Investigating community adaptability and resilience in Urban Kampung, study case: Water and sanitation infrastructure of Kampung Muka, North Jakarta

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Abstract. Urban kampung is an urban settlement with a community that indicates the characteristics of “vulnerability” and adaptability at the same time. The vulnerabilities of their existence rely from internal and external pressures which consist of chronic stresses (the community’s limitations to fulfill their daily needs) and acute shocks (sudden threats that emerges from outside the community). Simultaneously their vulnerabilities are strengthened by community-based adaptations as a respond of kampung residents towards these pressures. This paper discusses spatial adaptations done by residents of Kampung Muka, North Jakarta as a respond to limitation of clean water provision and sanitation facilities. We utilize qualitative methods consist of site observation along with an interview with the locals. We employ Resilience Assessment as a guiding tool to investigate vulnerabilities, adaptations, and resilience of urban kampung. This guide incorporates the adaptive cycle model to study how the system changes over time, following a pattern of four phases which incorporate both long-term and short-term challenges in the context of water infrastructure from the historical and current point of view. Adaptive capacity shown in urban kampung indicates potential resilience in their community, which could be developed and implemented in a larger urban scale.

1. Introduction
One of the phenomena which happened in urban areas, particularly Jakarta is an informal settlement as a form of adaptation of people with middle to low socioeconomic status who want to live in the middle of the city. UN-Habitat defined informal settlement as a residential area occupied by inhabitant with no security of tenure, limited access to basic services and infrastructure, housing conditions are irrelevant with existing regulations, and geographically located in dangerous areas [1]. The emergence of informal settlement is the impact of community inability to access primary infrastructure services, mainly low-income people.

According to Ernawati et al. kampung as informal settlement face great challenges to survive from the activities of formal development [2]. Vulnerabilities as the daily lives of informal settlements include poor sanitation, inadequate clean water provision, floods, fires, and demolition. These issues that occurred in Jakarta’s urban kampung were discussed in "Kampung Kota Merekam" [3] by focusing on the eviction and relocation of urban kampung community to other places and their struggles to defend their right to live.

There are several publications which suggest that urban kampung community can adapt to particular vulnerabilities while still maintaining their function. These previous studies discuss urban kampung community and their adaptive capacity in responding to risks and vulnerabilities. Ischak et
al. discuss socio-spatial adaptation done by enclave settlement in confrontation with new planned settlement development in Tangerang [4]. In a more specific aspect, Yatmo and Atmodiwirjo discussed public toilets as a collective spatial strategy carried out by urban kampung community in Semper Barat in response to the lack of sanitation facilities [5]. Their study discusses how to regulate the utilization of space between users.

This study investigates water and sanitation infrastructure as the focal system that will be the focus of the discussion. The issues raised in this paper is based on domestic water management in urban kampung which was relatively independent of the intervention of external parties since the colonial era [6] so that self-reliant water supply in urban kampung became an intriguing topic to discuss. The aim of this study is to investigate adaptive capacity and the tendency to become a resilient community by using the lens of water-related infrastructure.

The novelty of this study is discussing themes related to the provision of clean water and sanitation facilities by attempting to analyze the issues from different scales, using communal water infrastructure built by urban kampung residents as a lens for learning community resilience. This adaptation could be associated with several community resilience factors based on the IFRC Framework for Community Resilience [7], which we discuss in a later section. Therefore, the discussion does not only stop at how spatial adaptation is carried out but also at the same time, what are the impacts on community resilience as well. Given the fact that vulnerability, adaptability, and resilience are interrelated concepts that could be applied to a variety of scales [8].

2. Method
This paper uses qualitative method consists of field observations and interviews conducted with urban kampung residents to gain a deeper understanding related to shocks and stresses they faced daily, as well as how the community can adapt and return to perform its function based on the historical description. This information is fundamental because we analyze the system dynamics by using adaptive cycles that cover various phases with different periods. As a tool for synthesizing findings, we employ Resilience Assessment [9] as a guiding method in studying several aspects of the system that includes five main stages of the assessment framework that is; describing the system, understanding system dynamics using adaptive cycles, investigating system interactions from different scale, evaluating government interventions, and lastly synthesizing.

3. Results and Discussions

3.1. Dynamics of Kampung Muka
Kampung Muka is a densely populated urban kampung located in Penjaringan, North Jakarta near Jakarta Kota Station and Mangga Dua Morning Market. These settlements occupy land owned by PJKA with early residents firstly occupied Jl. Transmigrasi legally. Then the illegal settlement began to inhabit the rest of the areas and spread out. Then the settlement underwent evictions during the reign of DKI Jakarta Governor Basuki Tjahja Purnama, in 2014-2016, specifically row of houses occupied canal’s perimeter in front of the warehouse area in the west side of Kampung Muka.

Figure 1. Settlement occupancy process in Kampung Muka
Generally, resilience could be understood as the capacity of a system to absorb disturbance or shocks and reorganize to retain its function and identity [10]. In investigating a system resilience, we need to address several vulnerabilities, including shocks and stresses, which are the main challenges of the urban community. This statement goes well with 100RC [11] definition of urban resilience as the capacity of individuals, communities, institutions, businesses and systems in a city to survive, adapt, and develop no matter what type of chronic stress and acute shocks they face. Hence in learning the system dynamics, we employ adaptive cycle which consists of four phases ranging from how the system develops (exploitation), phase in which the disturbances occurs (release) as well as how they could adapt to it (reorganization) [12]. In the context of urban kampung, we could translate these phases into the occupancy process, disturbances happened in Kampung Muka in terms of water provision, and how they reorganize.

![Adaptive cycle in the context of Kampung Muka](image)

**Figure 2.** Adaptive cycle in the context of Kampung Muka

### 3.2. Water provision and sanitation facilities in Kampung Muka

Generally, clean water in Kampung Muka is used for two main functions which are sanitation activities and consumption. Based on these functions there are three water sources; PAM / PALYJA that is a private company supplying clean water; wells that spread throughout the settlement and water sellers in jerry cans that get their water from the filling center. Interviewees said that in a day he could sell at least ten carts of clean water. Meanwhile, according to the statement of a consumer, she usually buys three jerry cans of water and used them for up to two weeks. The reason people continue to buy water for consumption need is that they are unsure about the quality of well water, even though it looks physically clean. Some of the wells are owned privately (located inside the house) and the others are utilized communally. Whereas sanitation facilities in Kampung Muka are public and communal toilets that also spread and are generally close to rented houses, because renters are the primary users.
Figure 3. Mapping of identified public MCK and public wells in Kampung Muka

The source of water used by the population depends on land ownership and economic capacity, such as residents who have permanent houses on Jl. Transmigrasi mostly uses PAM / PALYJA water. Likewise, residents who are financially capable such as public MCK and rented unit owners use water from PAM / PALYJA. The local government has not issued the permit of PAM/PALYJA water distribution in Kampung Muka entirely because the majority of residents do not have land and building ownership or property taxes documents.

Figure 4. Public wells in Kampung Muka
3.3. Interactions between adaptation and resilience according to scales

Community resilience in Kampung Muka in terms of the availability of clean water and sanitation facilities is carried out through adaptation that occurs reciprocally between public toilet owners and their users. Public toilet, in this case, is considered as a smaller-focal scale, i.e., with only surrounding areas as the user coverage. If we take a look at this issue from a larger perspective, the collection of several public toilets proves the existence of an independent water supply system and sanitation facilities of Kampung Muka community. Public toilets owners provide a facility for bathing, washing, and lavatory while users are required to pay in return. This phenomenon shows the influence of spatial adaptation on the business/economic activities of the residents of Kampung Muka.

The adaptability of public toilet owners in responding to their vulnerability has an impact on the overall resilience of the community as a whole. Residents who succeeded in reorganizing by constructing public and communal toilets, provide facilities for other residents to carry out bathing, washing, and toilet activities. Especially, for renters with no private lavatory inside their rented units.

We also take economic factors into account in investigating interactions between public toilets as...
smaller-focal scales, and Kampung Muka community resilience as the larger scale. Assuming that there are no public toilets in Kampung Muka, then each resident need to have a private lavatory in their dwellings. This could not be possible yet, because of limited space due to densification and their economic capacity. Hence, residents with better financial ability built public toilet as a means for communal sanitation facilities. Users need to pay IDR 2,000 for one use, while the owner claimed that usually in one day there were approximately 50 users. If this number multiplied by toilet cost, her income per day is IDR 100,000. This income is used to meet their daily needs in addition to income from rented units.

Therefore Kampung Muka community could be considered resilience in terms of providing clean water and sanitation facilities, if we refer to the definition of resilience according to Walker and Salt [10] and Laboy and Fannon [13]; the capacity of individuals or systems to withstand shocks and pressure. In this context, urban kampung vulnerabilities act as shocks and stresses that could be overcome by the community. Providing clean water independently by utilizing public wells and the existence of public sanitation facilities scattered throughout the settlement is a supporting factor of urban kampung community resilience. This argument is related to aspects of community resilience according to the International Federation of Red Cross and Red Crescent Societies [7]. The factors include knowledgeable and can meet its basic needs, socially cohesive, have economic opportunities, and could manage its natural assets. Meanwhile, other factors which are well-maintained, accessible infrastructures and services that are well connected has not yet fulfilled. These aspects could also act as a framework to justify the potential importance of urban kampung.

The community resilience could reinforce in developing a resilient city if we refer to The City Resilience Framework (CRF) [14] based on the community's adaptation to the availability of clean water and sanitation facilities. The resiliency of Kampung Muka covers the dimensions of health and well-being, economy and society, as well as infrastructure and environment. The health and well-being dimension refers to the ability of urban kampung community to provide basic needs independently. This dimension relates to the next one, namely infrastructure and environment, which refers to the provision of primary services; hence, the formal institution needs to provide PAM/PALYJA for the entire community. These two dimensions relates to the last one; economics and society that refers to the financial system, a cohesive group of people that acts collectively and is involved in improving their community.

| Table 1. Resilience Assessment in water provision and sanitation facilities |
|-----------------------------------------------|
| **Main System Definition**                   |
| Independent clean water supply system and  |
| public sanitation facilities established by  |
| Kampung Muka is due to uneven distribution   |
| of PAM / PALYJA water supply which does not  |
| cover all areas of the settlement. The      |
| underlying cause of this issue is on land    |
| and building ownership status (security of   |
| tenure). Therefore the government has not    |
| issued clean water distribution permits for  |
| the entire area.                             |
| **System Dynamics**                          |
| Kampung Muka has succeeded in passing       |
| through all phases of the adaptive cycle,   |
| particularly being able to adapt in the face |
| of shocks and stresses occurring in the      |
| release phase.                              |
| **Interaction among Scales**                 |
| Adaptation is carried out in smaller-focal  |
| scales, that is how public toilets are      |
| arranged in such a way among densely        |
| populated settlement so that                |


it can act as a form of adaptation to meet the basic needs of Kampung Muka residents. The adaptation has several impacts on a larger scale (Kampung Muka as a whole) in providing water infrastructure independently.

**Government Interventions**
The local government or formal institution have not yet made a significant intervention in the provision of clean water for Kampung Muka.

4. Conclusions
We conclude that Kampung Muka community are resilient in terms of providing clean water and sanitation facilities, based on our reference to the definition of community resilience in CARRI [15]. Resilience is the ability of the community members to cope with long term pressures and remedy the impact of a problem. They manage to do this by utilizing resources, intervening the environment, and taking meaningful, deliberate, collective action [16][17]. These attributes may also present in other urban kampung community, therefore the informal settlements are still maintain to occupy some part of Jakarta. A city could be considered resilient when every component has the same supporting characteristics. To exemplify, if a shock caused by natural or human-made disaster occur, the city could recover better and bounce back from adversity by integrating the adaptive capacity of every community. If several communities - especially those who are vulnerable - are excluded and not considered as part of the city. Then if a disturbance occurs, that specific community will have a difficulty to recover. In the end, it can be concluded that inclusive urban design is needed to integrate urban kampung as part of the city to support community resilience which will have an impact on resilience on an urban scale.

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