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Mapping community environmental sanitation issue using household spatial cognition: A case of Bulu Lor Subdistrict, Semarang, Indonesia

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Abstract. Recently, a community in cities has played a key role in practicing an inclusive sustainable development with other stakeholders. However, the city government has a limitation in data spatial collection and documentation of urban environmental sanitation services, for instance. At the local scale, this data particularly relates to the local community knowledge and experiences. Unfortunately, the role of community as spatial data resource has not been encouraged yet. Instead, this condition has got worsened due to the lack of community spatial literacy. Nevertheless, this strive is important for data input on the planning process which illustrated how community recognizes their environmental changes. This paper attempts to build a simple mapping method based on household spatial cognition on urban environmental sanitary problems using GIS. Inductive mapping method applied to capture the community knowledge and experiences with a case study approach. In-depth interview was conducted with several key informants on Bulu Lor Subdistrict, part of North Semarang District, Indonesia. The reconstruction of household spatial cognition demonstrates transformation phase on the sanitation improvement due to community knowledge elevation on their health awareness and creation on their communal sanitation governance.

Keywords: *Inductive mapping, Sanitation problem, Spatial cognition, Urban services, GIS*

1. Introduction

Inclusive sustainable development needs a multi-actor, multi-sector and multi-scale approach. Therefore, everyone in the society should take a role in the development process which starts from spatial planning activity. In the micro-scale of participatory planning, there were some difficulties regarding less data input particularly to support the decision-making process. In terms of environmental issues, the local government has limitation to make all of data spatial collection and documentation. In contrast, the local community who has been experiencing those environmental problems does not encourage taking part as spatial data resource yet.

1.1. Spatial Cognition to Encourage Community as Data Spatial Resource in Micro-scale

Spatial cognition is a research interest between geographic and psychology which consider noncartographic map [1]. There are some research developed 'cognitive mapping process' which represent someone's memorizing of objects and its profile in a certain space [1], [2], [3],[4]. One of the popular roots reveals by [5] with 'image of the city,' followed by [6] with 'mental map'. On simple terms, those research expressed on how someone attempts to transform perceptions upon their surrounding environment into a map. However, those previous findings focused on city scale where

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people visualizing to encode object and spatial properties, decode or attribute a major characteristic of their city environments. Meanwhile, this paper attempts to apply spatial cognition to micro-scale especially focus on environmental sanitation problems facing by the community at subdistrict and neighborhood area.

1.2. Sanitation Problems and Regulation in the City of Semarang

Sanitation was mentioned in the Sustainable Development Goals (SDGs) number 6. Achieving this goal relates to the other SDGs, i.e. number 3 (healthy lives) and number 11 (city resilience) [7][8]. Sanitation availability became a significant way to create healthy lives and city resilience.

Sanitation problems in the City of Semarang reveal the lack of community access to healthy lavatory (bathroom, laundry-wash room and toilet) services. Residential area in Bulu Lor Subdistrict characterized by high-density buildings that have limited space to accommodate household private lavatory. People in this area usually use communal lavatory built by the local government for reducing contamination risk from open defecation behavior.

The community behavior improvement attempts related to how community poses a capacity for practicing Hygiene and Healthy Lifestyle (HHL). Indonesian Government through the Ministry of Health develops Community-Based Total Sanitation (CBTS) which organizes how city or regency could leverage their community behavior to create Open Defecation Free (ODF) area.

This research attempts to incorporate community knowledge and experiences about their sanitation problems which reconstructed as spatial and object properties. These steps were important to create a simple model of community spatial cognition as data spatial resource in micro-scale planning.

2. Research Methods

2.1 Scope of Case Study Research

Located on North Semarang District, Bulu Lor Subdistrict was selected as case study area because of some reasons (Figure 1). First, it is part of a high density of the urban residential area and some household have limited space to build a private lavatory. Second, it is a flood-prone area [8] which experienced some environmental sanitation problems. Third, Bulu Lor Subdistrict has classified as one of many subdistricts in Semarang which declared as ODF area [9] and revealed by a kind of community transformation attempts to the better environmental sanitation services.

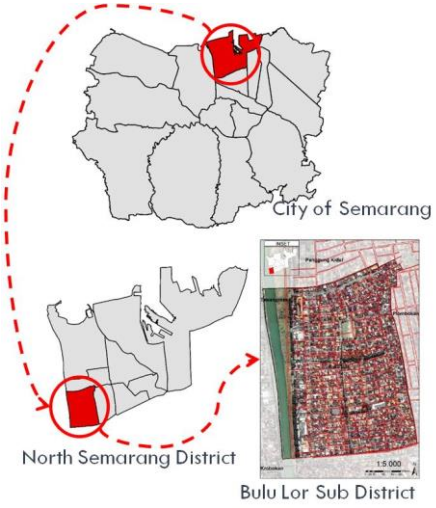


Figure 1. Bulu Lor Subdistrict as Case Study Are

2.2 Data Collection Method

This research applied case study method for exploring 'why' the community poses various transformation types of sanitation services and 'how' they attempts to reconstruct their knowledge and experience into spatial information [10]. Data collection was supported by in-depth interviews with five key informants. Those informants were selected from local dwellers as local champion in Bulu Lor Subdistrict which have had the best capacity of knowledge and experiences due to their environmental sanitation problems. Triangulation was conducted by desk study on secondary data from related Semarang Government agencies, non-governmental organization such as KOTAKU, and community organization such as PKK (a group of women for family welfare development), FKK (subdistrict health forum), BKM (community representatives in subdistrict empowerment) and LPMK (community empowerment institution).

2.3 Data Analysis Method

There were two analytical methods conducted in this research [10], namely the case unit and inter-unit analysis. Case unit analysis was withdrawn from each informant by whom some important unit information from in-depth interview coming up. Inter-case unit analysis was done as further analysis to find some causal or reciprocal unit information between case units. This step took as a validation process to verify any unit information respectively and restructured as a main thematic issue. Those thematic issues were validated by triangulation which supported by some desk study from secondary data to answer why and how the community in Bulu Lor Subdistrict could transform their environmental sanitation level of services within a certain range of timeline.

Unit information as an output of case unit analysis content some data object and spatial attribute. Object attribute refers to types of lavatory which describe not only the community behavior but also sanitation condition which consist of bathroom, laundry and water closet, solid waste, drainage and wastewater system services performance.

Inductive mapping approach was applied to encode and decode those data (object and spatial attribute) from descriptive/narrative into a certain space or place through reconstruction process of the point, line and area identification, distribution, or coverage [11]. Community spatial cognition then depicted as sketches above a Google Map of Bulu Lor Subdistrict. These sketches were validated by focus group discussion as a forum that gave an opportunity for all key informants to adjust and verify their spatial cognition into better articulation map regarding such sanitation issues respectively.

3. Result and Discussion

3.1 Community Knowledge and Experience in Practicing Better Hygiene and Health Behavior

Residential areas in Bulu Lor Subdistrict consist of organic housing-kampong and planned housing-estate. The healthy toilet characterized by closed water closet, roofed and covered by walls, and waterproof floor found at all planned housing-estate and some of organic housing-kampong. Building coverage area is about 90-100% with total lot housing space in the range from 15-18 m^2, 96-110 m^2 and 240 m^2. Those dwelling units settled along 120 and 180 cm width alleys, and 350 cm width neighborhood road. Sharing toilet, bathroom and laundry found at RW 8 and RW 6 mostly occupied by households living along 120 cm width alleys at a house with total lot space 15-18 m^2. Those sharing toilets built by Semarang Public Works Agency and maintained by the community. There is a cost-sharing mechanism applied through monthly compulsory donation (IDR 10.000) for every household regardless of user/nonuser status. Each communal toilet has a janitor man responsible for keeping the toilet clean. Public toilet users who come from outside RW 8 and RW 6 neighborhoods charged by IDR 1000/person/use. Peak hour of toilet occupation is from the dawn till 6 am the next morning and 4-6 pm in the afternoon.

There are various types of toilet transformation which have been leveraged from conventional 'helicopter' along Banjir Kanal river in the year 1970 into sharing a toilet with no septic tank in 1986,

and sharing a toilet with the septic tank since 1993-2002 up to now, and private lavatory since 1990 up to now. In the helicopter phase, most of the community practicing open defecation along the river and has caused significant contamination on Banjir Kanal Barat River which also used as Semarang water pipe resource. Sharing toilet still needed by a household with no private lavatory due to limited space of their house. Disturbance on using the sharing toilet is 15-30 minutes queuing time. Meanwhile, a house with eight or more occupants also has 15-30 minutes queuing time. The longer waiting duration time the bigger potential for practicing open defecation in the backyard, drainage channel or along the river.

3.2 Inductive Mapping of Data Object and Data Spatial Attributes

There are three steps of inductive mapping started by 'point' identification of landmark or object as an initial orientation on cognition steps (shown by the location of OD/helicopter or sanitation services facility). Next step is 'line or path' identification to display alleys or roads to access neighborhood facility including sharing toilet/communal sanitation and boundaries of neighborhood area. Last identification is community spatial cognition on 'area' which imaginary revealed by the type of residential area in pair with improvements attempts to achieve healthier sanitation services. Figure 2 illustrates the overall inductive mapping steps.

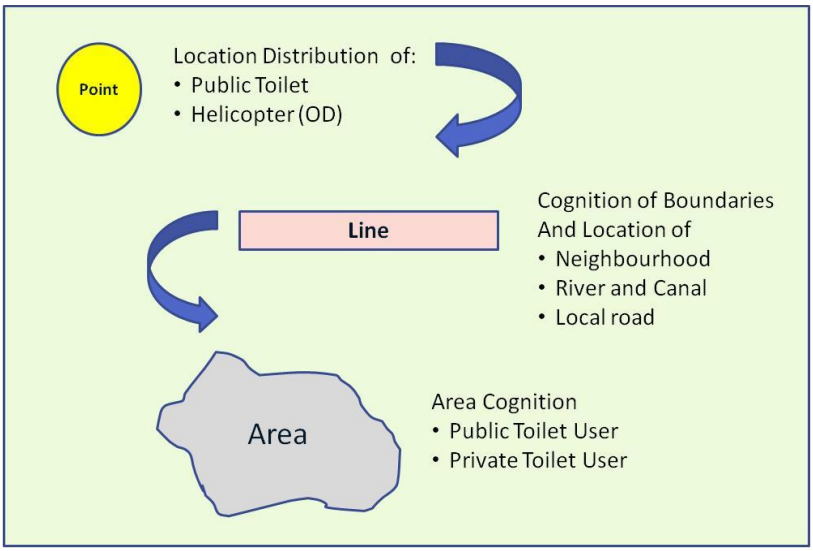


Figure 2. Simple Model on Bulu Lor Household Spatial Cognition

3.3 Community Spatial Cognition on Environmental Sanitation Issue

Spatial cognition on environmental sanitation issue has become a kind of social space which reveals either a behavior, symbolic or affective level [12]. This spatial cognition depicts household perceptions of space and place as a social relationship with their environmental sanitation issue from 1970 up to now. The household cognitions comprise three steps, namely acquisition, representation and reflection [1]. An acquisition is about where their sanitation services located reveal as objects in a point identification. This spatial cognition is continued by the acquisition of Banjir Kanal River, drainage canals, local road and alleys as line identification. This followed by the acquisition of neighborhood boundaries as area identification. The second step is a representation of their acquisition of objects through inductive mapping and end up with a reflection about their transformation on a timeline of achieving healthier sanitation improvement. Figure 3 illustrates those transformations as a final result of Bulu Lor Spatial Cognition. Although most of the household in Bulu Lor Subdistrict has a private lavatory since 1990, the OD behavior still exists among less than 10% inhabitants. The increase of community awareness in using hygiene lavatory with septic tank either on public or private toilet comes from public consciousness in practicing hygiene and healthy lifestyle. PKK, as a women organization

for family welfare development, encourages the community health awareness by weekly monitoring. This activity has been done to defend and avoid dengue fever by investigating every household lavatory.

The most interesting part in Bulu Lor shown by community governance to maintain sanitation services. There is a cross-subsidized financing mechanism. Every household gives 10,000 IDR for their monthly donation (either as public toilet user or not) to supply water availability and pay the electricity for deep-well operation and cleaner equipment for keeping the public toilet clean.

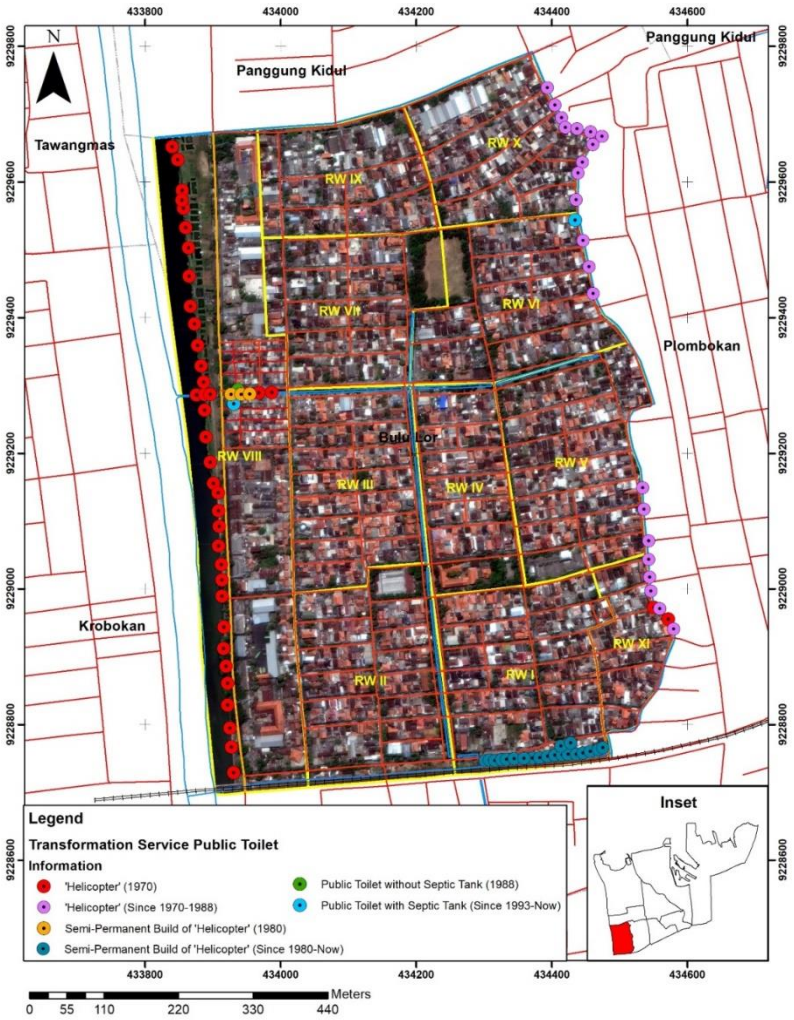


Figure 3. Bulu Lor Household Spatial Cognition on Environmental Sanitation Issue

4. Conclusion

The reconstruction of household spatial cognition in Bulu Lor demonstrates transformation phase on the sanitation improvement attempts (from 1970 up to now) due to community knowledge elevation on their health awareness and creation on their communal sanitation governance. It shows that bottom-up information such as sanitation problems are potentially utilized as data input for the planning process. Inductive mapping approach supports as a simple tool for incorporating community knowledge and experiences as data spatial resource in the micro-scale level.

5. Acknowledgments

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