

Written Report - Flood Resilience in the Klong Toei Slums

Problem Statement:

Of the 5,500 slums in Thailand, the Khlong Toei slum, one of the largest and most congested in Bangkok, occupies an area of 2 square kilometers and houses over 100,000 people. As with other slums, the residents of Klong Toei are highly affected by substandard living conditions, primarily inadequate elevation and infrastructure, which increases their vulnerability to environmental factors. The slums are located on land that legally belongs to the Port Authority of Thailand, which has become a point of friction with the authorities.

Kru Prateep, a locally celebrated leader of the Duang Prateep Foundation, highlighted that the slum consists primarily of rural migrants from Thailand's outer provinces, who earn their living through cheap labor, or by vendoring fruit and vegetables in the nearby street market. The residents believe they will be evicted in the near future and thus have very little motivation to improve their current living situation. In addition, most of the younger residents are denied education and social security due to being unregistered, leading to greater health risks and cyclic financial insecurity.

Amongst a host of problems, one of the most prominent, is flash flooding. Thailand experiences three main seasons of monsoon from May to October, and in Bangkok, the rainy season is characterized by intense, heavy bouts of precipitation (Ajavavarakula et al., 2016, 2-3). During such times, the low elevation (4.4 to 5.6 meters above sea level), in conjunction with severe trash buildup, creates a highly ineffective drainage system.

There are five significant consequences of flooding. firstly, property damage - floodwater enters and damages the residential property and weakens the wooden infrastructure of the houses.

Due to underreporting the extent of the damage cannot be described, however there are several

houses that will collapse each monsoon season due to flooding. Second, harmful pests - stagnant floodwater provides favorable conditions for insects such as mosquitoes, rodents, and reptiles such as water lizards, and snakes. These pests result in a higher occurrence of infectious diseases and bodily harm. Third, health risks - floodwater can carry water-borne diseases such as Cholera, Typhoid, and Hepatitis A. When combined with the waste present in the area, the flood water becomes highly toxic, resulting in skin conditions and foot diseases for residents. Fourth, immobilization - the Klong Toei slum has extremely narrow walkways, ranging between 1-2 meters. Floods can further aggregate problems in mobilization for the densely congested population, affecting their ability to earn a living. Lastly, there is a debt cycle - the residents in the slum are highly sensitive to any economic hindrances, and the occurrence of floods can affect their income. The residents in the area are generally already in debt, often to informal lenders, and the flood causes hindrances in their ability to earn income, which leads to higher debt obligations. Several residents have to divest their income into strengthening or rebuilding their homes after floods, which only adds to this issue.

The flooding, although largely attributable to environmental conditions, is also perpetuated by other causes. Firstly, housing - the houses in the slums are generally constructed through galvanized iron sheets, wood, bamboo, and other materials, causing them to be completely or partially non-durable. Their locations are also sporadic and unplanned in the small area and are built on the waterway, which blocks the flow of water, making it easier for water to rise during periods of intense rainfall. Secondly, improper waste disposal - even though there are designated trash collection sites, waste is still found in the surrounding areas and besides walkways. Such improper waste disposal, along with sediments, gets flowed by the runoff stormwater, builds up, clogs up the drainage system, and causes flooding. Thirdly, legal constraints - as per an interview with Assoc. Prof. Suchart from Chulalongkorn University, any changes to the slum infrastructure must be authorized by the Bangkok Metropolitan Authority

(BMA) and PAT, who have commonly restricted such motions in the past. In addition, residents are not willing to temporarily relocate for the repairs to occur, as they believe that other residents will not be willing to relocate, and it could be a tactic by PAT to evict them. Fourth, environmental regulations - in 2016, the PAT closed the pipes that let the water from Klong Toei drain the Chao Phraya River, by citing security concerns over people sneaking through the pipelines to steal from the PAT. In addition, drainage water from the area cannot be released to the Chao Phraya river as it does not meet the minimum required water standards. Lastly, community - the residents in the area are not educated or motivated on how to make changes. Due to being denied access to education, and unstable living conditions, there is also a lack of awareness regarding proper waste disposal. Without such knowledge residents are unable to reduce the waste clogging the drainage system.

Solution Development and Implementation:

As voiced by Kru Prateep (DPF), a governance framework involving the active participation of residents can definitely mitigate the flooding problems. In 2016, the BMA launched a campaign, with the participation of the Koh Klang community residents, to remove weeds, water hyacinth, and trash from the canal. The campaign had improved the water flowing through the canal drainage system remarkably. The program also created a new network of volunteers within the community residents to continually help with environmental activities, creating a sustainably effective campaign. This evidences that resilience to disaster risk becomes stronger with community involvement.

The solution for community resilience relies on three critical components. Firstly, it requires a cooperative relationship between local authorities and the Khlong Toei residents. Secondly, it requires an active participation by Khlong Toei residents in disaster reduction activities, such as periodic cleanups of the drainage systems. Finally, to increase its chances at longevity, this

solution needs a community education program, teaching residents on how to properly dispose of waste, and when and where to clean up trash to prevent flooding. These three elements contribute to an effective resilience building program against flooding for the Khlong Toei community.

From research, one of the feasible and realistic solutions to mitigate flooding and its adverse effects is monetizing waste collection and management in the Klong Toey slum area. Our solution aims to build a sustainable and self-reliant waste management system in the community, which will help reduce the occurrence of floods in the area through community participation and drive stakeholder engagement. From our communications with DPF and certain locals, a monetary reward would work best to help encourage them to take action.

In conjunction with the BMA and the Duang Prateep Foundation, there will be a waste collection program, "Return and Earn", where residents will be provided a monetary reward for the amount of trash they have collected. Generally, the BMA pays their employed street waste pickers between 300-400 THB (9 to 12 USD) per day for a collection of 40 to 50 kilograms of unsorted solid waste. This solution will require the BMA's cooperation to subsidize this program, as a reward for residents sorting the waste into favorable methods for effective recycling.

The program will also provide training and resources to provide adequate knowledge on proper waste management and equipment such as gloves, clothes, wheelbarrows, and garbage bins. In order to motivate the younger residents to participate and attend the workshop, nutritious snack food and drinks will be provided. The workshops will be conducted by community leaders, local experts, and BMA authorities. The idea is to educate the residents about the adverse effects of improper waste disposal, how this exacerbates the floods, adds to their poverty cycle and leads to more harmful diseases and pests.

We will be placing multiple inexpensive reverse vending machines in the area, which will reward the person with money, for their proper disposal of recyclable plastic waste. The reverse vending machines can be placed in partnership with beverage companies or recycling companies who can benefit from the purchase of the recyclable materials, they will be more reliable partners for the maintenance and refills of the reverse vending machine.

The main risks with this solution are cooperation from local authorities and the continued lack of motivation from the community residents. We hope to mitigate this risk with the BMA and PAT by highlighting through community petitions the positive impact such a program would have on the community. For the residents, the risk should be addressed with the presence of monetary rewards and effective education, which are already present in the solution. In combination, these actions will help encourage residents to be more proactive in their community, reduce the clogging of waste into the drainage system, and reduce the occurrence and level of floods, thereby building the community's long-term resilience to flooding.

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