their complex interactions and lessons learned from the participatory process to provide evidence at the local level with different lenses [10]. The methodological approach of this study is highly participatory, demonstrating a hybrid of multi-spectrum stakeholder workshops, field visits in Metro Manila and online surveys, etc. This study is mainly fieldwork-based rather than being desk-top research. Therefore, it uses dominantly primary data including local community group discussions,

expert interviews, own project proposals, interim reports for the Ministry and correspondence with the local expert team in Metro Manila. All of this evidence geared knowledge preparation for a final "Resilient Upgrading Online Validation Workshop" on 8 October 2020 (via Zoom).

Concerning the two case studies in this paper, data were mainly collected in conjunction with a multi-level stakeholder workshop (50 participants) which took place in Metro Manila in February 2020. This was shortly before the lockdown of Metro Manila due to the COVID-19 pandemic.

Relevant to this paper, are two sets of online questionnaires. The first set (pre-workshop) was selectively distributed in September 2020 to the relevant agencies who have been engaged in upgrading activities (12 respondents via LimeSurvey). The second set was a real-time polling with ca. 42 participants during the October 2020 online workshop.

The majority of Filipino participants of the Resilient Upgrading Online Workshop on October 8th were those who have been stakeholders of this research over the last two years. They represent multi-level government bodies from the Philippine national agencies (e.g., National Economic and Development Authority, National Housing Authority, Housing and Land Use Regulatory Board, Social Housing Finance Corporation, Department of Public Works and Highway, Philippine Statistics Authority, Philippine Volcanologist and Seismologist), and Metro Manila Development Authority and three Local Government Units (the City of Valenzuela, Quezon and Marikina where the initial case study areas are located for this study). International agency representatives such as from Asia Development Bank and the German Corporation for International Cooperation in the Philippines (GIZ) also participated in either online surveys or the October online workshop. Moreover, non-government organizations' representatives are also one of the important components, including Homeless People Federation Philippines (HPFP), Tao Pilipinas (a women-led NGO which works on ground with ISFs for technical assistance), Eastern Regional Organization for Planning and Human Settlements Philippines, etc. This workshop also invited three resource speakers from the national, local and NGO level with the topic of "*Responsive Resilient Upgrading Strategies and Scenarios under COVID-19 Pandemic*". Respectively, the resource speakers are the technical assistant from the Housing Support Services Group of National Housing Authority, the executive director of the Kasagana Ka Synergizing Organizations and the Head of Quezon City Planning and Development Department. The rest of the participants of the workshop are from Thailand, Vietnam and Indonesia, where this research is to be extended in the following years. Nevertheless, this paper is limited to the geographical setting of the Philippines.

The Resilient Upgrading survey questions and its online workshop were streamed into three categories:

- Upgrading Key Agencies and Planning Strategies;
- Upgrading Typologies with Localized Practices; and
- Upgrading Needs and Dimensions.

Analysis and debates of this article are partly in concord with these three categories. Nonetheless, this paper only provides partial results of the study over last two years. Besides, authors also incorporated the current pandemic into their study given its pressing impacts on informal settlement resilient upgrading and the incurred changing scenarios.

3. Key Observations of Planning Strategies and Agencies Concerning On-Site Upgrading in Metro Manila

In the following, crucial results regarding resilient upgrading key agencies and their planning strategies will be presented, combined with policy and working paper analysis. The authors' primary data from online surveys and the October online workshop substantiated the analysis and verified the findings.

3.1. On-Site Upgrading—Not a Priority as a Resilience Strategy for Disaster Mitigation and Risk Management

UNDRR [13] concluded that the Philippines is one of the leading countries in integrating disaster risk reduction (DRR) into the national laws and ordinances given the country's awareness of achieving Sustainable Development Goals (SDG) and harmonizing processes and methods to enable coherent implementation of the Sendai Framework and New Urban Agenda. In this regard, participants from Vietnam and Thailand reflected that they do not have climate change-related policy integrated with urban planning at the national and local level. Therefore, on-site upgrading as a resilience strategy is not well-known.

The Philippine National Disaster Risk Reduction Management Plan 2011–2028 (NDRRMP) [14] accentuates a "paradigm shift" from a technical and engineering approach to "non-structural and non-engineering measures, e.g., community-based disaster preparedness and early warning, indigenous knowledge and land use planning". In the light of the Sendai Framework for Disaster Risk Reduction [5], Priority 2: strengthening disaster risk governance to manage disaster risk, the Philippine National Disaster Risk Reduction Management Act (NDRRM Act) also adopts a proactive approach for risk governance. It dictates LGUs must allocate 5% of total revenue to DRR, namely 30% on response and 70% for preparedness [15]. Efficacy was seen on mainstreaming risk reduction and climate change in the national comprehensive development plan for the purpose of influencing policy and decision making. The enactment of the Disaster Resilience Act in 2018 further elevated the importance of the aforementioned mainstreaming across multi-sectors and stakeholders via focusing on proactive and viable local disaster recovery. Besides the NDRRM Plan, risk governance was deployed to LGUs via establishing local disaster risk reduction and management offices since 2014.

During the workshop on 8 October, the representative from the newly established Department of Human Settlements and Urban Development (DHSUD) acknowledged among the audience the key messages from the Housing and Urban Development Coordinating Council (HUDCC): Firstly, in the light of the climate change, HUDCC has complied with its own strategy in developing the Mid-Rise-Buildings (MRBs) via emphasizing the use of appropriate standards for housing units' construction to incorporate DRRM and climate change adaptation (CCA). Secondly, construction costs of housing units shall be reduced in consideration of the basic geographical location, soil quality and other environmental features and exploration of using indigenous and recyclable materials as environment-friendly alternatives [16]. Furthermore, the National Urban Development and Housing Framework 2017–2022 also formulated clearly security of tenure shall be for both formal and informal urban settlers. Climate-resilient and affordable housing development shall be realized through the formulation of department policies or guidelines for guiding LGUs in their city development planning activities [17].

Despite the awareness of climate change and community resilience building under the informality, this study ascertains that on-site upgrading as a strategy for resilience building falls short at the national level in terms of policy making and at the local level in terms of application in Metro Manila. This study underpins several core causes given the current failure. Regarding interknitted causes and consequences out of failing to integrate informal settlement upgrading as a strategy at the national planning level, this study disclosed three major aspects:

Firstly, 67% of agencies of the pre-workshop survey pointed out that previous upgrading projects remain spontaneous and sporadic without coordinating with city development. This situation means, on the one hand, there are few beneficiary households without fulfilling the project outreach. On the other hand, settlement upgrading has not been fed into the city's development scheme to sustain the community development in consideration of its spatial and socio-economic integration with the surrounding urban areas. Consequently, project upscaling is questionable. There are very few good practices to convince both national and local government to elevate upgrading as a viable strategy regarding DRR and resilience building. To echothis identified knowledge gap, the World Bank has initiated a citywide development approach to informal settlement upgrading in the Philippines, which is expected to allow the government to reach scale in a timely manner. This initiative also

indicated the importance of identifying priority informal settlements for upscaling via decentralizing the informal settlement upgrading process to the LGU level [18]. UNHABIT also reflected experiences that "Upgrading cannot be the only component of a housing policy and upgrading programs must be integrated with city level and country policies (...) Upgrading programs are most effective when led by the municipal authority and implemented at the community level (. . .)" [19] (p. 16–17).

Secondly, one of the consequences of the above-discussed failure of integrating upgrading as a national strategy in resilience-building leads to the fact that few agencies in the Philippines are motivated to work with upgrading programs. Our online real-time polling (Figure 1) demonstrated the intertwined factors in regard to both policy and implementation facts. The lack of national policy integration and acknowledgement also explains to a certain extent why agencies view upgrading as an 'expense' rather than an 'investment' for the city's sustainable future (39% in Figure 1). The results strengthen that ascertaining of upgrading's role in resilience building via national policy is determinant. Likewise, given the understated role of upgrading and its limited practice in Metro Manila, there exist limit good local good lessons to convince decision-makers about on-site upgrading as a resilience strategy. These above-argued aspects also enlighten the needs of a cross-sectoral coordination both vertically (from national to local to the community) and horizontally (inter-LGUs) to understand resilient upgrading by identifying common goals among all actors for DRR and community resilience building. The success of resilient upgrading hinges on multi-level collective efforts both from the government, civil society, private sectors and communities.

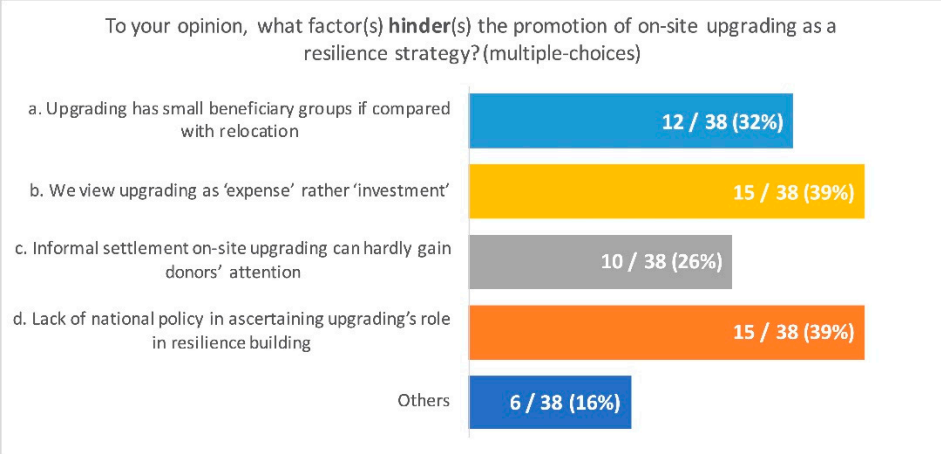


Figure 1. Real-time Zoom polling results regarding the question of "To your opinion, what factor(s) hinder(s) the promotion of on-site upgrading as a resilience strategy?" Source: Results of the authors' Resilient Upgrading Online Validation Workshop on 8 October 2020.

Thirdly, this study concluded that informal settlement on-site upgrading is not a planning priority when compared to the overall resettlement approach in Metro Manila. In order to validate this statement, the September pre-workshop survey revealed two paramount reasons, which were also agreed upon during the October workshop (see in Supplementary Materials Figure S1: Results regarding question of "Why informal settlement on-site upgrading is not a planning priority if compared to the overall resettlement approach in Metro Manila?). They are:

1. There are often strong land disputes concerning informal settlements. Stakeholders consented that the envisaged upgrading achievements cannot be secured because landowners would think ISFs will remain permanently (answer c, based on 87% of respondents).
2. Upgrading is not recognized as a new project. Hence, there is very little interest or investment in this area (answer b, based on 42% of respondents).

3.2. On-Site Upgrading—Pragmatic Issues with Its Operation

The feasibility of executing on-site upgrading shall be also taken into consideration. Statistics in 2017 showed that 51% of informal settlers in the Philippines are located in danger-prone areas and 39% of the total households were identified as ISFs in Metro Manila [20], though there are still ISFs households that cannot be geographically tracked. "On-site development" refers to the process of upgrading slum urban areas with a view of minimizing the displacement of the dwellers in said areas and with provisions for basic services. Here "danger areas" include esteros, railroad trucks, garbage dumps, riverbanks, shorelines, waterways, and public places such as sidewalks, roads, parks and playgrounds [21]. Therefore, the majority of this category of informal settlements are not suitable for on-site improvement. The second category is the 25% of informal settlements that are occupying privately-owned lands. The third category is about 18%, which are on government-owned lands. Given the scarcity of lands and increasing land prices in Metro Manila, private owners opt to commercialize their lands with an expected high turnover rather than selling their properties to the government. Government-owned properties do not equal a guarantee in pursuing on-site upgrading in regard to the market speculations and other prioritized city development schemes (see the example of Quezon City CBD in Section 5.1). Therefore, the potential operational category of informal settlement upgrading mainly refers to those settlements on government properties with political wills and a convincing city-level upgrading scheme for a long run.

Hitherto, this study showed a manifold-facet and reasons why upgrading has failed to be promoted as a resilience strategy. Pragmatically, political wills and city visions are decisive for informal settlement upgrading. So far, in the Philippines the national government is still the mainstay in funding upgrading programs. As aforementioned in Section 3.1, due to the lack of policy integration at the national level and the understated role of on-site upgrading for resilience building, there is no specific allocation of funds targeting ISFs in high-risk areas. The reality is upgrading activities are still mainly funded by the national government, which has not acknowledged upgrading as a strategy in community resilience building. The second funding source is from LGUs themselves. Since the enactment of the 1991 legislation of the Local Government Code, the LGUs of Metro Manila have been relatively autonomous. The Code enables LGUs to implement programs in urban development and housing with their own constituents. This legislation positioned LGUs in the forefront in formulating their own city development plans and implementing their prioritized development programs [22]. When being asked (Figure 2) if there are any observable geographical location changes of upgrading hotspots, 44% of participants of the October workshop considered that LGUs development plans are influential, which also reflected how the statutory position of upgrading is determinant to upgrading success. Figure 2 displays the condition of land market prices and the status of land ownership regarding this question has minimum impacts, when compared with LGUs' political will. It is evidence-proofed that individual LGU's initiatives can be very decisive in promoting upgrading as a resilience strategy.

There are so far few known cases and debates around on-site upgrading integrated with disaster mitigation in Metro Manila, when compared with in-city relocation and off-city resettlement programs over the last decades. In the late 1970s and earlier 1980s, NHA had some upgrading sites of Maricaban and Tramo in Pasay City; CAA Compound in Las Pinas City; Hulo in Mandaluyong City; Barangka in Marikina City; and Bagong Barrio in Caloocan City. They are also known as the Zonal Improvement Program (ZIP) in urban Metro Manila. In the regional cities of Cagayan de Oro, Davao and Cebu it was implemented through the Slum Improvement and Resettlement (SIR) Program. These upgrading programs were mainly driven by social movement regarding housing and urban services in Tondo Foreshore, the largest squatter area in Asia in the 1970s. Naerssen [23] argued that the Philippines is the only Southeast Asia country where informal settlers' communities have been self-organized and produced discernible impacts on the country's urban policies. However, these upgrading schemes were not integrated with disaster mitigation and fell short among ISFs due to the security of land tenure. The socio-economic and eco-spatial transformations and sustainability of those upgraded settlements were not widely acknowledged.

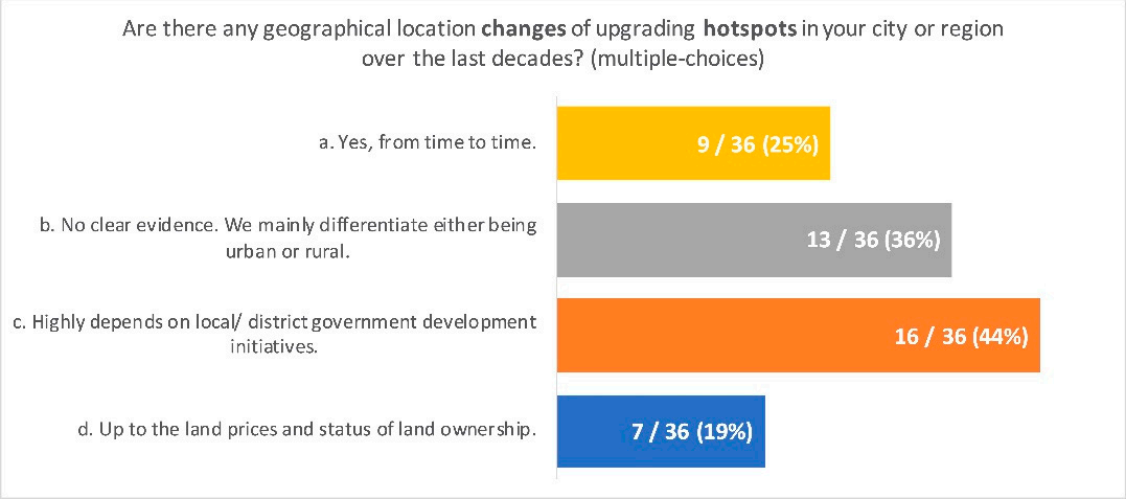


Figure 2. Real-time Zoom polling results regarding the question of "Are there any geographical location changes of upgrading hotspots in your city or region over the last decades"? Source: Results of the authors' Resilient Upgrading Online Validation Workshop on 8 October 2020.

Further, the recent large-scale programs have not significantly integrated informal settlements upgrading as a viable component. On the contrary, eviction of ISFs was quite often the precondition of implementing these programs. Taking Pasig-Marikina River Channel Improvement Project PMRCIP (2002–2006) for instance, this Japanese loan-financed program undertaken by the Philippine Government targeted rehabilitation of Pasig River and flood control. However, how to deal with the ca. 2400 ISFs along the river and in waterways have not been integrated into the program. For those ISFs in high-risk areas both under National Housing Authority (NHA) and Local Government Unity (LGU) properties, the common approach is in-city relocation or off-site resettlement. National Informal Settlements Upgrading Strategy for the Philippines reports that the massive relocation of informal settlers to a distant location, destroying the existing housing stock and replacing them with new units, has cost the Government a staggering Php 42 billion in the last 12 years. In contrast, informal settlement upgrading programs have cost much less at just nearly Php 8 billion for almost the same number of beneficiaries [24] (p. 7).

The Philippine Republic Act 7279 otherwise known as the Urban Development and Housing Act of 1992 defines Socialized Housing as "Housing programs and projects covering houses and lots or home lots only, undertaken by the Government or the private sector for the underprivileged and homeless citizens which shall include sites and services development, long-term financing, liberalized terms on interest payments, and such other benefits in accordance with the provisions of this Act" [21] (p. 4). Socialized Housing is designated to accommodate the poorest 30% of Filipinos, with the units valued at less than Php 300,000 each. NHA is mandated as the sole national government agency to engage in shelter production focusing on the housing needs of the lowest 30% of the urban population via socialized housing through comprehensive development and implementation integrated with housing and resettlement programs [25].

However, Galuszka [26] (p. 277) indicated that minimal financial resources are currently devoted to housing programs (less than 0.1% of GDP on average, which is one of the lowest amounts in Asia and Ballesteros [27] (p. 5)). According to the authors' recent workshops and surveys, the situation is not improved. Furthermore, the 20% of socialized housing that private developers are obliged to provide are usually delivered through off-city relocation. The Philippine Development Plan 2017–2022 (PDP) reveals the fact that upgrading accounts for 2.53% of NHA's housing production, while resettlement for ISFs takes 35.86% [12]. With this note, on-site upgrading in terms of housing support fell short.Moreover, here the referred upgrading was only understood as housing unit production, rather than a comprehensive strategy integrated with disaster mitigation.

Further, the NHA's target beneficiary groups are not only ISFs residing in high-risk areas, but also urban families who are in dire needs of housing within the above indicated 30%. Therefore, ISFs are automatically excluded due to their very low affordability. The PDP also pointed out there is a limited budget appropriation for the housing sector and delayed release of funds for NHA housing projects. In general, from the 1980s untill today, there shows a strong decrease in investment regarding informal settlement upgrading. During the October workshop, a resource speaker from the Housing Support Services Group of NHA introduced that, concerning the working scope of NHA, for instance in the year of 2020 within Metro Manila, upgrading related activities have merely meant survey and some titling works of the informal settlements for its housing unit production. Hence, it demonstrates a great gap in understanding on-site upgrading with this study. NHA made a clear indication this year, while categorizing calamity victims shall have the biggest share of NHA housing production. Nevertheless, it does not target directly ISFs in high risk areas in Metro Manila.

4. Two Informal Settlement Case Studies in Metro Manila

This study takes two informal settlements, respectively in two Barangays of Quezon and Marikina City (Figure 3). Both sites are very different in terms of sizes, risk profiles, community history, needs, and development priorities to heighten resilience building.

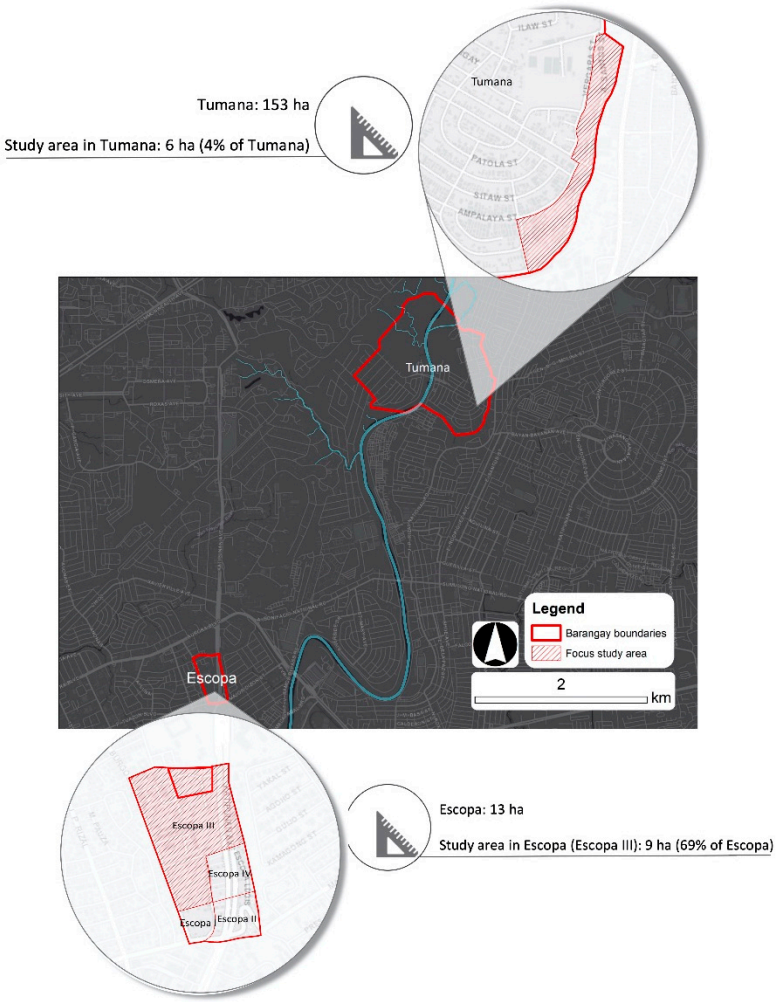


Figure 3. Focus study areas: Barangay Escopa III in Quezon City and Barangay Tumana in Marikina City in Metro Manila. Source: own illustration based on GIS base map 2020.

4.1. Barangay Escopa in Quezon: A Test Ground for Multi-Stakeholder Upgrading Projects

4.1.1. Quezon City and Its Development Strategies

Based on the 2015 census, Quezon City has a total population of 2,936,116 inhabitants and is with 142 Barangays (the lowest administrative unit in the Philippines) and 166.2 km^2 ($\frac{1}{4}$ of entire Metro Manila) the largest city in the National Capital Region. In addition to several creeks, the City's main waterways are Tullahan River, Marikina River, San Juan River, San Fransisco River, Salapan River, Pasig River, and Dario River. Particularly noteworthy is the La Mesa Dam Reservoir in the north of the city, holding up to 50.5 million cubic meters, which is the main water supplier of Metro Manila. Quezon City accommodates the largest number of ISFs (213,978 as of December 2019), or 31% of Quezon City's population. According to Quezon City Housing and Community Development and Resettlement Department (HCDRD, 2019), 60% of the total lands in Quezon are being occupied by informal settlers, among whom 59,862 ISFs are residing in disaster-prone areas including waterways, in road right-of-ways, on top of pipelines, in open spaces, etc.

Quezon housing stresses are both from the proliferation of ISFs and in-migration population growth. According to the authors' discussion with the City Planning and Development Department this year, the total demand for housing units is more than 200,000 and the real produce can only achieve ca. 1000 housing units per year. Low-cost socialized housing is viewed as one of the sustainable housing solutions for ISFs. Quezon City institutionalized HCDRD as the key implementer of the City's socialized housing program. Given that the majority of upgrading projects are still highly dependent on the national funding scheme, the City has two fund generation schemes, so far: (1) imposition of Idle Land Tax; and (2) imposition of Socialized Housing Tax. Through the creation of a socialized housing special account, the proceeds of the Socialized Housing Tax and the Idle Land Tax go into this special account, which partly addresses mitigation of disaster risks of ISFs in high-risk areas. Quezon City is also one of the few cities in Metro Manila, which realized its socialized housing program via land banking. Land banking including an inventory of lands is also recommended by the Philippine Development Plan 2017–2022 to LGUs given their endeavor for their socialized housing programs.

4.1.2. Barangay Escopa III and Its Community's Development Priorities

Escopa consists of four Barangays numbered I, II, III, and IV. The study area, Escopa III, has approximately 4000 households or 20,000 residents. Escopa III has a size of 9 ha (out of 13 ha Escopa total area) and the major road of Escopa (and also Escopa III) is crossed by Katipunan Avenue. As authors conducted a field visit in February 2020, residents pointed out that space under the flyover of this Avenue serves often as an evacuation for more than 200 people during fires, particularly the "Big Fire of 1990".

Directly to the west of Katipunan Avenue, the Oval Area, is still being considered as the last remained informal settlement area within Escopa III (Figure 4). A focus group discussion with the Barangay officers showed that the community's priorities are more affordable housing units on Quezon LGU's lands and they will pay amortization to the LGU. Secondly, there's a budget from Quezon City of eight million pesos for the construction of a parking facility and a covered court in front of the Barangay Hall. The parking facility aims at decongesting the streets of the Barangay, especially for an efficient evacuation during fires and natural disasters. The revenue of the parking facility will go to the Barangay. Besides the space under the flyover, the old barangay building is also being used as an evacuation center, as well as the covered courts. The Barangay cooperated with People's Organizations for disaster preparedness (fires, earthquakes). Hazard maps are updated yearly at the household level, as Quezon City has mandated it.

Figure 4. Site Impression of Barangay Escopa in Quezon City. (**Above right**) ISFs in the Oval Area of Escopa III next to Katipunan Avenue very prone to landslide. (**Below right**) haphazard housing conditions in Oval Area. Source: own illustration based on GIS base map 2020 and authors' field visit photos in February 2020.

4.1.3. Major Hazards in Escopa III

Escopa lies 18 to 30 m west of the West Valley Fault. Landslide observed close to the northeast boundary of Escopa is considered as the major hazard that affects the informal settlement Oval Area in Escopa III, which houses ca. 70 ISFs. Flood events, that appear, on average, once in 25 years (Figure 5), affect Escopa II-IV as well as the Barangay Marilag on the east border and the Industrial Valley in the west. Flood predictions indicate a water height up to 1.5 m, mainly in the roads of Escopa III. The analysis of landslide hazards revealed that Escopa II can be affected by unstable slope masses in the southwest. Therefore, some small areas are indicated as no dwelling zone, some require slop protection and interventions, and most are only supposed to be continuously monitored. In the area exists institutions such as a police station, daycare centre, and also Center for Health Development Region IV-B (less than 1 km away from Escopa III). Besides the existing natural hazards, the authors' field visit found out that the community considers domestic fires due to illegal electricity connections is a constant threat. Official power provision only applies to those households on lands without ownership disputes and under maintenance conditions, e.g., identified access to a major road. The Barangay wants to be fire-proof. They will make plans and conduct drills for that. Another adverse impact due to the current high-density housing projects is water shortage.

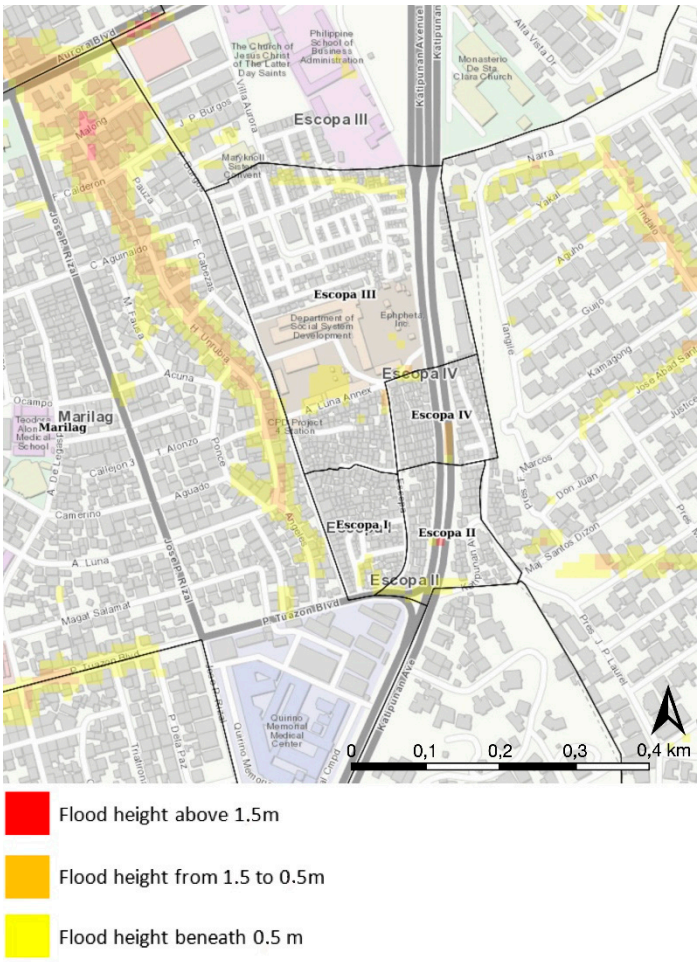


Figure 5. 25 Year flood hazard map of Escopa III, Quezon City. Source: based on Nationwide Operational Assessments of Hazards (NOAH) 2019.

4.1.4. Ongoing Housing Projects in Barangay Escopa III

Escopa has a good strategic location, close to commercial and industrial centers (Cubao) as well as to industrial services. The Barangay has a mixed tenure with both formal and informal settlements. Escopa III has the largest population and area size of all Escopa Barangays. Therefore most recent housing projects are located there.

The Quezon LGU owns all lands of Escopa III. Originally, land in Escopa III cost 250 Php/m^2. Currently, it reaches 2500 Php/m^2. The majority of housing units are social housing units in Escopa III. As of the authors' field visit in February 2020, there are eight housing projects in Escopa, respectively from Quezon LGU, Housing and Urban Resettlement Association, and Gawad Kalinga (GK), an international NGO. Different agencies have different housing beneficiaries. Bistekville 7 was an initiative of Quezon City LGU as a resettlement housing project for low-income families (Figure 6a). Its awardees have to monthly amortizations (ca. 1000 pesos per month up to 30 years). Field visit interviews disclosed that resettled residents think the amortization rate is fairly high. GK's housing beneficiaries are only those victims of constant fires from 1990 to 2018, who were originally residing in Escopa III. Through a rollover upgrading, the residents moved to GK's Shaw Keegan Village (Figure 6b). Interviews showed that GK residents are content with the results of the upgrading, though they were negatively affected by the construction and reblocking during the rollover upgrading process. Another of GK's housing projects targets only persons with disabilities (PWD) and their family members (Figure 6c).

(**a**)

(**b**)

(**c**)

Figure 6. Housing project impressions in Barangay Escopa. (**a**) Bistekeville 7 for low-income urban families; (**b**) Gawad Kalinga's (GK) Shaw Keegan Village for fire victims; (**c**) GK village for PWDs and their family members. Source: authors' field visit photos in February 2020.

4.2. Barangay Tumana in Marikina: On The Way of Upgrading Disaster Preparedness Infrastructure

4.2.1. Marikina City and Its Development Strategies

The City of Marikina, composed of 16 Barangays, had in 2015 a total population of 450,741 inhabitants on an area of 22.64 km^2 and shares a border with Quezon City. Marikina lies to the west of the East Valley Fault, which extends to the province of Rizal. Marikina is a low lying catchment

basin surrounded by Mountain Sierra Madre. The two major rivers are the Marikina River and Sapang Baho River. Marikina is traversed by the Marikina River, which exposes the Barangay to extremely high flood risks (Figure 7a). The City has achieved significant resilience to flooding (though not to earthquake) over the last decade. During Typhoon Ketsana/Ondo in 2009, Marikina achieved zero casualty due to Marikina City's effectiveness in the early-warning system. One of the important lessons gained from Marikina City is the community information services in managing crises and post-disaster recovery efforts.

Figure 7. Site Impression of Barangay Tumana in Marikina City. (**middle**). Satellite image showing Marikina is traversed by Marikina River. (**above**). DPWH's undergoing project. The 17-m water level monitored by Marikina Central Communication and Command Centre marks the first preparedness for flooding. (**below**). Residents of Block 74 indicated water level during Typhoon Ketsana in 2009. Source: own illustration based on GIS base map 2020 and the authors' field visit photos in February 2020.

Regarding low-cost social housing for ISFs, Marikina LGU is seeking affordable lands in the city to realize socialized housing programs, including negotiating with private landowners for land purchase

at a reasonable price. Recommendations from the LGU in regards to the formalization of lands in Tumana include:

- The national government through NHA can take Barangay Tumana under the land acquisition project and make people amortize to the government; and
- Marikina LGU may acquire the property, under the condition that the beneficiary can pay amortization directly to Marikina City.

4.2.2. Barangay Tumana and Its Community's Development Priorities

The total population of Tumana is 43,239, of which about 1/3 belongs to the dependent population group (young and old age). With 153 ha, Tumana covers around 7% of Marikina's total area. Edgewater Realty Development Inc. (ERDI) owns 44 ha out of the total 153 ha with ca. 5900 households living on its land property. A court case occurred in 1992 around the eviction of Tumana residents that beheld enforcement when the LGU entered negotiation with ERDI later in 1994.

Compared with Quezon, Marikina does not house a large number of ISFs. However, the majority of ISFs are dwelling in the case study area, Barangay Tumana, in Marikina, which is extremely disaster-prone. According to the Marikina Settlement Office, most ISFs of Marikina City are living in Barangay Tumana. The authors' focus study area of Barangay Tumana is its eastern area (see Figure 3 "Study Area"), owned by Marikina LGU. Altogether, there are 10 blocks in the eastern area of Tumana, being considered as informal settlements with approximately 270 ISFs. Statistics in 2014, from the City Settlement Office, showed that 8% of these ISFs were living in danger-prone areas especially those in this eastern area, which has been continuously very flood-prone. Among the total 78 blocks in Barangay Tumana in total, Block No. 74 residents were resettled in the 1990s to Tumana due to an infrastructure establishment in their original home city. Back then, Tumana was initially held as a temporary relocation site by the City of Marikina in the 1990s. Afterwards, the city government purchased the land from the private owners and took over managing this area. This area has gone through certain in-situ upgrading over the last decades, such as the drainage in the 1990s and the newly built community sports court in Block 74.

Most of residents work as construction workers and drivers with paying capacity of Php 200–500 per month to amortize. When being asked, "Based on the experience of flooding in your area, would you like to stay in your place in an event of flooding" (as of February 2020), 96% answered they would prefer to stay in their houses rather than being relocated. Residents consider employment opportunities, the proximity to jobs and community public space as community priorities. ISFs say the available public space is very important for community daily life. They said access to public space here is also one of the reasons for them to stay despite potential natural hazards.

4.2.3. Major Hazards and Risks in Barangay Tumana

The last flooding event was reported in 2019. Residents usually carry all belongings to the second floor and stay at home until the water level normalizes. However, the livelihood is heavily affected as both formal and informal commercial establishments are located on the ground floor of the buildings. However, during Typhoon Ketsana, the water level reached already the second floor and took weeks to descend (Figure 7b).

Tumana is a typical multi-hazard prone area with high potentials of overlaid risks. The hazard potential in Tumana arises from floods but also landslides and earthquakes posing risks to the area. In the event of a 25-years flood cycle, most parts of Tumana are flooded above 1.5 m. Only slots in the northwest are less affected. Also, the bordering Barangays are flooded by the Marikina River. Figure 8 the integrated hazard map of Tumana indicates that in the southeast of Tumana a significant earthquake appeared before 1990. The map does not show it, but landslides also affect the area. Small slots in the northeast are indicated to have unstable slope masses. The potential hazards pose pressing issues because critical infrastructures are located in the direct neighborhood of the Barangay. Three schools lie on its border, including Saint Nicholas High School, Christian Education Mission, and the

Balanti Elementary School. Besides, healthcare facilities in the bordering Barangays are also located in potential flood areas.

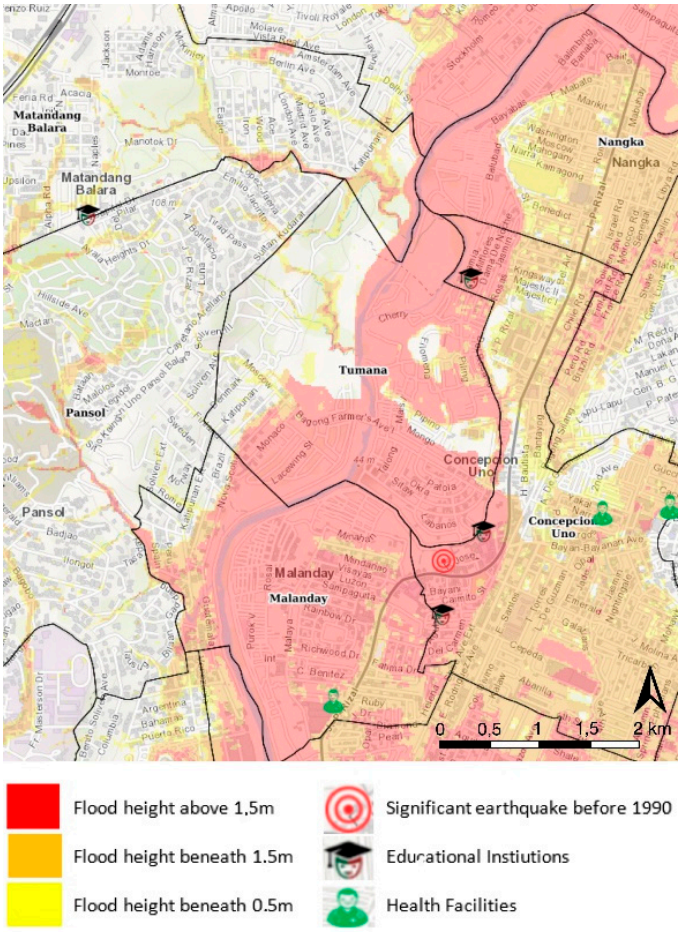


Figure 8. Integrated hazard map of Tumana showing almost its entire eastern part will be flooded with above 1.5-m water level height. Source: based on Nationwide Operational Assessments of Hazards (NOAH), 2019.

4.2.4. Resilience Lessons Learnt from Marikina LGU

Prevention and preparedness measures including both infrastructure and community-based information services are considered as the major resilience investment of Marikina LGU. Other preparedness measures are taken by the City's DRRM office including regular simulations and drills, family preparedness programs and provision of equipment for the community. The LGU acknowledges residents' good response to disaster preparedness mainly out of constant consultations and orientation through a participatory approach. According to interviews with the Marikina DRRM Office, they expressed that community participation is key for the City's achievement in resilience building.

Currently, a new bridge, including embankments is being undertaken by the Department of Public Works and Highways. The bridge links Quezon City and Marikina City and replaces the old bridge, which was quite often submerged in floods. Marikina residents will receive the first level/early warning from the Marikina Central Communication and Command Centre when the water level reaches 17-m height (Figure 7c). There is an observation that the local residents are practicing aqua-culture, e.g., planting water spinach in the river during the dry season for a conscious self-reliant food supply.

In terms of prevention measures, Ordinance No. 048 (Series of 2014) [28] requires the construction of new houses and renovations of residential structures in all low-lying lands and frequently flooded areas of Marikina should be on stilts. Considering public infrastructure, Marikina LGU does not allow new establishments in low-lying areas. However, there are not yet effective strategies in improving disaster resilience of the existing public infrastructure (schools and health facilities) as the above listed. There are also ongoing activities in improving old drainages conducted by the City's Engineering Office. For housing structure renovation, the LGU will issue a permit based on pre-requisites. Coordinating with the Metro Manila Development Authority (MMDA), the Marikina Central Communication and Command Centre monitors rainfall that will come down to the Marikina River. The community is aware of, listens to the radio and checks online information. Residents know the locations of evacuation centers (including schools, community halls, etc.). Outside the evacuation centers there are cages to secure the animals, which are part of their livelihood and economic sources. Current recovery measures taken by the Marikina DRRM Office include both livelihood projects and tax relief.

5. Discussions and Contemplations

5.1. Costs and Benefits of Resilient On-Site Upgrading of Informal Settlements

This research argues costs and benefits both concerning investors and the ISFs. Community benefits out of on-site upgrading have to be also taken into consideration. For investors, their key concerns are land price and costs of infrastructure. As previously discussed, in the Philippines, the national government takes a major financial role in upgrading projects. During the 1970s and early 1980s, the land price in Metro Manila was low and the population size was small. Authors' interviews in 2020 revealed that land in Escopa III in Quezon City costs 2500 Php/m^2, compared with 250 Php/m^2 in the past. NHA had allocated funds for upgrading programs such as ZIP within Metro Manila and SIR outside of Metro Manila in the 1970s, as mentioned in Section 3.2. From the early 1990s, there has been a continuous decrease of NHA's funding related to upgrading activities. For LGUs, the affordability is equally an issue. As discussed in the case study, Marikina LGU is looking for lands to realize the City's socialized housing program. However, it can only afford 2500 Php/m^2, against the offered price of 4500 Php/m^2 from the private landowner (original offer 6500 Php/m^2 as fieldwork in 2020 revealed). While considering economic benefits, certain lands even under government ownership have to give way to high turnover projects. An example is Quezon City CBD planning (2012) which is intertwined with a displacement of at least 6000 urban poor families. This is even under the condition that NHA owns the land, which was designated for Quezon City CBD to realize mixed-use districts. This category of on-site development for economic achievement bears obviously different visions.

For urban poor and ISFs, affordability is equally questionable. Taking the national level Community Mortgage Program (CMP) for instance, its cheapest in-city land typically costs 6500–7500 Php/m^2 as of in 2013. For a five-person low-income family needing a 25 m^2 lot, it costs an averagely Php 175,000 in total. This is an amount beyond the maximum that can be borrowed from CMP (Php 120,000), and this total amount is only the price for the land itself. Thus, according to Villena, it has only benefitted 189,000 families since 1989. Therefore, its outreach is low. Additionally, the housing construction costs increased the difficulties. The Family Incomes and Expenditures Surveys reveal that urban poor families are able to pay only 200–500 Php/month [29]. Based on a construction cost of 13,000–16,000 Php/m^2, ISFs cannot amortize with the interest rate per annum (e.g., CMP's 6% interest rate per annum). As a result, the entire expenditure on housing is too high and the informal settlers cannot afford their houses. The LGUs cannot subsidize informal settlers' needs in this regard either. For those who amortize houses from developers, the critical issue to secure their long-term affordability (25–30 years). There should be regulations of relatively fixed amortization rate, instead of completely following the market fluctuations.

Concerning Bistekville 7, the resettlement housing project in Escopa III from Quezon City, the monthly amortization rate is ca. Php 1000 with low-income urban families as target beneficiaries,

the majority of whom actually cannot afford this either. Field household interviews revealed that beneficiaries are afraid of (unstable) income loss to continuously pay the amortization. Therefore, there arises also a low occupancy rate in such kinds of housing projects. During the field visit in this February, only 34 units were occupied out of 50 units in Bistekville 7. Likewise, the planned one- to three-storied low-rise building type, for a majority of ISFs, is unaffordable based on the 30-year amortization scheme.

Further, due to the entry of private sectors in housing, there is a decrease of in subsidies and investment for public housing. The Philippine government has had a number of housing programs since the 1950s. During that time, most of the houses were built by the government. Private sector participation in this regard arrived in the 1960s but this was mainly for low-income families not ISFs. Currently, there are no mid-rise buildings (MRBs) for ISFs, due to the high construction costs and ISFs affordability. The PDP (2017–2022) strongly recommends that there should be a law passed to make appropriation for land banking and socialized housing mandatory, especially for hazard-prone cities. Both of case studies also display the efforts of Quezon and Marikina in this aspect. In Vietnam and Thailand, for example, there are no hazard maps at the community level for residents to refer to. Regarding the question of what approach shall be promoted as a sustainable housing solution at the city level for ISFs, real-time online polling during our workshop indicated that low-cost socialized housing and LGU-led public rental housing are the options identified by the participants (Figure 9). Therefore, a strong need for decentralization of housing and urban development interventions is present. However, what should be noticed is, in general, there is a very limited budget for housing and socialized housing as aforementioned. Further, the local government needs to secure provisions of socialized housing in safe and suitable areas and provide basic on-site services and facilities.

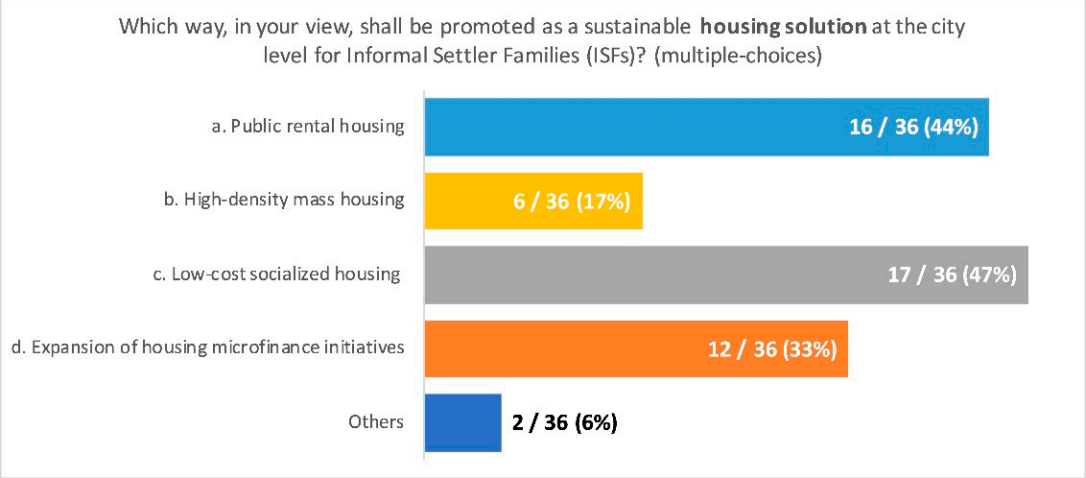


Figure 9. Real-time Zoom online polling regarding to question of "Which way, in your view, shall be promoted as a sustainable housing solution at the city level for Informal Settler Families (ISFs)?" Source: Results of the authors' Resilient Upgrading Online Validation Workshop on 8 October 2020.

5.2. Recasting Metro Manila On-Site Upgrading of Informal Settlements in the Time of Pandemic

While being asked to project resilient upgrading scenarios under the pandemic, participants confirmed two salient points:

- There will be fewer financial subsidies from the government and the inability of ISFs to pay amortization due to the government efforts right now in combating Covid-19.
- Therefore, on-site upgrading will be highly dependent on LGUs' funding priority and political will, as their own local strategies.

Stakeholder discussions revealed that there is a government issuance allowing the national government to pool unused funds from various agencies and reprogram these to fight the current pandemic. This means that many housing-related projects that are not yet in full swing run the risk of getting defunded. Workshop participants consider that this said situation will make it less viable to practice upgrading.

Given the projected defunding trend on housing right now under the pandemic, there calls for strong pro-livelihood innovations regarding resilient on-site upgrading. On another note, the current pandemic equally challenges the government on how to keep ISFs still in urban areas without relocating them permanently back to rural areas. As revealed from workshop discussions, due to the loss of daily income, ISFs have no ability to pay amortization to sustain the housing program. The ISFs must address daily meals first rather than investing in their shelters for disaster resilience. Before the pandemic, there saw government efforts on promoting small-scale upgrading innovation in informal settlement communities, e.g., installation of solar panels, infiltration promoted road pavement, rain harvesting, though the majority of ISFs considered the installation costs still too high. During the pandemic, many agencies stated that ISFs are not any more interested in this, due to their loss of daily income to feed the family (see in Supplementary Materials Figure S2: Real-time Zoom polling results regarding question of "Is locally based small-scale upgrading innovation being practiced by informal settlement communities e.g., solar panels, infiltration promoted road pavement, rain harvesting, etc. in your city or region?").

In terms of emergent assistance, the government has difficulties of tracking ISFs for food delivery and emergent medical services, due to the long-standing problem of identifying and tracking ISFs and their locations (see Section 3.2). Lack of updated data is one of the main constrains on informal settlement upgrading [10] (p. 26). It urges again the necessity of formulating the operational definition and statistical framework to define informal settlers as asserted in the Philippine Mid-Term Development Plan (2017–2022) [12]. Additionally, the pandemic raises again the debated issue of how to monitor occupancy rate and allocated lots for both public and private buildings in Metro Manila.

Thanks to the results of the pre-workshop questionnaires and the October online workshop discussions, a resilient food system has been raised as an issue to update resilient upgrading conceptions. One of the essential questions is how to achieve food security measures in conjunction with undertaking on-site upgrading of informal settlements. In the duration of the COVID-19 pandemic, urban gardening started to gain popularity in Metro Manila. (During this time, people who started urban gardening practice in Metro Manila are named as *plantito/plantita*.) It calls attention to how to realize the urban poor's self-reliant resilient food system without exposing themselves to extra hazards and travelling afar. RUAF, the global partnership on sustainable urban agriculture and food systems, summons the integration of resilient food systems with social housing and informal settlements' upgrading programs on forging urban agriculture's role in DRR [30] (p. 5). Regarding an actionable integration with on-site upgrading in Metro Manila, this study advises experiences should be gathered on, for instance, how to realize and secure lands and plots for this purpose without aggravating land conflicts between ISFs and the owners; how to institutionalize community management of the urban gardens under different land titles (communal, private, government lands, etc.); how to adapt communal urban farming to local climate change impacts for a city-wide sustainable growth; and how the urban farming affects the ecological landscape of those high-risk informal settlements in urbanized areas. This study suggests community organized food gardens can be a starting point in mobilizing ISFs on-site to invest in their livelihoods and build their payment capacity (e.g., amortization and interest rates) in a long run. Through a community food garden, it can provide a mechanism for resilient livelihoods. Nevertheless, topics of food resilience, urban agriculture under climate change, and their alignment with on-site upgrading need to be further investigated.

Regarding agencies' activities, the current pandemic forced certain informal settlement-related projects into suspension due to social distancing regulations. Mass gatherings, such as community consultations, are not allowed. There need to be quick reactions to continue to foster community

engagement activities based on trust-building. The success of resilient upgrading hinges on community organizations, which is very resource-intensive and time-consuming. Nevertheless, the pandemic changed the mindset of many agencies by shifting their upgrading focus to small on-site health infrastructure at the community level, e.g., clinics, medicine stations, portable water stations. These localized health facilities and services should be sustained even after the pandemic.

5.3. Foreseeing and Accepting Limitations of On-Site Upgrading and Its Side Effects

On-site resilient upgrading bears the objectives of accentuating a community-based approach counterbalanced with planning interventions. It calls for a resilience responsive plan with structural, cohesive and actionable upgrading activities. This plan tends to make safety requirements and livelihood improvement compatible. Therefore, upgrading activities shall avoid triggering potential risks. Risks also mean uncertainties regarding their magnitudes, overlaid results under the circumstances of climate change. Therefore, it was further assured that balancing the locational needs of ISFs and exposure to climate changed-related hazards will be one of the most critical decisions when considering the appropriateness of upgrading [10] (p. 25). However, it has been indicated that "international funds that are meant to support climate change adaptation do not see informal settlement upgrading as a priority. They also lack the structures to engage with local governments and local civil society organizations to make this happen" (p. 30).

The PDP (2017–2022) unfolded the reality that there is a decrease in the production of housing units due to the adverse impact of natural disasters and climate change. It gives an alert that LGUs should invest in disaster-resilient houses. Above all, there should ensure LGUs to prepare local shelter plans that integrate vulnerability and adaptability assessment. On a similar note, the National Urban Development and Housing Framework (2017–2022) also encourages exploring resilient housing via retrofitting of existing housing structures based on climate change vulnerability and disaster risk with the convergence of its affordability for the urban poor. Besides, financial incentive schemes should be applied for public rental housing. Government rental control regulations such as prohibiting rent rate increase should not discourage the landlords and owners in maintaining rental accommodations for disaster resilience. Particularly due to natural disasters, improperly maintained rental housing will cause huge environmental and social-economic damage. This should be a cautious note given the promotion of public rental housing right now in Metro Manila.

However, some conditions which do not allow the practice of on-site upgrading. As indicated in Section 3.2 regarding upgrading operation, 51% of informal settlements in the Philippines are located in extremely high-risk areas, which are not suitable for upgrading in consideration of the land suitability, geo-hazards, hazard intensity, and frequency. Outcomes of the overlay hazards are detrimental and tremendous given its socio-economic loss. This category does not allow for upgrading as there cannot be encouragement for residents to remain on site. Under the circumstance, it is also quite costly to protect the existing infrastructures and settlements to sustain their presence and development. As UNDRR [31] (p. 55) stated that "In flood-prone areas, the removal of informal settlements and other unauthorized structures along waterways is sometimes seen as a proactive measure". Further, land tenure can be also decisive, be it under private or public land ownership. As discussed above, both private and public landowners consider turnover of the on-site upgrading area as an investment. Thirdly, this study heightens upscaling informal settlement on-site upgrading at the city level through feeding into the city's development plan such as through the urban regeneration schemes. Bearing this note, gentrification cannot be ignored despite its positive side of enabling capital movement. It causes not only the displacement of ISFs and urban poor, but also changes in urban patterns and urban functions. Development-induced displacement of ISFs need to be further researched in alignment with resilient on-site upgrading for community resilience building, should the urban renewal befits be shared among all involved stakeholders.

6. Results and Way Forward

This section focuses on part of this study's results through highly participatory methods as mentioned in Chapter 2, such as a recent online survey and a stakeholder validation workshop. The afore-analyzed two cases provide context-specific settings to comprehend the results. Particularly, the authors discussed UNHABITAT practiced tools, e.g., *land readjustment* and *reblocking* applied in informal settlements of developing countries to complement this study results' analysis. Nevertheless, this study is not intending to analyze international organizations such as UNHABITAT's roles in Metro Manila spatial planning. The authors concentrate on viable and replicable practices that can be adaptably employed in Metro Manila. However, the authors consider the potential influences of international organizations' support on informal settlement on-site upgrading, which can acknowledge and uplift resilient upgrading to a significant policy level.

6.1. Upgrading Typologies with Localized Practices in Metro Manila

Figure 10, "Upgrading Typologies", summarized four prominent upgrading typologies within this study scope over the last two years. This summarization is by no means a full picture of the entire Metro Manila. In general, upgrading typology within this research scope tends to be localized at the city level due to cities' and communities' different risk files, community history and development needs, and individual LGU's visions and initiatives in resilience building. Therefore, the upgrading typologies are very context-specific. Further, all these typologies have been verified via stakeholder workshops and surveys. They are:

1. *Housing structure improvement:*

    - Retrofitting housing structure, e.g., structural modifications, adoption of durable materials especially for walls and roofs, etc.; and
    - Adding a second floor to existing structures to gain resilience to flooding and having a place to live and store belongings when flood events occur.

    Housing structure improvement assists informal domestic economic activities (Livelihoods).
2. *Site development*: including:

    - Basic service installation, e.g., connection to water taps and electricity, waste collection; and
    - Establishment of a community hall and covered sport court for multi-functional purposes given both evacuation and daily activities.
3. *Land readjustment*:

    - Reblocking within the settlement. The purpose of reblocking is to subdivide and repurpose community land use for disaster mitigation and livelihood improvement. This applies to, for instance, major road identification both for evacuation and community collective activities; and
    - Rollover upgrading, which is locally recognized as on-site relocation within the same settlement via settlement layout restructuring.

    Land readjustment refers also to the settlement boundary land aggregation with its surroundings, which requires a coordination with city-level planning such as through urban renewal frameworks.
4. *Legal instrument*:

    - Securing land tenure;
    - Rental housing, e.g., based on modified housing structures for ISFs.

Figure 10. Upgrading typologies. Source: own construct, 2020.

The authors' fieldwork showed that tenure security is usually the priority of informal settlers rather than increasing resilience to natural disasters. To which level of tenure security the ISFs can accept has not been investigated yet by this study. The basic ideas are land titling and legalized tenure status are quite time-consuming, but the process of achieving tenure security can be a continuum accompanied by on-site upgrading. "While achieving security of tenure is a critical outcome of informal settlement upgrading, this concept is not synonymous with full legal title". There is "[. . .] a range of approaches to achieving tenure security lying somewhere between the fully illegal and legal" [11] (p. 22). Further, regarding the resilience level, conventional understanding is that vulnerability arises with insecure land tenure, which is true. However, this study acknowledges that adverse impacts should be noted, because the secure tenure status may trigger natural hazards due to unguided housing modifications and retrofitting activities. Hence, there needs that "(d)ecisons about land tenure should be based on land policies that are developed in line with a DRM framework, as part of a disaster mitigation process" [32] (p. 127); and inclusion of addressing people-land relationship for DRM [33].

For the September 2020 online survey question of "Which strategy(s) could be technically and financially implementable to build community resilience in informal settlements considering the impacts brought about by COVID-19?", stakeholders view site development (answer "b") and legal instrument (answer "d") as the most implementable regarding community resilience building of informal settlements in Metro Manila (Figure 11). Notably, workshop participants from Vietnam and Thailand also consider site development as the most technically and financially implementable approach in community resilience building. Particularly right now under the pandemic, timely provision of community health facilities and services is a dire on-point need, including its sustainability after the pandemic. Regarding typology of land readjustment (answer "c") in general as a tool and solution of land management, respondents affirm that it is not yet widely practiced in the context of informal settlements in Metro Manila, despite their awareness of its good practice in developed economies such as in Japan. As a tool for urban development, this typology does not gain a common understanding among stakeholders. Raised reasons during the workshop discussions are multiple, including less familiarity with this tool, uncertainty due to unclear legal and institutional conditions to undertake the process with targeted communities, etc. Regarding the usefulness of land readjustment in the unplanned development context, UNHABITAT pointed out the imperativeness of applying land readjustment in informal settlements with insecure tenure. "Poor neighbourhoods, often characterized by overpopulation, lack of, or unclear, legal rights, poor infrastructure, inadequate services and poverty, are often not only spatially segregated but also economically and socially alienated. Land readjustment presents a mechanism through which such areas may be transformed from blight spots into vibrant communities" [34] (p. 16). Land readjustment is also viewed as an inclusive approach to land improvement while keeping the population density but without compromising the quality of housing and provision of basic services [35].

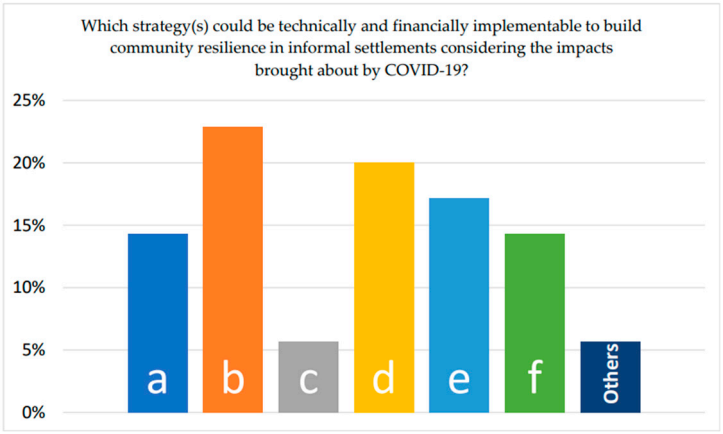


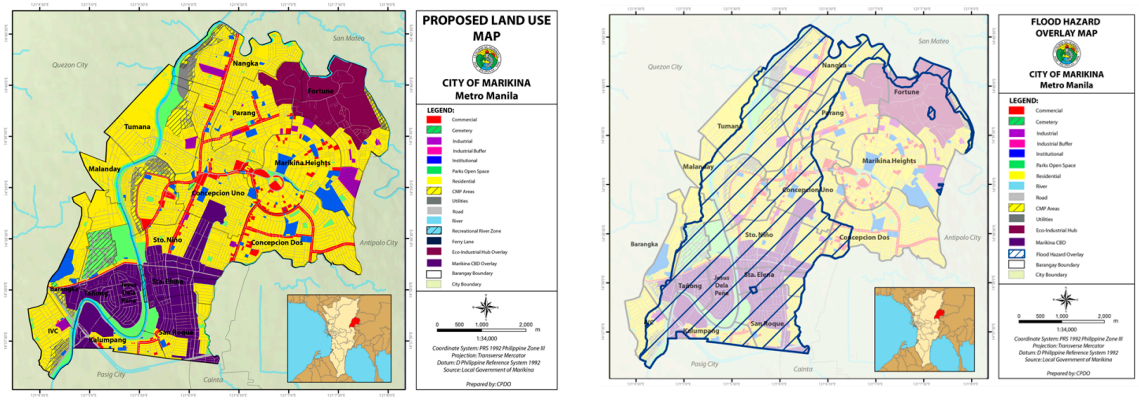
Figure 11. Results regarding question of "Which strategy(s) could be technically and financially **implementable** to build community resilience in informal settlements considering the impacts brought about by COVID-19?". (a) Housing structure improvement. (b) Site development. (c) Land readjustment. (d) Legal instrument. (e) Soft planning interventions. (f) Community cooperative establishment for resilience building and others. Source: Results of authors' pre-workshop online questionnaire via LimeSurvey in September 2020.

Likewise, in terms of reblocking itself, workshop participants pointed out that past projects demonstrated difficulties in convincing households of ISFs to change their house locations within the settlement. Particularly those households who have already invested in retrofitting the structure. In understanding the in situ upgrading process and its methodology, Abbott emphasized the necessity of an approach of the internal relocation of households within the settlement to avoid not only the potential future risks associated with these house locations but also to release lands for the collective social and amenity services for users' conveniences. He urged (Cape Town) local authorities and

professionals to study how communities perceive the importance of social services to reflect their social priorities [36]. Within the context of high-risk and dense informal settlements located in highly urbanized areas in Metro Manila, reblocking can be proposed to subdivide the settlement area for residential purposes if the community population grows. In this way, it attempts to equally distribute lands among the residents without moving any households out of the settlement. In many cases, reblocking of residential lands can also provide a precondition for identification of the settlement's main roads, so as to improve settlement connection with its surrounding areas, allow evacuation vehicles access to the settlement, centralize a market place for the maximization of home-based economic activities, etc. Prior to the reblocking activities, the LGU is not eligible to provide services. Therefore, there demands a direct link between the technical finalization of reblocking activities and the local government's financing and provision of on-site infrastructure and services.

6.2. Compounding Land Use Planning with Disaster Mitigation and Climate Change

In Metro Manila, the conventional planning strategies based on the approach of a spatial separation of hazards, vulnerable land uses and no-build zones cannot find a convergence in the context of haphazard development, the influx of population, and persistence of informality in highly urbanized areas. As aforesaid, the Philippine NDRRM Plan accentuates the paradigm shift to community-based indigenous knowledge and land use planning in disaster risk mitigation. The study case of Marikina City and its LGU's strategy demonstrates a clear reflection of enhancing disaster preparedness via land use planning. Figure 12 visualizes the flood zone catchment area integrated with the recent proposed comprehensive land use plan (2018–2027) for Marikina City, so as to prepare the City's future development under climate change. Nevertheless, the role of spatial planning in the post-disaster period needs to be strengthened among practitioners. Above all, this research observes that in the first place, multi-level stakeholders still need to understand the key role of spatial planning in disaster mitigation and recovery.



(**a**) (**b**)

Figure 12. Marikina City Flood Hazard Overlay Zone (in total 1338.45 Ha) with the City's proposed Comprehensive Land Use Plan. (**a Left**) Marikina recently proposed Comprehensive Land Use Plan; (**b Right**) Flood hazard overlay map with the Marikina City's Comprehensive Land Use Plan. Source: Marikina City Comprehensive Land Use Plan 2018–2027, Marikina City Government, National Capital Region, the Philippines.

Further, discussions during the October 2020 online workshop indicated a strong need in terms of a common understanding of concretized tools and methods regarding the application of risk-informed land use planning. For instance, the no-build zones or designated hazard areas do not equal areas without land use planning and being segregated from the city development. As previously discussed, upgrading surpasses mere activities on housing production. Resilient on-site upgrading shall play a significant role as a land management strategy in housing policy. The question is to find out where

is the interface. Debates on how to tackle settlements as an entirety and their potential integrations with the surrounding urban fabrics in a long term involve, to great extent, restructuring the settlement layout. As UNHABITAT [37] (p. 47) summarized "International experiences in all regions demonstrate that the implementation of an area-base plan calls for spatial restructuring, demolitions, relocation of buildings and families and redefinition of plot boundaries and properties and the opening and/or consolidation of streets and pathways. The establishment of a street network and the realization of an urban layout configuration as part of the physical and spatial integration strategy unquestionably require demolitions, relocation of residents and re-blocking and housing (re) construction". During the October workshop, participants pointed out that reblocking is the least favorite upgrading method (Figure 11 "Upgrading Strategies" in Section 6.1) which is largely due to difficulties to convince the communities, who are actually the final beneficiaries.

With the vision of integrating informal settlement upgrading at the city level in Metro Manila, topics such as how to achieve common understanding and undertake land readjustment as an established mechanism, technical and financial assistance of reblocking and its consequent on-site services, and how to facilitate the community during the transition are worth researching. Addressing the spatial relationship of the individual house, house clusters and their informal settlements improves the chance of minimum households being relocated outside of the community as well. Therefore, modifying informal settlements' spatial layout in urban areas improves not only the settlements per se as functional human settlements (eventually being formalized), but also determining settlements' spatial relationship and performance with their hosting cities. As argued by UNHABITAT [34,37] above, experiences also indicated necessities in modifying informal settlements structures as an approach beyond the basic service of installation and housing construction. Hence, the relationship of on-site upgrading as a resilience strategy to link disaster risk reduction, spatial planning and urban development can be clearly articulated. As Abbott pinpointed "(m)odifying the spatial layout of the settlement, it means the government has to be more directly involved, as greater resources and government support are both prerequisites" [36] (p. 2). Such involvement assists multi-sectoral stakeholders in identifying a common comprehensive development goals across different spatial scales.

Another relevant aspect is thinking about the selective retreat strategy in high-risk areas. The selective retreat involves the relocation of critical infrastructures (schools, hospitals, etc.), while allowing the settlers to remain in the same area but with the improved shelter that adapts to risks in the area or vice versa in case of costly technical infrastructures. Greiving et al. [4] argued that differentiations should be made regarding susceptibility or dangerousness of various land use types and desired protected physical structures within targeted informal settlements and their surroundings. The goal of this strategy is to avoid relocation of entire settlements, but still to minimize adverse impacts of natural hazards. The rest of the community can opt to remain in the area because of the existing economic interests and based on the community's acceptance level of risks. The community should agree to adopt tailor-made upgrading measures.

When being asked "What do you think of the applicability of selective retreat strategy in high-risk informal settlements in Metro Manila?" nearly 30% of agencies of our pre-workshop survey reckon land availability within Metro Manila hinders its application (answer "c" in Supplementary Materials Figure S3: Results regarding question of "What do you think of the applicability of selective retreat strategy in high-risk informal settlements in Metro Manila?"). Agencies expressed also the need for some context-specific lessons to understand this strategy's role of being an effective spatial resilience strategy in disaster mitigation (answer "a" in Supplementary Materials Figure S3). Additionally, the cost for its application regarding finding new lands for the relocated critical infrastructure is also one of the hindrances in promoting this strategy. Nevertheless, land use planning has to be aligned at both regional and local levels to avoid contradictions. UNDRR status report [38] pointed out that the regional development of the Philippines has focused primarily on socio-economic sectors, at times failing to recognize DRR concerns.

6.3. Further Research Needs Driving towards Viable Resilient On-Site Upgrading

This study addresses how resilient upgrading can be a strategy in building community resilience as an utmost goal. It urges endeavors on resilient upgrading applications with the aforesaid resilience responsive plan for implementation and expected achievements. It underpins again Abbott's note of seeking the most effective way to achieve on-site/in situ upgrading on how to deal with informal settlements after almost three decades of debate [39]. This study is convinced that on-site upgrading does not aim at planning new sites. Instead, it focuses on financially and strategically viable solutions for improving the existing informal settlements' societal and physical stances to be more resistant to natural disasters and to recover faster. On-site upgrading is risk-sensitive, also bearing the note of responding to overlaid adverse impacts aggravated by rampant urbanization. Interestingly, concerning the dimension of resilient upgrading achievements, disaster-resilient communities with ecological accomplishment ranks the lowest among participants (Figure 13). Hitherto, in the Philippines, interim achievements are positive, but mainly converging on physical improvement of housing and provisions of basic infrastructure, as commented by participants (69% in Figure 13). Secondly, the synergies between standards of community living and DRR has to be created. This means community daily used infrastructure and amenity provision shall comply with evacuation plans during the disasters. Our online workshop real-time polling revealed that 40% of participants think there are no clears signs of compliance in this regard; 34% think it is not effective to fulfill the evacuation purpose despite the compliance.

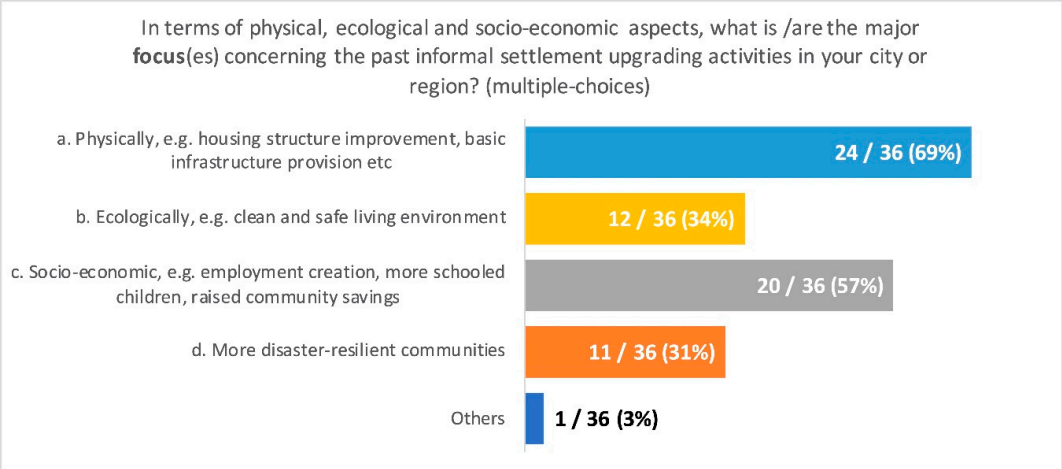


Figure 13. Real-time Zoom online polling results regarding question of "In terms of physical, ecological and socio-economic aspects, what is/are the major **focus**(es) concerning the past informal settlement upgrading activities in your city or region?" Source: Results of authors' Resilient Upgrading Online Validation Workshop on 8 October 2020.

In another view, there is a strong need to address ISFs' vulnerabilities to disasters from the angle of community spatial organization and its impacts on DRR in hazardous informal settlements. This aspect is often understated when dealing with community resilience. At a larger spatial level, findings heighten the urgency of accelerating and upscaling resilient on-site upgrading by embracing a concept to reach a city-level development as in Section 3.2 indicated. It calls for empirical-based research activities and suitable methods, along with political and planning interventions. In Metro Manila, the observed arising needs are to take stock of focal informal settlements at the city-region level as part of the next phase of our project (2021–2025), so as to be able to clearly identify their critical urban resilience needs under LGUs' mandates. The focal sites will meet the needs of identifying a pilot site for testing real physical interventions through appraising such as:

1. Its potential integration level of on-site upgrading with the city to respond to high priority needs and to maximize upgrading benefits in multiple sites in the future;
2. Community assets, vulnerability, livelihoods and internal cohesion to enhance residents' adaptability; and
3. Community top resilience priorities counterbalanced with planning interventions to address city-wide development, etc.

Upgrading physical infrastructure and addressing security of tenure must be accompanied by a deliberate focus on protecting and enhancing livelihoods [11] (p. 26). Driving factors and connections of upgrading activities with livelihoods and risk reduction are to be identified. This approach also makes resilience-building more realistic on the ground and corporates it into a manageable spatial scale for future upscaling and good practice replications. Community vulnerability and assets' security need to be studied in the spatial planning process which requires a deep understanding of the respective contexts including the legal-administrative system and the cultural beliefs, a planning process is embedded in. Thus, a knowledge transfer by applying our findings to other political planning contexts, such as in Vietnam and Thailand would be beneficial in order to identify commonly applicable elements and those which are clearly context-dependent.

Supplementary Materials: The following are available online at http://www.mdpi.com/2071-1050/12/24/10600/s1, (1) Three extra survey results referred in the texts. Figure S1: Results regarding question of "Why informal settlement on-site upgrading is not a planning priority if compared to the overall resettlement approach in Metro Manila?", Figure S2: Real-time Zoom polling results regarding question of "Is locally based small-scale upgrading innovation being practiced by informal settlement communities e.g., solar panels, infiltration promoted road pavement, rain harvesting, etc. in your city or region?", Figure S3: Results regarding question of "What do you think of the applicability of selective retreat strategy in high-risk informal settlements in Metro Manila?". (2) Zoom Live Poll Survey Sheet from the authors' online workshop "*Responsive Resilient Upgrading Strategies and Scenarios under COVID-19 Pandemic*" on 8 October 2020.

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