Spatial pattern of the social space in self-built and core house post-disaster housing in Yogyakarta, Indonesia

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Abstract. The main purpose of this article is to understand the spatial pattern for social space in post-disaster housing reconstruction in Yogyakarta as an actualization of their important socio-spatial space in Javanese dwellings through an in-depth examination and comparative analyses between two real cases of post-disaster housing in Yogyakarta. The methodology of this research is based on several periods of on-field observation, which including physical data documentary, interview and literature reviews. Items related to development of space pattern and its relation to the activities and social interaction behaviors in the spaces were assessed. Based on the cases, a discussion on how residents adjusted their post-disaster housing were performed, and in conclusion, results suggest that modification were being made in their development of spatial pattern to accommodate their needs of social space in order to maintain users’ personal and social lifestyles.

Keywords: Socio-spatial space, spatial adjustments, housing reconstruction

1. Introduction

Post-disaster reconstruction process needs to be sensitive in accommodating the existing complexity as the projects often require a limit time to implement amid a chaotic condition. Because the most frequent risks identified in post-disaster reconstruction projects appear to be the non-acceptability of the project outcomes and the absence or lack of satisfaction amongst the project beneficiaries with their houses [1]. Additionally, the design of resettlement houses is often inappropriate for domestic activities which require different kinds of spaces for different uses according to season. Finding on the previous study in dome-donated post-disaster housing program has also supported this view [2]. A poor understanding on local needs and values has resulted in failures. As open-ended design did not appear in dome post-disaster house design, certain habitual practices are no longer possible to perform. This mentioned study case highlights the importance to consider both socially and culturally needs as well as values of the affected population when utilizing a certain house design.

Additionally, in relation to disaster issues, a core house is used in various post-disaster housing reconstruction projects as a way to quickly provide livable permanent housing to an increased number of beneficiaries [3]. The core house is a house planning idea that can be built in stages by taking into account that the families who occupy the house will have children, their economic levels will increase, and those who gradually want to develop their space dwelling [4]. Therefore, the unit should be designed flexibly so that it can be changed and adjusted easily [4]. The core, which can be built quickly, needs fewer resources for initial construction; later on, residents can leverage their own funds or donations for expansion [3]. Generally, the basic functions contained in the ‘core house’ are the bedroom, multifunction room, and MCK (Mandi, Cuci, Kakus; bathing, washing, and toilet) that refer
to the standards of the World Health Organization (WHO) [5]. Meanwhile, core houses space needs that take precedence are primary spaces such as guest room, family room, bedroom, bathroom and kitchen [6]. Another research mentioned that a traditional ‘magersari’ housing, a traditional house and other public housing so called ‘core house’, consists of ‘guest room’, ‘bedroom’, and ‘kitchen’ [7]. Meanwhile, ‘core houses’ alteration often start with the expansion of double/triple size of guests room, which acts as a social space and then followed by bedroom as the private space [8]. However, the existence of ‘guest room’ was even found in the temporary tents and house at the early stage of Java 2006 earthquake. Despite the need on other functional rooms (bedroom, kitchen, etc.), the victims opted to accommodate their social behavior which was expressed and actualized in the ‘guest area’. This fact, once again, draws the influence of social behavior on Javanese dwellings.

Javanese are known as people who highly uphold the values of harmony among neighbors (rukun) and harmony in living a social life together [9]. The harmony of social life is often formed because of the interaction process that is manifested in the Javanese social and ritual traditions so as to provide a separate representation in the meaning of the spaces and development of Javanese dwellings [10, 11]. A house for Javanese is a living environment that represents a philosophical concept of the society itself [12]. Correspondently, it is found that the greater the overlap of public and private space in the Javanese house indicates the higher role of social life [13]. The middle and the front of the house can be said as territory of semi-private or semi-public with the possibilities to be functioned for public/guests [13]. The merging of these public and private spaces emphasizes a strong social relationship of the Javanese community.

In the last two decades, Yogyakarta experienced two major natural disasters, namely the earthquake in 2006 and the eruption of Merapi in 2010. An earthquake centered at a depth of 20 km from the city of Yogyakarta, had killed more than 5 000 people, injuring thousands, and moving nearly 20 000 lives from their residence. The housing reconstruction program was soon implemented, involving the role of NGOs (Non-Governmental Organization) and the government. Meanwhile, the 2010 Merapi eruption that killed more than 340 people has destroyed thousands of homes and surrounding areas [14]. In response to this, the National Disaster Management Agency (BNPB) instructed the relocation of 200 000 residents living in Disaster Risk Areas III to safer zones, as villages around the slopes [14].

In this research, two different types of post-disaster residential reconstruction schemes are investigated. The two types are post-disaster housing after the 2006 earthquake (self-built housing) and the 2010 post-disaster housing after 2010 Merapi eruption (template design based core house housing). This different condition forms the basis for analyzing the development of the spatial pattern of their post-disaster housing. This research purpose is to understand the spatial development of post-disaster housing especially relate to their spatial pattern to accommodate their social activities and lifestyle in order to find the linkage between disaster residential planning and the importance of understanding the users’ needs and lifestyles. This study presumed that physical and behavioral adjustments on post-disaster settlements are the reflection of suitable dwellings. The results of this study are expected to be a reference in post-disaster residential planning.

2. Method

Aiming to address the objective of the research, two relevant studies on real cases of post-disaster housing were compared. The difference is in the type of reconstruction house between the two cases studies became the basis of the chosen cases. For this study, the sample for post-disaster housing after the 2006 Java earthquake is self-built housing and the post-disaster housing after Merapi’s 2010 eruption is template based core housing. Data were obtained from several periods of field observation, including physical data documentary, interview and questionnaires in both area of study cases as well as literature studies. More detailed information was acquired by conducting series of structured-interviews to the victims of Java Earthquake 2006 in sub-villages of Ketonggo, Mangung, and Tegalrejo as well as those who were affected on Merapi eruption 2010 in sub-villages of Petung, Kaliadem, Ngepringan, Palemsari, Kpeng, and Jambu. A comparison between the two-collected data shows residents’ preferences on adaptations of their dwellings. Focusing on human behavior as the object, the outcome of this discussion will highlight the linkage between disaster residential planning.
and the importance on understanding the users’ need and lifestyle. This study presumed that physical and behavioral adjustments on post-disaster settlements are the reflection of suitable dwellings.

Figure 1. Locations of the study.

2.1. Overview case studies
After the 2006 earthquake in Yogyakarta, a case of reconstruction was directed by NGOs and authorities to foster housing recovery for nearly 5 000 affected people. Taking place on sub-villages of Ketonggo, Manggung, and Tegalrejo, the first study case evaluates the self-built post-disaster housing in two integrated observations in year 2006 and 2008. The 2 yr difference of this survey was purposed to see the development of the dwellings, mainly on the alteration from temporary to permanent house spatial pattern development. As many as 39 households participated on the first survey, whereas only 33 of them were re-surveyed as some of them were moved out from the area. As for the criteria of this survey, participants were those whose houses’ condition were completely destroyed and had been rebuilt their house based on users’ design cognition.

The second study case is located at six neighboring sub-villages in Cangkringan district, Yogyakarta Special Province, where in 2010, this region had suffered from devastated Merapi eruption. These sub-villages, namely Petung, Kaliadem, Ngepringan, Palemsari, Kopeng, and Jambu, had conducted a relocation program with a technical assistance from Community-Based Settlement Rehabilitation and Reconstruction (REKOMPAK). Through this scheme, affected families were being involved throughout the entire process of reconstruction. Not forget to mention, participants were also encouraged to have inputs in decision-making in these following phases: selection of the relocation site, development of the master plan, as well as its construction processes. Government provided a 100 m² site (10 m × 10 m and 8 m × 12.5 m) coupled with housing assistance in the amount of 30 000 000 rupiah to each household to built a 36 m² template based permanent core house. This post-disaster house would comprise of a common space, a bedroom (can be one or two), and a toilet. Once the construction finished, the majority of residents started to modify their dwellings. As they felt necessary, many families were found adding a kitchen, and in some cases, followed it with veranda or garage. However, a total of 102 participants were involved in this survey which was organized in July 2014, or 2 yr after the completion of this post-disaster housing project.
Table 1. Detail description of case study areas

| Case                  | Java post-earth quake disaster dwellings | Post Merapi eruption dwellings |
|-----------------------|------------------------------------------|-------------------------------|
| Resident ethnic       | 100 % Javanese                           | 100 % Javanese                |
| Dwelling design       | Self-built post-disaster temporary and permanent house built by self-design cognition | Core-house with technical assistance by REKOMPAK |
| Type of area          | three Sub-villages (Ketonggo, Manggung, Tegalrejo) | Rural area, Yogyakarta, Java six Sub-villages (Petung, Kaliadem, Ngepringan, Palemsari, Kopeng, Jambon) |
| Time of survey        | November to December 2006, November 2008 | July to August 2014 |

2.2. Field observation

At the earliest stage, before modification and addition of the self-built post-disaster dwellings were carried out, field activity began with an initial observation on research’s participant. Following it, questionnaires and in-depth interviews were conducted with the help of volunteers from Universitas Gadjah Mada. By comprised of two people on each team, one was responsible to sketch the house plan, while the other did the interview. Information acquired as follows: participant’ background (age, sex, family, occupation, income, etc.), house condition (land status, house age, structure, etc.), house plan (room space, size, etc.), space usage (including personal and interpersonal activities), and cognition of spaces on front/back, hidden/seen, public/private, flexibility, etc. Meanwhile, during the second part of the survey, the team had to re-observe and analyze the differences on physical qualities of the built environment, including to perform an assessment on occupants’ degree of satisfaction.

Similarly, field activity in the second case study started with the selection of respondents. The main selection criteria were families who already performed self-modification on their dwellings. Field observation on the physical condition were arranged to gather data on houses’ plan and record the possible changes. As nearly all of the dwellings have been modified by the users, alteration of the housing is the focus on this, thus can examine the users’ preferences in changing the planning of their house. On the other hand, data categorized as background of participants were collected through structured-interviews. This required information is provided to identify demographic condition and socio-economic status. Questions were ranging from personal data, such as age, number of family, occupation, level of education, (including details on head of family’s occupation and his level of education) and monthly income.

3. Result and discussion

3.1. Importance of social interaction

Nearly 41 % of respondents in sub-villages of Ketonggo, Manggung, and Tegalrejo accepts guest activities as everyday occasion, whereas 90 % of them shows involvement in community gathering and accept large gathering in their house. As many as 95 % of the respondents express traditional social behavior, including Javanese living practices and community values such as ‘gotong royong’ (spirit of helping one another through good and bad), and ‘kekeluargaan’ (feeling of extended kinship in which the community is considered to be one big family). Over 60 % of them said that both of the values grew significantly following the disaster.

On the other hand, value of ‘gotong royong’ and ‘kekeluargaan’ were shown in post Merapi eruption residents through their active role in the community-based relocation scheme. A high level of participation along with great enthusiasm appeared at the early stage of the reconstruction program, although shows a decline as the program entered the construction process. Background of the residents, as well as their status on the reconstruction’s team were considered as the factor on this
finding. Moreover, different level of participation was spotted between the adult and the youngster group. Yet, in practice, the juveniles played an active role in assisting the older on each reconstruction phases. Hence, the occurrence of this phenomena highlights the fundamental aspect of Javanese community: gotong royong and kekeluargaan, which still perceived even at the difficult situation.

3.2. Spatial pattern in post-disaster housing

Within 2 yr observation in self-built post-disaster housing in three sub-villages of Ketonggo, Manggung, and Tegalrejo significance size and number of room expansion from temporary houses to permanent houses increase more than two times its temporary size. In both temporary houses and permanent houses, total size indicates that bedroom is the largest space in the house. However, guest room size had expanded the largest by more than five times its original size (Figure 2). Moreover, integrated multifunction guest and family room had decreases more than 50 % and in exchange separate guest room increase more than 50 %. This emphasize the needs of guest room for interaction space with guests to be separated from family room as interaction space for family or people that considered family (Figure 2).

Figure 2. Spatial pattern in self-built post-disaster housing of earthquake 2006 [2].

In the Core post-disaster housing in Cangkringan district, the initial design of post Merapi eruption settlement did not include kitchen (K). Following this, had the construction of the main unit finished, the majority (80.4 %) opted to expand their back area to function as a kitchen. The average area of enlargement is recorded at 17.4 m². Another fewer respondents chose to combine their kitchen with a family room (F+K). The founding also show a constant addition on both number of rooms and total areas for guest room. Yet, the need on family room (F) slightly rises as indicated by having 1.8 times larger than its original size (Figure 3). As many as 90 % of the post Merapi eruption dwellings in six sub-villages (Petung, Kaliadem, Ngepringan, Palemsari, Kopeng, and Jambu) has been extended, with a major addition in support spaces area. This area comprises of Kitchen (K), Garage (Ga), Storage (S), Terrace (Tr) and Shop (Sh). Interestingly, these called support spaces are also acts as social spaces, where Terrace (Tr) use to accept non formal guests, Kitchen (K) where the wives interacts with their neighbors and Storage (S)/Garage (Ga) is actually added exactly next to their neighbors that usually still have family connection to create a larger non formal social space that can be use for both families. Despite the fact that no changes in size and numbers of guest room in the development of core house, nearly 68 % of the respondent add terrace (Tr) to support the need on social interaction. Moreover, as many as seven respondents convert their garage into a multi-functioned room (M) that might be used as a utility and gathering space. This multi-functioned room, which was a design result from the integration of in between spaces among two-core house, is considered as a shared space. Similarly, these needs for social space in the spatial pattern development is found in self-built post-disaster housing, although addition in private area also shows a notable result.
Figure 3. Spatial pattern changes in core-house of Merapi eruption 2010

In both cases of self-built and core post-disaster housing illustrate a growing need on expansion and addition of bedroom areas (B) in both types of post-disaster housing (Figure 2 and Figure 3). In the post Merapi eruption dwellings, the need on this private room has increased 1.2 times with an average of one addition for about 9 m². However, in the self-built post-disaster housing, although shows identical finding, the average area size of extended bedroom decrease although the addition number increase.

The expansion and separation tendency of guest area have relevant founding with public housing complex in Yogyakarta where most ‘core house’ alteration cases started with the expansion of guest room to the front area and had doubled its original size [8]. However, total room number of bedroom is still the highest overall changes which also indicate a high need of private space although its average room size actually decreases.

The same pattern in the development of these two types of houses is in line with the concept of a traditional Javanese house, where semi-public or semi-private areas are usually functioned as social spaces to interact [12, 13]. This can be seen in the increasing amount of space not only in the private space but also in the semi-public space. In the case of self-built post-disaster housing, it can be seen that the semi-public and private areas increase by three times both in terms of quantity and amount of space while the core-house case of Merapi, although the semi-public space and private space do not increase significantly instead support increase drastically. Interestingly, support spaces such as storage or garage became multifunction space. Support spaces does not only function as a garage or parking lot but also functions as a social space between neighboring houses and shared together as usually they have family connection. From both study cases, the results shows that the spatial pattern development tendency toward the needs to facilitate both social spaces and private spaces. These spaces considered as dualism in Javanese dwellings, where the philosophy of Javanese society considers the home as a microcosm of the universe, so they also seek balance in their housing through social interaction [15].

4. Conclusion

The development of spatial pattern of both study cases in self-built and core post-disaster housing shows a highly need on spaces’ adjustment, either on adding private spaces or social spaces. Correspond with this, users’ tendency on alteration depends on the availability of the preferred rooms on their initial temporary or core house. In the case of core-house in Cangkringan district, adding kitchen and family room are the top priority, whereas in sub-villages of Ketonggo, Manggung, and Tegalrejo, the majority choose to expand their guest room area, in both cases can be considered as social spaces where social interaction happens. The differences between the two-housing type
reconstruction schemes also becomes the reason on why users have different tendency on performing room’s modification. Although there are differences in the type of room development but in both cases the changes of the rooms addition or expansion still correlate with the need of social spaces, the difference is the type of social activities the space facilitates.

Through the above findings, it can be concluded that the need on social interaction could not be separated from Javanese community and need to be facilitate in their dwellings even at a constraint situation. During the reconstruction processes, other external factors, such as time limit and donors’ availability often made the housing design completed within a minimum standard of housing. Though from the spatial pattern development findings shows that the survivors made adaptation and adjustment on their behavioral aspects in using their private and social space in order to maintain their previous personal needs and lifestyles. This shows that post-disaster settlement requires flexibility on the design to accommodate users’ needs that in the long run will improve their quality of life.

Basically, the Javanese dwellings always have duality space of private space and public space. Although the conditions of their space are very limited in both self-built and core houses, residents will develop their homes into houses that can meet their needs for personal and social interaction activities and lifestyle. Social space is a space of interaction, both public, semi-public, semi-private, and private which facilitates various social interaction from interaction between oneself with their family, neighbors, guests, or strangers. Therefore, both private space and public space are equally important to be accommodated even in such constraint condition such as post disaster housing.

References

[1] Dikmen N and Elias-Ozkan S T 2016 Housing after disaster: A post occupancy evaluation of a reconstruction project *IJDRR* 19 167–178
https://www.sciencedirect.com/science/article/pii/S2212420916301972

[2] Marcillia S R and Ohno R 2018 Importance of social space in self-built and donated post-disaster housing after Java earthquake 2006 *ajE-Bs* 3(6) 111–119
https://aje-bs.e-iph.co.uk/index.php/ajE-Bs/article/view/241

[3] Maly E, Kondo T and Shiozaki Y 2012 An incrementally expandable core house for disaster reconstruction: two cases in Yogyakarta, Indonesia after the Central Java earthquake *Memoirs of the Graduate Schools of Engineering and System Informatics Kobe University* (4) 1–7
https://www.semanticscholar.org/paper/An-Incrementally-Expandable-Core-House-for-Disaster-Maly-Kondo/b746774c7c7c4dcarbf8c327dc5f4fa674184593

[4] Aryani S M Wahyuningsih I E S and Mulyadi 2016 Evaluasi rumah inti tumbuh perummas berdasar kecenderungan transformasi desain [Evaluation of core houses grows perummas based on trends in design transformation] *Tesa Arsitektur* 14(2) 64–72 [in Bahasa Indonesia]
http://journal.unika.ac.id/index.php/tesa/article/view/668

[5] Sindu M S 2017 Analisa kebutuhan luas minimal pada rumah sederhana tapak di Indonesia [Analysis of minimal area requirements on simple site houses in Indonesia] *Jurnal Permukiman* 12(2) 116–123 [in Bahasa Indonesia]
http://jurnalpermukiman.pu.go.id/index.php/JP/article/view/62

[6] Agusniansyah N and Widiastuti K 2016 Konsep pengelolaan desain rumah tumbuh [The concept of managing home design is growing] *Modul* 16(1) 1–12 [in Bahasa Indonesia]
https://ejournal.undip.ac.id/index.php/modul/article/view/10778

[7] Winarna 2005 Magersari as an alternative of housing and settlement development concept *Informal Settlement and Affordable Housing (November 17-18 2005 Surabaya)* pp 15–18
https://www.irbnet.de/daten/iconda/CIB973.pdf

[8] Ikaputra 2009 Core house: A structural expandability for living study case of yogyakarta post earthquake 2006 *Dimensi: Journal of Architecture and Built Environment* 36(1) 10–19
http://dimensi.petra.ac.id/index.php/ars/article/view/16969/16952
[9] Lestari S, Faturochman, Adiyanti M and Walgito B 2013 The concept of harmony in javanese society Anima, Indonesian Psychological Journal 29(1) 24–37. https://www.researchgate.net/publication/304086214_The_Concept_of_Harmony_in_Javanese_Society

[10] Kumalasari L D 2017 Makna solidaritas sosial dalam tradisi ‘sendedek desa’ (studi pada masyarakat desa Ngogri Megaluh Jombang) [The meaning of social solidarity in the tradition of ‘village alms’ (study of Ngogri Megaluh village community in Jombang)] Seminar Nasional dan Gelar Produk (October 17–18 2017 Indonesia) pp 1110–1123 [in Bahasa Indonesia] http://research-report.umm.ac.id/index.php/research-report/article/view/1336

[11] Djono Utomo T P and Subiyantoro S 2012 Nilai kearifan lokal rumah tradisional Jawa [Local wisdom value of traditional Javanese house] Humaniora 24(3) 269–278 [in Bahasa Indonesia] https://jurnal.ugm.ac.id/jurnal-humaniora/article/view/1369

[12] Harahap, Yulia Nurliani 2016 Exhibiting Modernity And Indonesian Vernacular Architecture: Hybrid Architecture At Pasar Gambir Of Batavia, The 1931 Paris International Colonial Exhibition And Taman Mini Indonesia Indah. Springer Fachmedien p 190 – 192 https://www.researchgate.net/publication/292630470_Exhibiting_modernity_and_indonesian_vernacular_architecture_Hybrid_architecture_at_pasar_gambir_of_batavia_the_1931_paris_international_colonial_exhibition_and_taman_mini_indonesia_indah

[13] Supriyadi B, Sudarwanto B and Werdiningsih H 2012 In search of the power of Javanese culture against the cultural urbanization in Kotagede, Yogyakarta-Indonesia Procedia Soc Behav Sci. 68 676–686 https://www.sciencedirect.com/science/article/pii/S1877042812057412

[14] JRF 2011 Laporan Perkembangan 2011 Terus Membangun dari Kesuksesan: Secara Efektif Menanggapi Beragam Bencana [2011 Progress Report Continues to Build from Success: Effectively Respond to Various Disasters] (Jakarta, Indonesia: Sekretariat JRF) p 5 [in Bahasa Indonesia] https://issuu.com/virgiftan/docs/4_issuu_-_jrf_report_2011_-_bahasa

[15] Ju S R, Kim D Y and Santosa R B 2018 Dualism in the Javanese house and transformation with focus on the houses of Kotagede, Yogyakarta J Asian Archit Build. 17(1) 71–78 https://www.jstage.jst.go.jp/article/jaabe/17/1/17_71/-_article/-char/en