Eco. Env. & Cons. 27 (2) : 2021; pp. (673-678)
Copyright@ EM International
ISSN 0971–765X

Evaluation of housing resilience in post-disaster housing of Pager Jurang and Dongkelsari, Yogyakarta

Lulu Muhammad[1], Lilianny Sigit Arifin[2] and Y. Basuki Dwisusanto[3]

[1]Department of Architecture, Parahyangan Catholic University, Bandung, Indonesia.
[2]Department of Architecture, Petra Christian University, Surabaya, Indonesia
[3]Department of Architecture, Parahyangan Catholic University, Bandung, Indonesia.

(Received 9 September, 2020; Accepted 15 October, 2020)

ABSTRACT

Although research on housing and settlement is not new, however, little is known about the concept of resilience in the resettlement of disaster-affected communities. The ability of housing to meet the needs of occupants has become a major challenge. As an adaptation process, changes that lead to failure to maintain the principle of resilience become a phenomenon that often occurs. With a case study of post-disaster housing Pager Jurang and Dongkelsari in Yogyakarta, Indonesia, this article analyzes the changes occurred in relation to housing resilience understanding. This research was conducted by analyzing the changes associated with the understanding of housing resilience by using a descriptive qualitative approach based on direct observation, interviews, and analysis of secondary data and literature. Physical, spatial, and culture become 3 main issues that are analyzed and linked to social capital and physical capital to find a new understanding of housing resilience. The study finds that the understanding of resilience should not only focus on physical and measurable matters but also need to give greater focus to non-physical matters which in the longer phase turned out to be very significant on the level of housing resilience and play a major role in its sustainability.

Key words : *Changes, Housing, Resilience, Post disaster*

Introduction

Located in the equator, with a unique geographical position, Indonesia is the one and only country with the highest disaster risk in the world. According to DIBI1, 9383 catastrophic events occurred in 2019 (an average of 25 incidents daily), created 684 casualties, 5.3 million displaced persons, and more than 50,000 damaged houses. With losses that can reach trillions of rupiah, disaster events always bring damage and loss impacts on aspects of life and livelihoods. In the post-disaster recovery process, resettlement affected communities through the provision of shelter and has always been the first priority. It is due to several factors including socio-economic conditions, increasing family members, changes in housing, and residential environment. The changes of function, form, and activities of the occupants directly affect the aspect of resilience that was built as the main reference.

The term resilience is often used and reflects the Latin root '*resiliere*' which means 'jumping back' (Klein *et al.,* 2003). In the context of housing, resilience has become the main reference used in the construction of post-disaster housing nowadays. The notion of resilience was first introduced by John Bowlby in 1969 based on the principles of 'The Attachment Theory' between mother and child

(Phaneuf, 2013). It is followed by Holling who defined the term resilience from an ecological perspective as a measure of the ability of an ecosystem to absorb change and survive, as mentioned in his article entitled 'Resilience and Stability of the Ecological Systems' (Maarif, 2012). The concept of resilience then gained recognition and was increasingly used in many fields, one of which was social. Mayunga, (2007) who defined it from the sociological point of view stated that resilience is the ability to exploit opportunities and fight and recover from negative shocks. This means that a strong social system must be able to absorb shocks and rebuild so that society remains in the same functioning state.

At present, the notion of resilience is increasingly being used in many fields, including disaster, as a concept for understanding and managing complex human and natural related systems. Timmerman (1981) is the first who use the concept of resilience in relation to disasters (Klein *et al.*, 2003). He defined the term resilience as a measure of the system or a portion of the system's capacity to absorb and recover from dangerous events. In line with the increasing global attention on disaster after the 2004 tsunami that shook the world, the concept of resilience began to be discussed and initiated globally. The latest definition of resilience that is considered as the most up-to-date and recognized globally through UNISDR, is 'the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions'. However, this notion of resilience is more focused in terms of disruptions that can be absorbed by the system in the event of a disaster but does not discuss anticipation of change within a certain time period. In the context of housing, there is no globally recognized definition of resilience yet, but in the 48th ISOCARP2 Congress in Nairobi, Kenya in 2010, it was Kristy Revell who defined city resilience as the adaptability of a system to respond and adjust to change both within the system and beyond. In the *World Habitat Award III held in* Quito, Ecuador 2016, World Habitat3 defined housing resilience as the ability of housing to minimize risks from future natural occurrences. The author argued that this definition is the most supportive of the formulation of the housing resilience definition and no available definition has been made as a global consensus. This argument is linked with Tuan Anh Tran notes in his book about "Developing Disaster Resilient Housing in Vietnam" that there is a lack of consensus in defining housing resilience and a gap in academic literature on this vital matter.

Materials and Methods

Resilience involves many things, including sustainability, adaptability, and capacity in reducing the risk of possible future disasters. Therefore, the ability to 'manage from' or 'spring back from a shock' for a group of residents or the community becomes very important. However, as with the definition of resilience in the ecology and disaster fields, the definition of housing resilience today still focuses on the ability to adapt to disruption, flexibility, responsiveness to shocks or sudden changes. It does not discuss situations when changes occur as a result of a process in a certain period of time and not as a result of a sudden shock. I have not found a proper understanding of housing resilience, especially for residents and stakeholders involved in post-disaster recovery processes. Therefore, by using a capital approach, this research was conducted to identify a new understanding of housing resilience in a more precise way for key stakeholders involved in post-disaster housing development. This research is also expected to provide input in the process of rebuilding housing and housing for communities affected by disasters, as well as the importance of social processes to support sustainability.

Insights from Case Study Location

Pager Jurang and Dongkelsari Post-Disaster Housing, Yogyakarta, Indonesia

The fieldwork for this paper was undertaken by the author over 4 periods in 2106 and 2017. Post-Disaster Housing of Pager Jurang and Dongkelsari are located 40 minutes of drive north Yogyakarta (Figure 1). It is a result of the relocation of communities affected by the 2010 Merapi volcanic eruption from Wukirsari Village, Manggong Village, Petung Village, Kaliadem Village, Kepuh Village, Sleman Regency, Yogyakarta.

Completed at the end of 2011, and handed over to the communities in January 2012 (Pager Jurang) and March, 2012 (Dongkelsari), both locations are inhabited by 448 households in the area of 50,365 m^2 (Pager Jurang) and 24,690 m^2 (Dongkelsari). Public

facilities are provided in both locations, including communal cages, mosques, community halls, playgrounds, and parks.

Fig. 1. Case Study Location (*Source:* Google Map)

Methodology

This research was conducted using a descriptive qualitative approach based on direct observation in the field. This research method was chosen based on problems (phenomena) that exist in the form of changes in the function and form of housing and social activities. The survey was carried out over a period of 8 months involving 60 residents (out of a total of 448 households), parties involved in development (including donors/funders), as well as local authorities. Figure 2 shows the framework as a basis for the overall research processes.

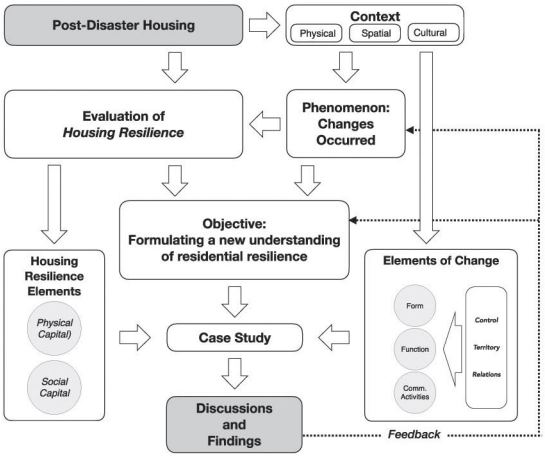

Fig. 2. Research Framework

Study of Territory and Capital in the Process of Changes

Activities of the residents as individuals or communities adapting to new needs directly affect the process of change in the built environment and the elements that are in it. In the case of changes related to the ownership, Habraken (1998) discussed the space in control of rules or ownership which is interpreted as territorial (*space under control is territorial*). The territory can be interpreted as a space that has rules relating to patterns of behavior and ownership. In addition to the control of space mentioned above, other theories from Habraken that could be considered as a basis for analyzing the cases are territory and control, territory and inhabitation, and territorial hierarchy. Several issues related to the above territory emphasize that the role of community and social activities has a very important meaning in determining the direction of change.

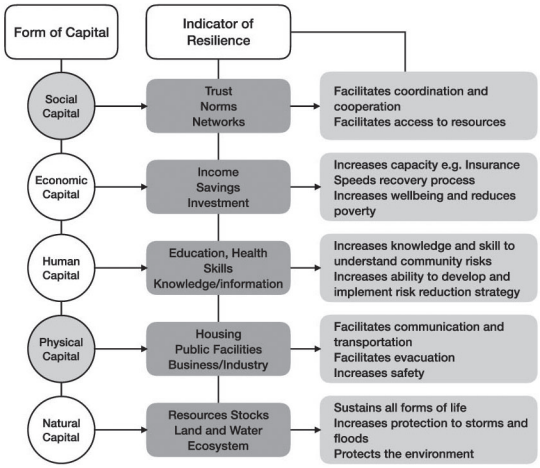

Fig. 3. Conceptual Framework of Capital Domains and Community Resilience (Mayunga, 2007)

Based on the above theories related to the process of change, this paper proposes the use of the capital-based approach as a framework to assess and evaluate housing resilience by building on the foundation laid out by Mayunga (2007). The foundation uses five main aspects of capital (Figure 3), namely: social, economic, physical, human, and natural. However, this paper selects 2 capitals, physical capital, and social capital, which are believed to be crucial in determining the direction of change and mostly have a connection with the theory of territory and control mentioned previously, and at the same time also believed as the components that have a strong

relation with local characteristics.

Physical capital is one of the important things in building housing capacity in dealing with disasters. The ability to build for disaster risks has been an important topic in many studies. New technologies and innovations have been discovered and applied in various regions around the world to be part of a housing recovery strategy and at the same time anticipate disaster risks. So, it is very easy to measure and find an understanding of resilience from this aspect.

As with the aspect of social capital, it is a more abstract definition and difficult to find an understanding of resilience. The aspect of social capital involves the community together in a social community. Community social activities determine the direction of the development of housing and the environment. Figure 4 below is a scheme where the effect of capital on the change process is related to territory and control.

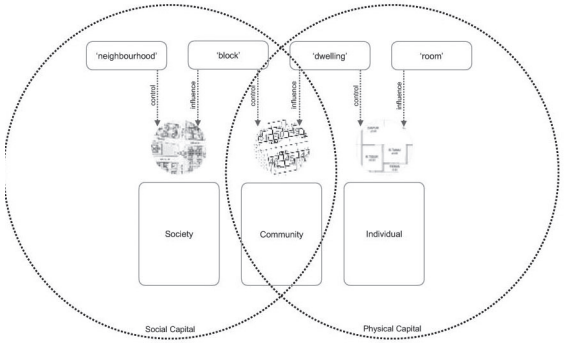

Fig. 4. Scheme of Settlement and Community Groups in Relation to Territories and Capita

Results and Discussion

The pattern of road access to those two study case locations facilitates a similar form of residential lots. The pattern also confirms the form of housing and location of community spaces that also function as an assembly point at the time of a crisis situation. The whole pattern, at the beginning of the design is intended to facilitate evacuation if needed during an emergency situation (Figures 5 and 6). Therefore, in some parts of the area, the physical condition of the road structure is not possible for vehicles. On the scale of dwelling, the uniform pattern of each dwelling also facilitates the formation of mutual agreements between the residents of the community for a common goal by prioritizing spatial flexibility and territorial rights agreements. These show the existence of direct support in forming the space and patterns of community activities for shared needs.

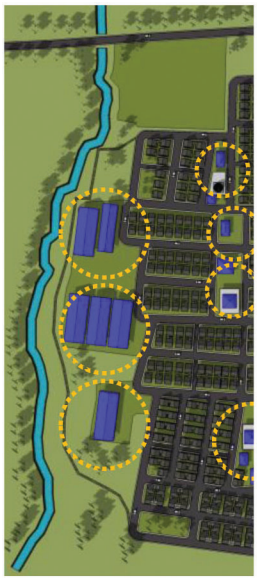

Fig. 5. Site Plan of Pager Jurang

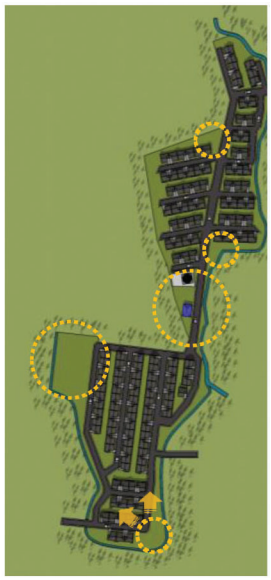

Fig. 6. Site Plan of Dongkelsari

Analysis of housing resilience is also carried out by analyzing the various types of changes occurred. Uniform types of residential units generally refer to the similarity in structure and elements, such as the facades, roofs, and selected building materials. The approach used by the residents to make changes can be grouped into 2 components: The first is the expression of change that is reflected in the form and function of those housing units, including on shared common spaces, while the second component analyzes the process of change related to social activities of communities.

Component 1

The two case study locations are formed by a combination of units lots and their circulation (roads, alleys, and aisles). With the lack of supervision on the location of housing-related to the rules of building code standards, the occupancy at the study location changed due to new needs. The residential units have changed to become attached to one another (Figure 7). The addition of inter-residential space functions, as well as changes in shape, appear to dominate changes in residential units. In this context, the unclear territorial ownerships triggered a new agreed commitment between residents with regard to the function and new forms of housing.

Privatization of roads/alleys/spaces in post-disaster residential environments exists in the expansion of building, especially on boundary of residential lots, roads, or alleys. The physical form of the residential environment has changed, resulting in the road or alley that was previously owned together to be controlled by the nearest residents who wanted to 'expand' the utilization of their assets for private interests. This was agreed by the closest neighbors because each occupant benefited from the change. Such a situation is a representation of denial or reduction of their social contribution by expanding their private space by controlling spaces that were previously shared. Functional space, road, or alley become narrow and no longer can be used for evacuation purposes (Figures 8 and 9). These shrinking of spaces, roads, and alleys make them more vulnerable to disasters.

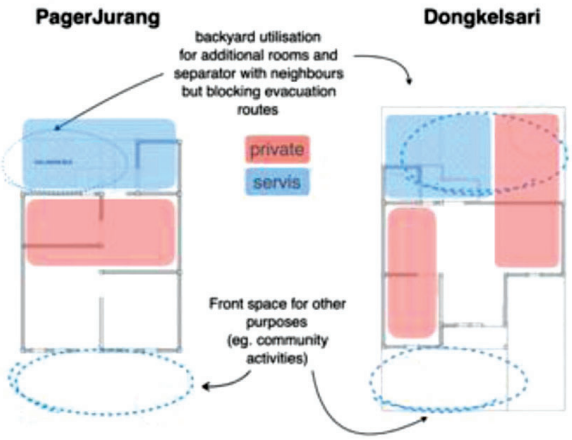

Fig. 7. Changes in Residential Units

Referring to the physical capital aspect mentioned earlier, where the security of building (incl. structure) and evacuation facilities act as indicators of housing resilience, it can be concluded that the changes occurred indicate both case studies locations to be vulnerable and no longer safe to inhabit. Disrupted evacuation routes, changes in the form of housing and residential blocks, and changes in the function of rooms and space between housing that were originally built to support 'build back better'4 after being inhabited for almost 10 years resulted in vulnerable housing. Changes occurred due to certain reasons and are mutually agreed upon by residents (based on surveys, most of the reasons for change are due to economic factors and additional space needs).

Figs. 8 and 9. Narrow Alleys Created Through Community Agreement

Component 2

Changes also occurred in the space between residential units including the front porch. Extending the front roof to cover the porch is very common (Figures 10 and 11). This situation resulted in the emergence of another phenomenon, wherein the front porch function as an important place of interaction for the community. Residents use the space formed by the modification of the front porch to coordinate and socialize and in some cases become a place for community decisions. This situation directly results in a high level of relationship between residents.

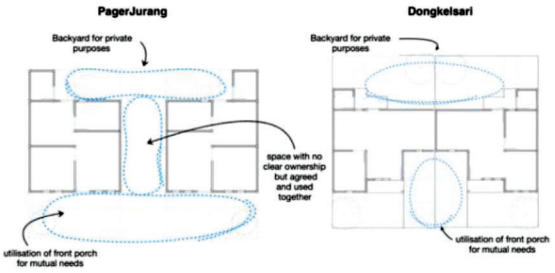

Fig. 10. Shared Rooms and Private Rooms

The strength of interaction and social activities of adjacent residents can also be seen from the agreement on territorial arrangements and changes in the form and function of spaces. The use of shared carport and guest room, shared space for livelihood related purposes such as drying agricultural product indicate the strong cohesiveness among residents. This never happened at the previous housing

location. However, based on the survey, all residents do not realize that such social activities situation actually supports resilience from the aspect of social capital.

Fig. 11. Front Areas with Roof Extension for Community Activities

Residents at both study locations tend to make changes by modifying the shape and function of the dwellings. Based on the interview with the residents, changing the forms and function of the dwelling are caused by the immediate emergence of space and function needs. A change period of less than five years after occupancy shows that the consultation process carried out through the mechanism of community groups at the time of development was not fully able to meet the expectations. The changes occurred also indicate that there has been a shift in the understanding of resilience which is quite significant. These changes do not consider safety and risks. Indicators on physical capital aspects related to building safety and adequate evacuation routes are not met. From the results of interviews related to this aspect, such issue has never been considered in the decision-making process.

Based on direct interviews and discussions conducted with communities and local authorities, it is noted that the understanding of resilience for the residents of Pager Jurang and Dongkelsari still revolves around the physical aspect only. As long as the dwelling is built properly and structurally confirm the building code, it is assumed that resilience has been fulfilled. On the other hand, the resident' agreements on ownership, control of territories and the use of shared space, has led to the formation of a new type of social network between residential units that are smaller but stronger compared to community networks in previous housing areas.

The formation of new networks between residential units which directly increases the community bonding shows that the norm as an indicator of social capital aspects is clearly fulfilled. Trust among residents, a sense of comfort, and shared ownership show that social activities are in place and become the main factor in strengthening social capital. However, the survey results also indicate such an issue has never been an important consideration due to the limited understanding of residents on resilience in terms of a social issue.

References

Habraken, N. J. 1998. *The Structure of the Ordinary*. Cambridge, Massachusetts: MIT Press

Klein, R.J.T., Nicholls, R. J. and Thomalla, F. 2003. *Resilience to natural hazards: How useful is this concept? Environmental Hazards*. 5 : 35-45.

Maarif, Syamsul, 2012. *Pikiran and Gagasan, Penanggulangan Bencana di Indonesia*, BNPB, Jakarta. pp 147

Mayunga, J.S. 2007. *Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach.* A working paper prepared for the summer academy for social vulnerability and resilience building, 22 – 28 July 2007, Munich, Germany, pp 6.

Phaneuf, M. 2013. Resilience: Abstract Concept *or Survival Skill?* http://www.infiressources.ca/fer/Depotdocument_anglais/Resilience_abstract_concept_or_survival_skill.pdf

Revell, Kristy 2010, *Working with informality*: 46th ISOCARP Congress 2010, Nairobi, Kenya, pp 2.

UNISDR, "*Resilience Terminology*" United Nations Office for Disaster Risk Reduction2017. http://www.unisdr.org/we