

論 文 要 旨

Thesis Abstract

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主論文題名 (Title) Implication of Flood Disaster Evacuation Behavior for Upgrading Informal Settlements on Urban Riverbank Kampongs in Indonesia			
内容の要旨 (Abstract) <p>Evacuation is a critical decision for saving human lives during catastrophic disasters, particularly for those residing in urban riverbank kampongs (informal/self-organized settlements). Evacuation in those settlements is complex and challenging, contesting between the built environment's risk, lack of disaster mitigation infrastructure, and socio-cultural characteristics of its dwellers. Despite efforts by local communities to enhance emergency preparedness and response, the physical and infrastructure quality in most riverbank kampongs remains subpar, leaving residents as captive evacuees within their settlements. In response, the municipal government has implemented a slum settlement upgrading policy to enhance physical quality and empower local community. Understanding the current evacuation behavior of riverbank dwellers and the impact of slum upgrading on future evacuation behavior, intertwined with the sociocultural and spatial profile of the settlement, is essential.</p> <p>This study explores the implications of flood disaster evacuation behaviors on the upgrading of informal settlements in urban riverbank kampongs in Indonesia. Employing a case study in two contrasting riverbank kampongs in Yogyakarta, Indonesia, the author developed a conceptual framework for a pedestrian evacuation behavior model. This model elucidates the interplay between human (societal) and space (spatial configuration) elements in informal riverbank settlements. The study also simulates how morphological scenarios in slum upgrading programs affect evacuation behavior and emergency preparedness. This research comprised three phases. The first phase involved mixed methods: walking evacuation simulations with video analysis, walking interviews to gauge risk perception, and spatial configurational analysis. The second phase included a collaborative design workshop and qualitative analysis of upgrading strategies. The final phase utilized Space Syntax and the Pathfinder agent-based model to examine the impact of morphological scenarios on evacuation route choices.</p> <p>The findings reveal that evacuation behavior in urban riverbank kampongs is influenced by a complex interplay of individual capacity determinants like gender and age, and the path network configuration of kampong spaces. Notable evacuation behaviors include individuals choosing riskier paths to reach evacuation points with assistance from the local rescue unit (KTB) or opting for safer but longer routes. Space Syntax analysis generally shows that pedestrians in both kampongs prefer the straightest route choices to simplify navigation through the complex street network. The study underscores that evacuation risks in kampongs can be cascading, disproportionately affecting vulnerable populations and potentially compromising evacuation effectiveness.</p> <p>The collaborative workshop on kampong settlement upgrading identified four morphological scenarios for evaluation: 1) baseline morphology, 2) morphology under flooding with disrupted path networks, 3) the M3K morphology (derived from "set-back 3 meters, go upstairs, building facing the river"), and 4) grid morphology through a land-readjustment approach. Stakeholder qualitative analysis</p>			

revealed diverse opinions on kampong upgrading, particularly regarding its impact on evacuation route choices. The grid morphology, while facilitating straighter and safer evacuation routes, faced objections from local stakeholders due to significant financial, social, and time costs. In contrast, the M3K morphology emerged as a promising alternative, offering improvements over the baseline morphology with less impact on route choices than the grid approach. A key insight was stakeholders' recognition of the planning and design strategies' anticipated outcomes on evacuation behavior for each scenario. The collaborative design workshop ensured inclusivity in upgrading, focusing on kampong neighborhood resilience.

The morphological evaluation using Space Syntax's configurational analysis indicated that street network connectivity improvements, as seen in the grid morphology, yield higher accessibility and provide more alternative straight routes for evacuation. This is crucial if primary evacuation paths are compromised. The agent-based model (ABM) pedestrian evacuation simulation supported these findings, showing that individuals generally follow the most direct route to the nearest evacuation zone, mimicking natural movement patterns. The combined spatial analyses highlight the role of spatial configuration in strategic flood evacuation decision-making in complex urban environments like informal kampong settlements.

This dissertation concludes that flood evacuation route choice behavior in Indonesian urban riverbank kampongs involves difficult and risky decisions, especially for vulnerable groups (e.g., women with dependents, older adults, disabled). The conceptual framework was developed to better understand two primary evacuation behaviors in Indonesian riverbank kampongs: evacuation following the straightest or safer route. These behaviors result from the interplay between internal (individual attributes) and external factors (spatial arrangement and path risk elements), underscoring human-spatial behavior in perceiving and identifying subjective and objective path risk elements needed for route choice decision-making. The study has achieved its objective, revealing empirical flood evacuation behaviors and their potential changes due to morphological kampong upgrading. It asserts that comprehensive upgrading, including morphological changes, enhances evacuation efficiency and community adaptation to flood and lahar disasters.

The use of mixed methods (quantitative, qualitative, and simplified ABM simulation) and collaborative approaches in this research is a notable strength. By focusing on riverbank kampong settlements, the study provides a model for evacuation behavior and planning for kampong neighborhood resilience. It offers a novel perspective and methodological approach applicable to urban scholars, safety planners, and local stakeholders for evaluating morphological impacts on evacuation behavior and formulating inclusive evacuation strategies for marginalized communities. Finally, the study frames urban riverbank kampongs as equitable and safe habitats, contributing significantly to achieving UN SDG 11—resilient cities and communities.