

Sustainability and vulnerability: Understanding the anomaly from disaster perspectives. Case study: Glagaharjo Village in Mount Merapi

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Abstract. In its concern for human safety, the Government's policy to relocate those living in disaster prone areas is twofold: it is perceptibly profound yet socially cataclysmic. This anomaly, created by the contradiction between the need for sustainability and the fact of vulnerability, could be found in the case of Mount Merapi. Communities living in the hazardous zone of Merapi, particularly those in Glagaharjo Village, are acknowledged for their persistent rejection of relocation programs despite their high exposure to the catastrophic impacts of eruptions. To mitigate the impacts, a safe and conducive dwelling place which considers the characteristics of these affected communities must be encouraged. This research adopts a consensus method towards responses obtained through a Likert scale-questionnaire and measured with a statistical program. Prior this process, theoretical reviews toward the concept of place attachment, place dependence and place identity was established in order to determine the research variables for the questionnaire.

1. Introduction

The geographical position of Indonesia, which is located above several tectonic plates and chained to the Pacific Ring of Fire, has caused its islands to experience some of the most powerful eruptions and earthquakes ever recorded in the history of disasters. Geologically, Indonesia contains over 130 hazardous volcanoes, mainly concentrated on the island of Java and stretched out along the Sunda Strait [1]. Among these volcanoes is Mount Merapi, a strato-type volcano in Java which is reputed to be the world's most active volcano [2]. Some researches show that its changing eruption characteristics and body deformation during the twentieth century will increase this volcano's catastrophic impacts, particularly due to the density of population around the volcano [3, 4]. Based on the Map of the Merapi Region, areas situated less than ten kilometers from Merapi's caldera and those along the volcano's southern slope are classified as Hazard Zone Level III of Merapi. Of nine sub-villages, three are even found to be extremely vulnerable because of their proximity to the caldera, which is only five kilometers away. Administratively under the jurisdiction of Glagaharjo Village, these areas are now identified as the National Park of Merapi as legalized through a National Government Act in 2011. All kinds of development within this zone are strictly forbidden, and as a result social polemic between these communities and the local authorities has risen. Despite this fact, these communities have long acknowledged their vulnerability to the catastrophic impacts of Merapi's eruptions, which include lahar, pyroclastic flows and other hazards.



The idea of sustainability usually arises when the existence of particular beings is exposed to certain events, such as wars, starvation, political turmoil and natural hazards. But when it comes to realization, sustainability typically encounters complex circumstances. One instance is the case of Yogyakarta and Central Java after the eruption of Mount Merapi in 2010. Responding to this, the National Government has authorized the revision of Merapi's land use zonation and initiated relocation programs. Relocation is typically regarded as a complex process, because it relates not only to infrastructure reconstruction, but also the social restructuring and the people's political and economic relationships [5]. Therefore, it requires long-term planning [6], and support from the affected communities who must already acknowledge the consequences of relocation [7]. After Merapi's eruption in 2010, almost 2,290 units out of 2,613 temporary shelters have already been occupied [8], and in Yogyakarta alone, almost 2,040 long-term shelters have been established [9]. Although publicly acclaimed as best practices for their quick construction, their effectiveness in terms of occupancy shows a contradictory result. Of the targeted 3,612 households, almost 1,059 households, particularly from Glagaharjo Village, refused to relocate [10]. This refusal is further instigated by the disagreeable experiences of those living in the temporary shelters. According to them, the relocation plan fails to advocate supports which are needed for long-term living. Unable to prevent Glagaharjo communities from reoccupying their disaster-prone neighborhood, the regional authority of Sleman initiated an agreement stressing these communities' commitment to being voluntarily relocated in times of danger. This agreement was initiated by the Government on the concept of living in harmony with disaster risk. Action plans have been generated from it, like encouraging a proper approach to the subject communities, optimizing the roles of a key figure to channel the locals' aspirations and incorporating evacuation routes into the neighborhoods [11]. Given the significance of integrating the aspirations of Glagaharjo communities with the Government's plans, this paper will examine the factors influencing these communities' attachment to their former homes as the essential keys to promoting not only a safe dwelling place, but also one conducive to their cultural sustainability.

2. Literature Reviews

The Concept of Sustainability and Vulnerability

Sustainability defined as a community's ability to recover by utilizing their own resources [12]. It also means recognizing and making the best use of the interconnection between social, economic and environmental goals to reduce hazard risks [13]. Regarding vulnerability, it is the internal factors encouraging the transformation of hazards into disasters [14], or conditions determined by some factors or processes which increase the susceptibility of a community to the impacts of hazards [15]. Consequently, it needs active involvement from each stakeholder in the host region to promote effective disaster management, the chief goal of which is the production of sustainable livelihood along with its protection and recovery during disasters and emergencies. If the goal is achieved, people will have greater capacity to deal with disasters, and their recovery becomes more rapid and abiding [16]. As a part of disaster management, temporary shelters should also be prepared prior to the occurrence of disasters.

Based on the WHO report (2014), emergency shelter involves the provision of temporary shelter during humanitarian crises including the provision of tents, and materials for the construction and repair or modification of public buildings to temporarily accommodate those affected. Actions for semi-permanent shelter relate to the provision of shelter as a long-term solution, including support for hosting arrangements, and the provision of materials and tools for construction or repair [17]. Relocation is aimed at providing a safe and secure existence for those subjected to the sudden onset or eruption of hazards, consequent upon which, returning to the former home for short or long-term inhabitation becomes perilous. Relocation must be considered as the last resort, and for this reason, *in situ* alternatives or solutions should be primarily evaluated, unless the subjected communities already have particular preferences of an ideal home or neighborhood [17].

Place Attachment

Through the Action Plan of Rehabilitation and Reconstruction Post the Merapi Eruption in 2010, the National Government initiated projects to help the disaster prone communities regain their livelihoods. Assistance and immediate aid from disaster relief and humanitarian agencies arrived to support the Government's plan and promote an effective recovery. One of its manifestations was the establishment of temporary shelters typically located in close proximity to the former homes. It relies on the idea that maintaining this proximity will help a transitional adaptation process preceding mobilization to long term shelters to be effective. To support this plan, the Government even incorporated an incentives policy into the program, but it still failed to appeal to the subject communities, particularly those in Glagaharjo Village. Persistent and continuing rejections coming from these communities have exhibited their strong preference for their former homes, despite their exposure to eruption risks. This event reflects an emotional bond phenomenon usually explained from a psychological standpoint through the theory of place attachment [18]. Theories of attachment were originally developed by a British psychologist John Bowlby, through his seminal works of the 1960s. The aims of attachment are twofold. Biologically, it is attuned to one's survival, while from a psychological perspective its aim is to fulfill one's needs of safety, security and protection [19]. Attachment is typically expressed through a set of behaviors towards particular objects, and its intensity is determined by the quality and timing of the bond. An intense desire for fusion or closeness towards the object is usually reflected through extreme behaviors like fear of separation, efforts to maintain proximity, or minimize distance from the object. If this object is able to fulfill one's needs of safety or survival, mechanisms to maintain proximity will occur [20].

The psychological connectedness to a particular place is not determined only by the place and its physical features, but even merely by the meaning of the place and one's experiences of it [21]. In this regard, place could serve as a container or repository of memories, and will carry some meanings for each spectator. Attachment to a place occurs when particular individuals develop a positive sense towards it, which evolves after having prolonged experiences [22]. Therefore, the intensity of attachment depends on personal experience, the meaning and the function of the object or place, and the perceptions of its roles, which enhance the significance of that object or that place [23]. Integrated to place attachment, place identity is conceptualized as a cognitive connection between one's self and an environment [24]. Place identity is also defined as those dimensions of one's self that develop a personal identity regarding a specific environment through a complex pattern of conscious and unconscious ideals, beliefs, preferences, feelings, values, goals, behavioral tendencies, and skills as the means of this process [24]. Environmental setting, in this context, offers an opportunity to express and affirm one's identity. Place dependence, on the other hand, is a concept established from one's positive evaluation of a particular place because of its capability to fulfill needs and to motivate a person to achieve some goals [25]. Place identity, based on emotions, differs from place dependence which is based on a functional relationship. This bond is characterized by the existence of particular facilities and conditions which are required to achieve specific goals and to perform various activities [26]. This bond will be developed if the frequency of travel is increased and interactions with the place's features occur intensively [27]. Therefore, the attributes characterizing the place attachment phenomenon include affection, cognition and behavior, orientation to a place, time and its pattern, social needs, interpersonal relationships, and those related to the place and its community [21]. Socially, each individual tends to share the same emotions with others towards a place, and thus a place will reflect the experiences and the characteristics of its inhabitants. Place is also perceived as satisfying if it can encourage control, creativity, power, privacy, self-esteem, personal display, and security.

3. Methodology

This paper stems from two disciplines, psychology and architecture, and focuses on solving a human problem, which leads this study to select phenomenology as the research paradigm. Phenomenology attempts to eliminate everything that represents a presupposition, and encourages the researcher to look at things openly with intuition and self-reflection [28]. Besides qualitative methods, the research also

employs quantitative methods. All data collected from questionnaires are transferred into tabular forms and then calculated by using a statistical analysis program. The result provides the basis for interpreting specific factors that underline the respondents' place attachment based on their experiences and perceptions.

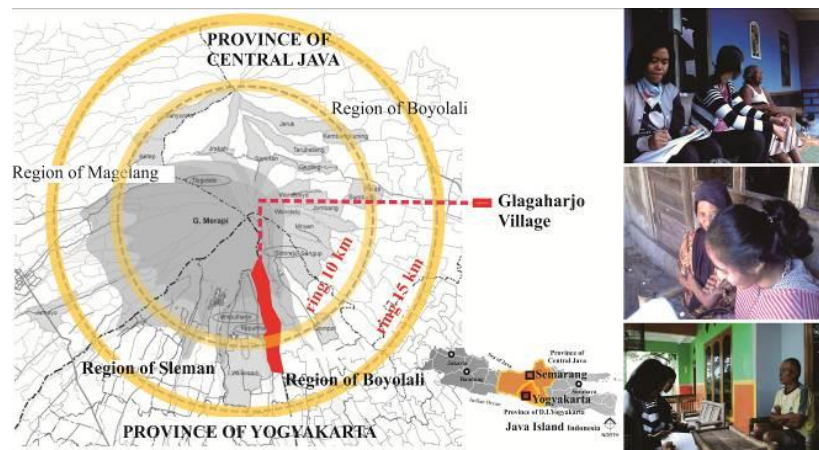


Figure 1. The location of Glagaharjo Village and the field survey with respondents

Considering the limited time given, the sample unit is determined 100 households from 656 households in Glagaharjo Village. The sampling unit is purposive-type towards which criteria of selection must be primarily determined [29]. Related to this, respondents must have settled in the understudy areas for at least ten years. It was based on assumption that at least within those years, their emotional bond to the dwelling place had been strongly developed. Involving ten surveyors, the questionnaire considerably needed 30 minutes of time for response and each response must be filled in on-site. Figure 1 shows the location of the village which is within 15 kilometres from the volcano's caldera and the interview process with the respondents.



Figure 2. The research framework based on questionnaire survey method

Figure 2 exhibits the systematical process of the research based on field and literature study. The research in this regard, adopts a Likert type questionnaire which comprises a range of response from strongly agree to strongly disagree along with undecided option. After all the responses were entered in

the Excel's tabular formats, they are statistically calculated using consensus method and the Average Percent of Majority Opinions (APMO) Cut-Off Rate method [30]. Considering there are 5 scales of response in the questionnaire, the formula was modified by adding the value of majority strongly agreements and disagreements. To reach a consensus, a percentage of strongly agree or strongly disagree must be higher than the APMO cut-off rate to reach [30, 31].

$$APMO = \frac{\text{Majority Agreements} + \text{Majority Disagreements}}{S \text{ Opinions Expressed}} \quad (1)$$

As the consequence of adopting a consensus method, the calculation result will reflect the respondents' general attitudes toward each aspect of place attachment. The grade of consensus could also be specified into categories with accordance to the majority level of agreements. Strong consensus shows agreement from more than 95% of total respondents, consensus shows agreement from more than 75% to 95% of total respondents, majority agreement comes from 50% to 75% of total respondents while no consensus category shows agreement from less than 50% of total respondents [32].

4. Research Results

Table 1 presents the general attitude of Glagaharjo's respondents related to place identity. In terms of distinctiveness, most respondents strongly agreed that their neighborhood has no capability of promoting uniqueness and safety compared to other neighborhoods. Regarding safety, this response actually expressed a consciousness of their exposure to eruption risks. Most respondents also strongly stated that their neighborhood's physical and cultural potentials are not attractive and advantageous while in terms of social bond and cultural richness, these factors are not viewed as those that shape the uniqueness of their neighborhood. Table 1 also shows that according to most respondents, their neighborhood's potentials do not contribute to their life improvement. The consensus in this aspect is achieved as 95.7% of respondents agreed to be relocated if a safe, unique and attractive dwellings at the relocation site could be established.

Table 1. Consensus based measurement on the aspect of place identity (1)

APMO	SAA	Consensus Based Measurement of Glagaharjo Respondents						
		SA	A	N	DA	SDA	UD	Missing
		Distinctiveness						
		The neighborhood is capable to encourage safety compared to other areas.						
96.8	3.1	1	2	2	21	69	1	4
		The neighborhood's environmental and cultural potentials are unique.						
87.9	1.10	0	1	2	31	48	9	9
		Attraction						
		The current home has some physical potential which are very attractive and beneficial.						
96.8	1.04	1	0	3	23	69	0	4
		The current home has some cultural potential which are very attractive and beneficial.						
97.9	3.09	3	0	2	22	70	0	3
		Community's strong social bond defines the uniqueness of the neighborhood.						
93.7	1.04	1	0	5	11	78	1	4
		Cultural richness and local wisdom define the uniqueness of the neighborhood.						
73.9	7.61	6	1	9	20	41	15	8
		The neighborhood's potentials contribute to improve my life quality.						
92.4	1.08	1	0	7	21	64	0	7
		If particular attractions are provided at the relocation site, I surely want to be relocated.						
97.8	95.7	88	3	2	0	2	0	5

Table 1 also demonstrates that according to most respondents, their neighborhood's physical and cultural uniqueness are not well-maintained. Contradictorily, they stated that attempts to maintain that uniqueness are not necessary because of its lack of positive impacts to the respondents' lives. As shown from table 1, majority agreement (64.9%) is achieved towards opinion that globalization is the main factor causing physical changes on their neighborhood and more agreement (77.4%) towards its

influences on the neighborhoods' cultural changes. Similar to the response towards the importance of maintaining the neighborhood's uniqueness, attempts to maintain the uniqueness of their former homes are also viewed as unnecessary. Despite these negative responses, the Government still needs to provide a unique environment which has the capability of sustaining all potentials that are appealing and contributive, in order to encourage the respondents to relocate. This suggestion is also supported by a strong consensus (94.6%) towards their neighborhood's sustainability. In terms of self-efficacy, most respondents stated that their neighborhood did not enable them to control the environment, perform specific activities and acknowledge the symptoms of eruption. A consensus is achieved as 91.4% of total respondents strongly agreed to be relocated if a neighborhood enabling them to have a control on their environment and perform various activities is encouraged at the relocation site.

Table 2. Consensus based measurement on the aspect of place identity (2)

APMO	SAA	Consensus Based Measurement of Glagaharjo Respondents						
		SA	A	N	DA	SDA	UD	Missing
Continuity								
The neighborhood's physical and cultural uniqueness are well-maintained.								
85.2	12.6	4	8	12	22	47	2	5
Some attempts must be made to maintain the neighborhood's uniqueness.								
91.5	5.2	2	3	5	31	51	3	5
The current home and neighborhood could support the sustainability of my activities.								
91.4	0.0	0	0	7	19	67	1	6
Globalization influences have changed the physical aspect of the neighborhood.								
86.1	64.9	54	7	6	16	4	7	6
Globalization influences have changed the cultural aspect of the neighborhood.								
84.9	77.4	67	5	5	5	2	9	7
Some attempts must be made to maintain the uniqueness of my home.								
90.1	2.2	1	1	5	19	61	4	9
If the continuity of uniqueness could be promoted at relocation site, I want to be relocated.								
94.6	94.6	87	2	3	0	0	2	6
Self-Efficacy								
The current home enables me to observe my surrounding along with all its changes.								
82.4	3.0	1	2	9	23	54	8	3
The current home enables me to perform various activities.								
87.1	1.0	1	0	6	18	62	6	7
The current home enables me to acknowledge the eruption symphomps.								
86.3	6.3	1	5	6	22	54	7	5
If freedom, control and various activities could be encouraged, I want to be relocated.								
94.6	91.4	84	2	4	3	0	1	6
Self Esteem								
The current home provides a privacy to perform daily activities.								
88.1	3.2	1	2	4	15	64	7	7
The current home gives supports for specific activities such as self-contemplation.								
82.0	5.6	4	1	5	20	48	11	11
The current home improves my potentials and life skills.								
76.7	8.2	3	3	7	25	25	10	23
The current home encourages safety and security from eruption hazards.								
92.7	19.7	18	1	7	17	53	0	4
If supports for various activities, skills development and safety are encouraged at the relocation site, I want to be relocated.								
93.6	90.4	83	2	5	0	3	1	6

As shown in table 3, most of the respondents strongly stated that their main activities are not only performed inside but also outside the house and generally relate to the fields outside the economy. Areas where economic activities occur are relatively located in a close proximity to the respondents' former houses and include the volcano's forest, agricultural fields and riverside which could be reached within

100 meters to 3 kilometers from the house or within 5 minutes to 2 hours, mainly by walking. Household activities are indicated as the routine that most respondents engage in, particularly because more than 50% of the respondents are housewives. Most of them strongly stated that only a little amount of time is needed to perform their economy activity, which is between 3 to 7 hours per day, and 56.8% of them strongly agreed that a considerable time is always allocated to observing the Merapi's volcanic activities. From the aspect of time, the main activity starts at noon and is finished in the afternoon. A few number of respondents stated that they allocate a considerable time to participating in social activities including in safety control activities and evacuation drills. While regarding the eruption event in 2010, some respondents agreed that they returned to their homes only one month after the event.

Table 3. Consensus based measurement on the aspect of place dependence (1)

AP MO	SAA	Consensus Based Measurement of Glagaharjo Respondents						
		SA	A	N	DA	SDA	UD	Missing
		Frequency						
		Frequently perform various activities at the current home and neighborhood.						
91.4	4.2	3	1	8	16	66	0	6
		Activities frequently perform relates with economy.						
94.7	7.3	6	1	5	10	73	0	5
		Duration						
		A large amount of time is needed to perform the main activity in current neighborhood.						
81.8	6.8	3	3	16	18	48	0	12
		Always provide a considerable time to observe the Merapi's volcanic activities.						
78.9	56.8	45	9	13	10	11	7	5
		Time						
		Starting the main activity in the morning at the current home.						
93.2	2.25	2	0	6	8	73	0	11
		Finishing the main activity in the afternoon at the current home.						
75.5	34.4	29	2	22	10	27	0	10
		Always allocate a considerable time to participate in the neighborhood's social activities.						
93.7	10.4	10	0	6	16	64	0	4
		Always allocate a considerable time to participate in safety control activities.						
92.3	37.3	30	4	6	15	35	1	9
		Always provide a considerable time to involve in evacuation simulations or drills.						
82.6	29.3	24	3	6	16	33	10	8
		After eruption in 2010, I evacuated to relocation center and returned less than one month.						
86.3	47.3	37	8	12	11	26	1	5
		Activities						
		The type of activity at the current home mostly relates with household activities.						
78.1	3.1	2	1	2	12	60	19	4
		The type of activity at the current home mostly relates with economy.						
88.1	48.3	43	2	4	12	25	7	7
		There are various types of activities occur at the current home.						
75.2	62.3	53	5	15	4	8	8	7
		Actively involved both in social activities and disaster mitigation programs.						
90.0	64.4	55	3	5	8	15	4	10
		If socioeconomic activities could be encouraged at the site, I want to be relocated.						
98.9	96.7	88	2	1	1	1	0	7

Table 4 shows agreement on the opinion that their main activity relates with economy, and majority of respondents agreed (62.3%) that various activities usually occur at their homes. Related to active involvement in disaster mitigation and social activities, majority of respondents (64.4%) also agreed with that statement. A strong consensus (96.7%) is achieved regarding their willingness to be relocated if a conducive neighborhood could be established at the relocation site. Regarding the need for particular

infrastructure, most respondents stated that their neighborhood fails to provide those needs. The unavailability of good access from house to workplace was asserted as the evidence. Related to the need for safety as a support for activities, majority of respondents (92.1%) agreed to be relocated if the Government could provide infrastructures that support their activities at the relocation site.

Table 4. Consensus based measurement on the aspect of place dependence (2)

AP MO	SAA	Consensus Based Measurement of Glagaharjo Respondents						
		SA	A	N	DA	SDA	UD	Missing
		Activities Needs						
		The current neighborhood could give supports for various types of activities.						
97.8	0.0	0	0	2	17	74	0	7
		The current neighborhood provides my specific needs to perform economy activities.						
77.4	2.1	2	0	5	13	57	16	7
		The current neighborhood is believed to be capable of fulfilling the need on safety.						
86.0	33.3	28	3	7	16	33	6	7
		If all the needs for living could be provided at the relocation site, I want to be relocated.						
95.5	92.1	81	1	3	1	2	1	11

Table 5 shows the motifs influencing the respondents' decision to refuse the relocation program. Their preference for living at the current house is not influenced by perceptions like the house has helped them obtain happiness and success, house is a family legacy or a personal asset, or caused by family's suggestions and the availability of neighborhoods' potentials.

Table 5. Consensus based measurement on the aspect of motivations and memory

AP MO	SAA	Consensus Based Measurement of Glagaharjo Respondents						
		SA	A	N	DA	SDA	UD	Missing
		Motivations						
		Living at the current house because it allows me to obtain a happiness and success.						
87.7	0.0	0	0	6	11	68	5	10
		Living at the current house because it is a family's legacy.						
94.1	11.6	6	4	5	15	56	0	14
		Living at the current house because of its status as a personal asset.						
96.3	6.0	3	2	2	13	62	1	17
		Living at the current house because of the family's suggestions.						
98.7	0.0	0	0	1	14	62	0	23
		Living at the current house because of the environment's natural benefits.						
96.8	0.0	0	0	2	17	75	1	5
		Living at the current house because of its proximity to economy sources.						
93.6	0.0	0	0	6	23	66	0	5
		Living at the current house because of its proximity to public and social facilities.						
79.1	13.8	6	4	14	24	23	1	28
		Living at the current house because of its proximity to guard posts and evacuation center.						
77.1	11.4	8	0	15	23	23	1	30
		Living at the current house because of the ancestral messages.						
84.2	31.9	13	10	10	9	29	1	28
		Living at the current house because of a superstitious belief.						
81.9	61.1	38	6	3	5	10	10	28
		If proximity is provided from home to workplace/public facility, I want to be relocated.						
93.6	91.5	84	3	5	2	0	1	5
		Memory						
		The current home or neighborhood reminds me of particular memorable places.						
81.8	32.9	24	5	3	4	39	13	12
		The current home or neighborhood reminds me of particular memorable events.						
80.2	33.3	21	6	4	5	33	12	19

AP MO	SAA	Consensus Based Measurement of Glagaharjo Respondents						
		SA	A	N	DA	SDA	UD	Missing
		The current home or neighborhood reminds me of particular moments of childhood.						
60.0	43.7	29	6	5	3	10	27	20

Table 5 also shows that majority of agreements (61.1%) is achieved towards a statement that mystical beliefs or ancestral messages is what influencing them to return to their former homes. Majority of respondents (91.5%) also asserted their willingness to be relocated if a close proximity from home to workplace and public facilities could be encouraged at the relocation site. While in terms of memory, only a few number of respondents agreed that their homes remind them of any memorable places or events including their childhood.

5. Conclusions

The argument posited in this paper focuses on the revelation of all factors that develop the emotional bond of Glagaharjo disaster prone communities to their homes. The research found that there is no strong consensus or consensus is achieved in this regard. However, a majority of agreement (more than 50% of total respondents) shows a correlation between the people-place bond phenomenon and functional factors. Based on the theory of place dependence, this type of emotional bond is characterized by an individual's intense reliance on particular place with all its features in order to support his or her activities. Although a strong consensus towards the neighborhood's capability to support various activities is not achieved, majority of agreement (more than 50%) shows that this capability along with the locals' strong social bond, are factors influencing them to return to their former neighborhood. To further explain, this bond could be maintained through various cultural ceremonies and social activities like a regular community gathering locally termed as *arisan*. Besides that, the need to develop a solid collusion among the community members of Glagaharjo Village regarding eruption risks, could also strengthen their social relationship and then their emotional bond to their former homes.

Based on the research study, the dwellings planning and design for the subjected communities in Glagaharjo Village must consider the following criteria. First, the house must be designed in a close proximity to the work place and public facilities. Criteria for access connecting those places should be set up and also accompanied by other alternatives for economic activity which avoid Merapi's hazardous areas. Second, the site of the house must be integrated with adequate open spaces which are potential for agriculture or farming. Third, the new neighborhood should encourage the local's social relationship and therefore, their mobilization as one social unit to relocation site must be encouraged. Fourth, the neighborhood should provide a good access from home to each public, social and health facility including to the work place.

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