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The Juxtaposition of Risk and Resilience in Heritage Areas

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Abstract

Risk and resilience often enter the discussion with respect to hazard and disaster. In accordance with the meaning of juxtaposition, these two issues often are connected to each other but with contrasting effect. This paper aims to determine integrated factors used in assessment and strategies to reduce risk and to improve resilience in heritage areas. The method was based on observations and questionnaires that were undertaken in the protected heritage areas of Jeron Beteng inside the fort of Yogyakarta Palace, Indonesia. A literature review on risk and resilience factors preceded the formation of the questionnaires. The first questionnaire collected data from the owners or dwellers of the heritage sites, while the second questionnaire addressed the inhabitants of the surrounding area of the heritage sites. The field observation acquired information through visual assessment of heritage buildings, the surrounding communities, and their environments. The quantitative analysis applied a Likerd-like scale to score the questionnaires. The calculation represented the value of risk and resilience according to the score of attributes and each entity. The qualitative analysis explained essential risk and resilience factors by comparing the value. Historical precedents and demographic data support the analysis and understanding of the contextual phenomenon in the area. The juxtaposition of risk and resilience reveals the category of community and heritage entities (both tangible and intangible) at the macro- and micro- scales. Community is the main factor that connects risk and resilience in environmental, building, cultural, and hazard-disaster attributes. The intangible “heritage entity” and its surrounding community depend on each other, especially in relation to building and cultural attributes. The community surrounding the heritage building affects the improvement of resilience in macro-scale. The heritage building as a single entity influences risk reduction at the micro-scale. There are important roles of responsive community and maintained heritage buildings for enhancing the resilience of heritage area.

Keywords

Risk; Resilience; Heritage; Yogyakarta; Jeron Beteng; Community

1. Introduction

In an environmental-related discussion, the definition of risk commonly is associated with concepts of hazard, exposure, and disaster. Disaster risk includes consideration of issues related to disaster risk reduction and disaster risk management, while risk characteristics often are associated with varied physical and social system contexts. Understanding the interactions of these different system contexts can raise awareness to cope with the impacts, thereby increasing resilience.

The discussion of risk encompasses its causes and contexts. The causes refer to physical and social contexts, which include destitution, population density, and building condition (Dickson et al., 2012, p. 41; Ruszczyk, 2018, p. 318; Bandyopadhyay, 2014, p. 39; Satterthwaite & Bartlett, 2017, pp. 10-12; Castelluccio, 2018). Meanwhile, risk also widely pertains to vulnerabilities within the context of urban risk (Romero-Lankao et al., 2014, p. 225; (Espada et al.,2015), pp. 319-321). Hazard, risk, exposure, and vulnerability are reflective of causes and context (Mitchell, 1990, p. 132), whereby the more factors involved, the greater the complexity of the risk context. Urban risk results from everyday risks (Satterthwaite & Bartlett, 2017, pp. 3-4), which includes famine, poverty, safety, sanitation, environment, waste, disease, and others (International Federation of Red Cross and Red Crescent Societies, 2011, pp. 12-13, 92). Urban risk will aggravate the impacts of disasters (Flower et al., 2017, p. 301).

Risk and resilience are also associated with disaster and adaptation but emerge from different conditions. Juxtaposition in this context means that risk and disaster are close together with contrasting effect. On one hand, risk encompasses hazard, vulnerability, and exposure (Espada et al., 2015), pp. 319-321) – or usually associated with the potential causes of threat. On the other hand, resilience comprises response, adaptation, capability, and mitigation. As a part of the risk, physical risk tends to influence behavioural mitigation (Larsen et al., 2021, p. 3). Behavioural mitigation is an important part of the resilience effort. Therefore, understanding factors of risk could evoke behavioural mitigation that will improve resilience.

Risk assessment in heritage area usually considers issues of construction, architecture, and history. When a disaster strikes, risk measurement adds components of events and physical loss value (Pedersoli et al., 2016, pp. 62-63). The risk assessment often considers building as a single entity when it refers to construction and architecture. Moreover, preservation efforts mostly are conducted in a building. However, the historical buildings in heritage area were connected in a certain history. This history covered certain boundary.

Heritage is a product of civilization, thinking, and behaviour and must be preserved for the next generation (Stanton-Geddes & Soz, 2017, p. 2; The United Nations Educational, Scientific, and Cultural Organization [[UNESCO], 2019). The forms of heritage are cultural, structural, and natural, and include both tangible (e.g. buildings, landscape), and intangible (e.g. cultural practices, religion, language) entities that continuously face challenges of identity, history, sense of place, and sustainable development. Hence, UNESCO ratified the convention on the Protection of the World and Natural Heritage in 1972 to identify, protect, conserve, and preserve the Outstanding Universal Value World Heritage List sites. Buildings are included as tangible cultural heritage entities among many acknowledged heritages (Maio et al., 201 9, p. 22).

To develop the standard of heritage assessment, ICOMOS (International Council on Monuments and Sites) adopts the perspective of environmental impact assessment (EIA) and employs the Outstanding Universal Value (OUV) attributes in their assessment (International Council on Monuments and Sites [ICOMOS], 2011) . However, identification of specific attributes in a local context for the assessment of heritage entities can be contentious. Moreover, the EIA assessment simply is based on natural resources, while the heritage assessment also should consider community and environment issues.

Historic city areas often are located in the dense city centre (Xu et al., 2015, p. 110). As a result, urban growth and development in the area potentially threaten the existence of heritage entities (Zhang et al., 2018, p. 4). Conversely, due to age and potentially poor physical condition, the heritage entities concurrently may endanger the surrounding community.

The area of this research is Jeron Beteng, Indonesia. Jeron Beteng is a settlement of royal communities protected by and within the fort of Yogyakarta Palace. The palace was established during the reign of Sri Sultan Hamengkubuwono I, who reigned between 1755 and1792. The existence of the fort represents the symbolic authority of the Sultan in controlling the city. Jeron Beteng occupies a 1.4 sq. km area surrounded by 4-meter-thick brick walls. The measurement of the fort itself is 1200 metres long from east to west and 940 metres wide from north to south with a 200-metre extended width along eastern side.

Following the acknowledgement of Special Region of Yogyakarta in Law of the Republic of Indonesia Number 13 of 2012, the sultan of Yogyakarta Palace is granted authority as the governor of the province. Therefore, his authority was acclaimed both within and beyond the fort. This condition influenced the division of spaces in Jeron Beteng which are divided into core and supporting areas. The core area is symbolized by the philosophical axis which represents the journey of life from birth to final passing and connects the Sultan Palace, southern Alun-alun (squares), and northern Alun-alun (Rully, 2019, p. 48). The axis also underpins and links the orientation of buildings, spaces, and heritage sites. The supporting area is where development occurred under certain regulation policy. (Figure 1)

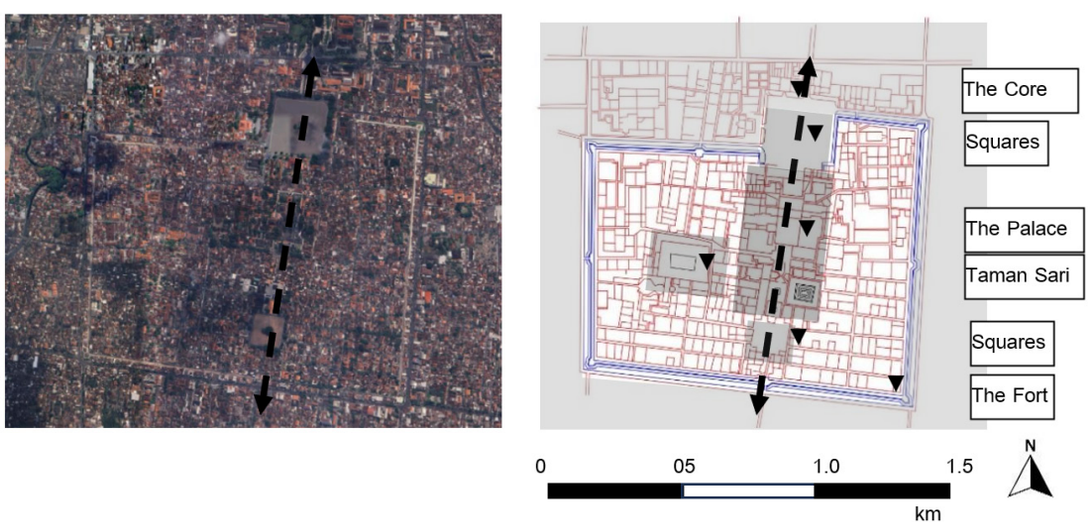


Figure 1. The traditional fort of Kraton Yogyakarta in double lines and the philosophical axis in straight-black line, with GPS -7.807794, 110.362870

Sources: Analysis by redrawing and Google Earth

The philosophical axis becomes the orientation of historical buildings in Jeron Beteng. It links one building to another under the spatial concept of cosmology with the palace as the centre of cosmos. The existence of one building responded to the other in regarding to orientation, ownership, and social status. The heritage buildings were responsive to each other under philosophical circumstances.

Risk and resilience are close to the existence of community, because risk and resilience have impact on and are generated by community. Community activities may increase risk or resilience. In heritage context, it is also important to consider the roles of community. People in Jeron Beteng contribute to the sustainability

of heritage buildings. People protected and served the noblemen. The noblemen gave people permission to occupy their lands. The juxtaposition of risk and resilience in heritage area of Jeron Beteng is special and important because it is based on community, that is different to risk and resilience in general. The assessment of risk and resilience in heritage area need the determination of the important attributes.

Under the Decree of Ministry of Education and Culture number 117M of 2018 and Governor of Yogyakarta Special Region Regulation Number 75 of 2017, the palace, including Jeron Beteng, is the core and the original city of Yogyakarta. The decree also declares that preservation for heritage assets has been overlooked by the need to solve the dense settlement issue. The settlements and the inhabitants in Jeron Beteng have an unwritten traditional consensus and regulations that control the interactions between them and the built environment to maintain tangible and intangible entities. Alteration in constructions or spatial alignments must respect the consensus and regulation. By the period of 1855-1877, Sri Sultan Hamengkubuwono VI enacted a new policy that allowed people to occupy areas surrounding fort and Taman Sari, the water castle and garden of the palace as a matter of safety and security (Karaton Ngayogyakarta Hadiningrat, 2017). As a result, this policy directly affected dwelling formation and conditions. The population densities in Jeron Beteng currently are between 1300 – 1900 people per 0.1 sq. km, although recently the area has experienced low and even negative population growth.

Population, settlement, urban growth has an impact on heritage sites (Zhang et al., 2018, p. 4; Łaszkiewicz et al., 2022), and without proper planning and maintenance heritage sites can increase risk for people. Accordingly, heritage sites within lesser maintained areas can cause destruction (Brusa et al., 2023, p. 279) and spatial problems (Alawadi, 2017, p. 2985). They can harm inhabitants around them.

Research on risk and resilience has been conducted separately when addressing the impacts of developments, especially in heritage areas. Heritage entities possibly deliver risks to their surrounding neighbourhoods and vice versa (Wu, et al., 2014). Multiple risks of heritage entities have evoked attempts to develop risk reduction as well as to strengthen community resilience and mitigation (Ravankhah et al., 2017, p. 275).

Risk definition is close to disaster. Resilience responses to disaster. The juxtaposition is to determine the correlation attributes that can give consideration for redefinition. Nevertheless, resilience discussions rarely cover heritage areas although these entities have survived through the years and could be reflect sustainability values. The sustained existence of heritage sites shows capacity in accommodating social cohesion, socio-economic regeneration, poverty reduction, social well-being, appeal, creativity, and tourism benefits (Labadi et al., 2021, pp. 13-14). Therefore, knowledge of how to cope and adapt to the changes of the environment can be obtained from study of the heritage area and the community.

2. Aims of the Study

This paper aims to determine integrated factors of risk and resilience in a selected heritage area. The heritage area needs assessment and development of an effective strategy that can reduce risk and improve resilience. The juxtaposition place risk and resilience together as a contrasting effect to generate a comprehensive strategy for reducing risk and increasing resilience. Risk always exists in human daily life, but resilience approaches provide a positive response to address, reduce, and adapt to risk. Therefore, it is necessary to identify the main factors that link both risk and resilience in heritage areas.

3. Literature Review

3.1 Linking risk and resilience in the heritage context

It is necessary to establish understanding of risk, resilience, and heritage before approaching the link between risk, resilience, and heritage sites. Risk is a possibility of adverse effects, loss, or destruction in community, infrastructure, and supporting service systems(International Federation of Red Cross and Red Crescent Societies, 2011, p. 18). The definition of risk influences the implementation of reduction and mitigation methods (International Federation of Red Cross and Red Crescent Societies, 2011, p. 100). Risk is categorized into several types, including chronic-extensive risk and acute-intensive risk (Baker, 20,12 p. 10; Satterthwaite & Bartlett, 2017, p. 6; Brooks et al., 2010, p. 2; International Federation of Red Cross and Red Crescent Societies, 2011, pp. 20-21). Chronic risk occurs gradually on a wide scale, while acute risk suddenly happens and is caused by hazard or disaster. Chronic risk escalates simply because people do not recognize it occurring on a daily basis.

There are two risk assessment scales, namely the macro- and micro-scale risk assessments. The macro-scale risk assessment is applied through two groups of considerations (Dodman et al., 201 3, pp. 21-22; Romero-Lankao et al., 2014, p. 225; Yu et al., 2013, p. 11). The first group consists of hazard, vulnerability, exposure, and asset value; while the second group consists of mitigation, capacity, and resilience. The assessment is calculated by dividing the summary of the first group with the second group. This macro-scale assessment mainly considers economic, social, and environmental resilience and response to the disaster (Peng et al., 2018, p. 9). Micro-scale risk assessment usually deals with structural age, architectural value, and historic value. The micro-scale risk assessment applies to buildings as a single case.

According to chronic risk, macro scale risk assessment is suitable for heritage sites in urban heritage areas. The integration of macro-scale and micro-scale risk assessment is essential in a heritage area because of various risk factors. Risk assessment at the macro- and micro-scales can secure population and place.
Resilience is the capability of a system, a person, or community impacted by disaster to anticipate, be aware of, reduce, and adapt to the changes along with maintaining essential functions to recover (International Federation of Red Cross and Red Crescent Societies, 2017, p. 16). Resilience is linked to resistance, recovery, and adaptability, especially in terms of sustainability and climate change (Huck et al., 2020, p. 3; Bizzotto et al., 2019, p. 8). If a city develops towards a resilient city, it is expected to achieve strong, prosperous, flexible, inclusive, integrated, and well-managed capacities (Feng et al., 2020, pp. 1-2). Therefore, resilience characteristics frequently are depicted in the opposite direction to vulnerability characteristics (Vitale et al., 2020, p. 3; The World Bank Group, 2019) .

Resilience encompasses diverse discussions and types which cover engineering, ecology, society, socioecology, and urbanization (Vitale et al., 2020, p. 3; Heinzlefa et al., 2020, p. 5). The discussion about resilience began to develop within the scope of urban planning and infrastructure improvement in the 1990s; and it was further developed in risk management frameworks from the 2000s onwards (Heinzlef et al., 2020, pp. 2-5). From that period until today, urban planning and risk management include both vulnerability and resilience considerations (Heinzlef et al., 2020, pp. 2-5; Feng et al., 2020, p. 1).

Risk and resilience are connected by risk management. Risk is close to vulnerability and resilience comprises stages to deal with risk. Therefore, risk management aims to reach resilience. Integrated risk management explores the interaction between attributes on the site, local regulation, construction, and community (López & Jimena, 2016, p. 120). Accordingly, it can be inferred that community and buildings are the vulnerable objects in the multiple contexts that are reflected in vulnerability and resilience assessment (Collins, 2018, pp. 490-491).

Risk in the context of cultural heritage was introduced in 1972 (López & Jimena, 2016, p. 21) with the idea that cultural heritage can be an integral part of risk management analysis (López & Jimena, 2016, p. 120). Consequently, the vulnerability of a building is added to the risk assessment (Maio et al., 2018). Risk relevant to the heritage building generally considers micro-scale risk, based on the construction strength, architectural value, and historical value (Yu et al., 2013, p. 11).

Heritage buildings may receive sustainability acknowledgment after they have passed years of occupancy. The existence of heritage buildings and their histories validate adaptation and resilience processes. The integration of heritage preservation and planning is relevant to human activities and settlements (Rukavina & Obad-Scitaroci, 2017, pp. 337-338).

3.2 Risk and resilience in settlements

Community is a substantial factor for risk and resilience assessment. Settlement represents community uniqueness. It can be positioned at high risk in case of vulnerability, such as occurrence of high population densities and inadequate infrastructure (Flower et al., 2017), although it is highlighted that any kind of density becomes an obstacle in achieving resilience (Sharifi, 2019, p. 250).

Furthermore, many discourses tend to position social vulnerability and community resilience as occurring in opposite directions. However, both are parts of a continuum process towards sustainability and resilience achievements. Nevertheless, there is a correlation between high levels of vulnerability and low levels of resilience. Although both should be treated distinctively, there is a tendency that the most vulnerable region is also often the least resilient one (Bergstrand et al., 2015, pp. 392-394, 406; Folke, 2016, p. 2).

Risk and resilience in urban spaces can be identified from the settlement. Settlement represents an integrated system (Espada et al., 2015). It comprises buildings, infrastructure such as roads, electricity, drainage, and other urban systems. The research of Arup and the Rockefeller Foundation synthesizes seven factors of a resilient system, which cover uncertainty and change, reflective, adaptive, resourceful, integrated, diverse, and inclusive attributes (The Rockefeller Foundation, 2014). These seven attributes are explored in the questionnaires.

4. Methodology

Data on population and building function represent interaction and adaptation of people and place (Samuelsson et al., 2019, p. 78; Lu et al., 2019, p. 3). Data on demography and heritage sites are essential for the process of quantitative analysis to express qualitative condition. There are two types of heritage entities. The basic unit is the neighbourhood block where heritage sites are located. The other is a single lot heritage building. The historical precedent and contextual phenomenon also are key elements characterizing data of place.

This paper is based on questionnaires and field observation. The questionnaires were informed through a literature review relevant to risk and resilience assessments. The guiding questions were prepared based on the working hypothesis that a heritage entity is prone to hazard-disaster risk and everyday risk. Everyday risk affects the built environment and social-economic conditions (Labadi et al., 2021, pp. 13-14; Wu et al., 2014). The first questionnaire addressed mainly the building and social attributes of heritage entities. The respondents are the owners or inhabitants of buildings. There were 11 questions about the building attributes and 4 questions about the social attributes (Table 1).

Table 1. The first questionnaire

	The Guiding Scope for the Questionnaires	Tangible (T)/ Intangible (I) Attributes	5 (highest risk)	4	3	2	1 (lowest risk)
1.	Generation of Inheritance (Descendant)	Building (T)	not known	4<	4	3	2
2.	The Number of Families	Building (T)	4<	4	3	2	1
3.	Area and User	Building (T)	very poor	poor	fair	good	very good
4.	Status of Land (Land Ownership)	Building (T)	not known	private property	lease-use without letter of agreement	usufructuary rights given by the Sultan	lease rights (under the Sultan agreement
5.	Renovation	Building (T)	Never	1-2 times	3-4 times	>4	anytime
6.	Function	Building (T)	Residential	office (government, private)	economic function (trade and service)	mix-use	social function (education, culture, society)
7.	Visual Assessment	Building (T)	very poor	poor	fair	good	very good
8.	Functional Problems	Building (T)	deterioration of construction and space	building needs maintenance and repairment	insufficient space for users	insufficient space for the function	None
9.	Government Fund	Building (T)	very poor	poor	fair	good	very good
10.	Renovation Assistance	Building (T)	very poor	poor	fair	good	very good
11.	Surrounding Buildings	Building (T)	Other	attaching inside and outside walls	attaching inside walls	attaching outside walls	surrounding the walls in certain distance
12.	Sense of Community	Social (I)	very poor	poor	fair	good	very good
13.	Socio-cultural Participation	Social (I)	very poor	poor	fair	good	very good
14.	Peaceful Society	Social (I)	very poor	poor	fair	good	very good
15.	Security, Mitigation, & Risk-Reduction Participation	Social (I)	not known	uninterested	no time to participate	moderate participation	active participation

Sources: Field Survey; Urban Risk Assessments (Dickson et al., 2012)

Literature study and field observation guided the determination of attribute values in Table 1. The explanation of building attributes needs profound deliberation. Offsprings in close generation with the first owner may understand history of their building, therefore they have emotional connection with the building and do adequate maintenance. Number of families that live in the same building may affect the maintenance to the whole building because of conflict of interest. Density of user is important for the matter of user's activities. Activities in the building should be accommodated in appropriate spaces. The ownership is important issue in Jeron Beteng. There are some land ownership statuses, but Sultan is the legitimated owner of Jeron

Beteng land. It happened in 1980s when government approved legalization of private ownership. Social function is most adaptable and acceptable function for heritage building because it accommodates wider activities initiated by government or community. Government can own and support the cost for maintenance. Mixed-used is residential combined with other function. Mixed-used heritage building can afford for maintenance because of the income. Economic function needs spatial adaptation. Office may be owned by private corporation or government. It needs changes in spatial lay out and building appearance. Residential function gives no income but need cost for maintenance. (Table 1)

Each heritage building is surrounded by walls. The lands outside the walls were owned by the noblemen. The community built their houses alongside the walls, both inside and outside of the space enclosed by the walls. The walls have a role as a boundary that represents different status, authority, and territory. Heritage buildings in certain condition can increase risk for inhabitants and the community around it (Castelluccio, 2018), while the settlement built close to the heritage site can damage the old building condition. The heritage entity and community settlement have been in special connection because of long time interaction and dependence. (Figure 2; Figure 3)

The second questionnaire collected data from communities surrounding heritage entities. The questions included basic attributes of community such as environmental, building, socio-economic, cultural, and hazard-disaster attributes. The environmental attributes were addressed by 9 questions, the building attributes by 12 questions, the economic attributes by 4 questions, the social attributes by 6 questions, the cultural attributes by 8 questions, and the hazard and disaster attributes by 11 questions. These attributes characterize the individual and community risk and resilience. The questions are available in Table 2, below.

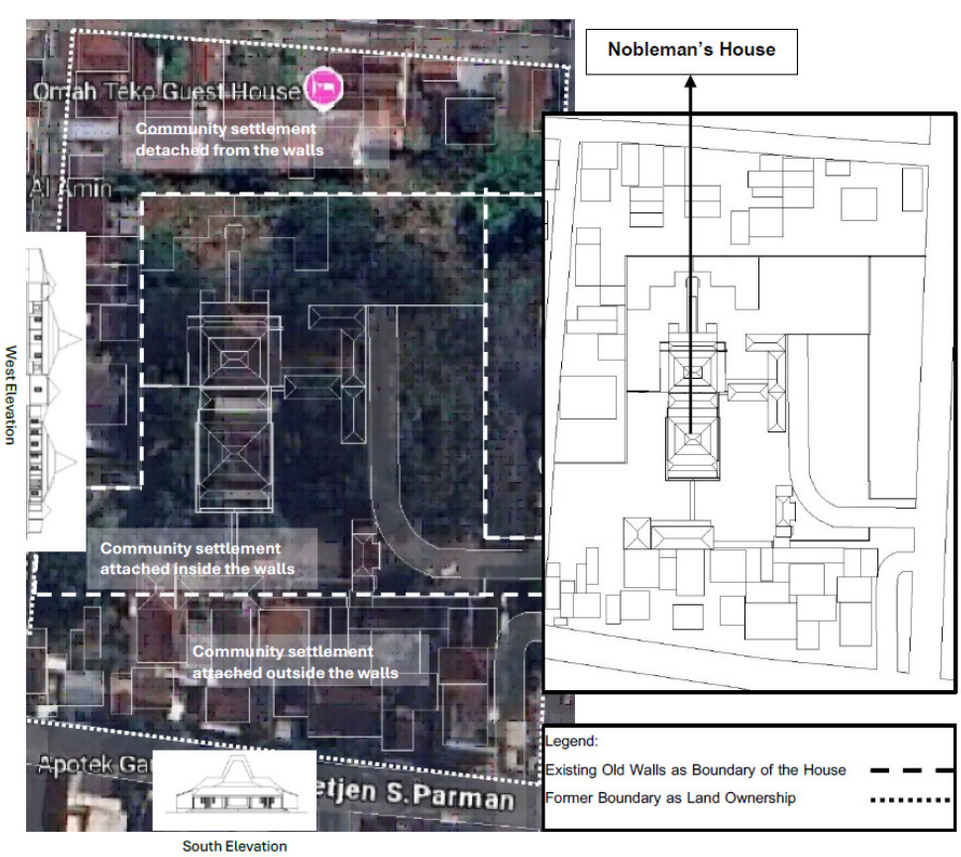


Figure 2. Drawing and superimposition of nobleman's-ty house Tedjokusuman (GPS: -7.80785099, 110.35535856)

Source: Analysis by redrawing and Google Earth

Figure 3. Heritage entity and community settlement interactions: (1) A field for public space owned by heritage entity, (2) The fort of Yogyakarta Palace with associated by new building construction, (3) a corner of the Yogyakarta Palace fort after revitalization and completed with drainage
Source: Author

The first questionnaire included 46 buildings which means 46 respondents. There were 185 respondents participating in the second questionnaire. The number of respondents depended on the type of heritage buildings. Single type had 10 respondents and block type 15 – 20 respondents.

The second questionnaire was selected from the first questionnaire based on the balance entities in orientation, block or single lot, building function, and administrative location. The quantitative analysis was developed based on collected data and information that are taken from the fieldwork and questionnaires. The responses in each of the two questionnaires were based on a Likert-type scale scored between 0 (the lowest resilience, indicating risk) ang 5 (highest level of resilience). The average response for each attribute was calculated and compared for each heritage entity. Finally, a mapping process resulted in four categories of risk and resilience, namely risk of heritage building, risk of community, the resilience of heritage building, and resilience of community.

5. Results

Observing the heritage area from the perspective of risk and resilience shapes the assessment and strategy to reduce risk and improve resilience. The assessment considers attributes within the community, such as social cohesion, socio-economic regeneration, poverty, social well-being, appeal, creativity, and tourism (Labadi et al., 2021, pp. 13-14).

Today, the accessibility and activities in Jeron Beteng are clear and busy, following a transformation of the area over time. The current socio-economic demands and the dynamics of the city have pushed Jeron Beteng and its inhabitants to accommodate mixing of modern and traditional lifestyle activities to survive. As a result, major intrusion of additional economic activities has led Jeron Beteng to include new functions such as services, trade, restaurants, offices, tourism, and accommodation. With these expanding new uses, alterations of spaces and functions take place and transform the existing original houses into mixed-function structures.

Population density is a problem in Jeron Beteng. The density, at 15,646 people per sq.km, is higher than the average density of Yogyakarta city (13,413 people per sq. km) in 2023. As a result, this density condition will impact the existing local neighbourhood's design regulation. For example, traditional regulation in Jeron Beteng, known as the paugeran, only accommodates a single-floor building. Nevertheless, the remaining high population density of Jeron Beteng still potentially triggers the occurrence of everyday risks and brings impact to the implementation of paugeran which is applied effectively for maintaining the physical condition of Jeron Beteng.

Based on observation in the Jeron Beteng area, the physical distance and connectivity to the heritage site implies respect for and dependency on the heritage site. The community gives high respect and less physical risk to the heritage buildings by maintaining a distance from their houses to the heritage entity. However, surrounding buildings within a certain distance from the heritage entity have reached 55% of the total building numbers. Buildings that are attached to the walls of the heritage entity have reached 27% of the total building numbers. This condition could cause either resilience or risk for the heritage entity. The resilience condition in this case means both surrounding dwellers and the heritage entity can support each other through activities and land occupancy. The risk means the dwellers and the heritage entity have a possibility of causing hazards or damage to each other.

The heritage entity in a block shows a strong relationship with the surrounding settlement by attaching to the walls. Based on field observation, the heritage entities within blocks are 60%, meanwhile the heritage entities on single lots are 31%. The heritage building as single lot has low risk of construction because of less attachment with settlement surrounding it but have high risk in terms of social and cultural attributes. Social and cultural attributes need participation of community surrounding the heritage building. Settlements in block have a communal relationship because of the historical dependency. The nobleman gave the opportunity to people to live on his land or close to the property. The nobleman in a single lot had less authority because of less territory, therefore the surrounding community had less dependency and owned the single lots as well. The remaining 9% of surveyed entities are non-occupied buildings. (Figure 4)

The current function is an important variable for the assessment process as a part of the building attributes. Function reflects the active roles of the entity, the value of resilience, and the community interaction. According to this research, the highest percentage of the current function is the socio-cultural function, which covers up to 29% of the entire functions of the surveyed entities. The elaborated functions within this socio-cultural attribute include education, society, religion, and arts activities. 'Single-function buildings' and 'buildings with mixed functions' represent 20% of the total surveyed heritage buildings. Most buildings with mixed functions are a residence which experiences additional use. (Figure 4)

Most of the heritage sites hold the lease-right under the Sultan's agreement. The palace reserves the right to grant or decline permission for occupying the property. There were several events in history that recorded limited conversions of land ownership into private property. The land ownership status shows 53% of the entities receive lease-right category. Apart from the major lease-right status, 31% of the entities receive lease-use without an official letter of agreement. Their existences are allowed under circumstances or special permission from the Palace. As a result, risk and resilience in terms of landownership currently remain sensitive issues due to the co-dependency between people and the Palace. (Figure 4)

The analysis of the second questionnaire focuses on 15 entities. The bar chart in Figure 5 shows the values of the social attributes. The bar chart explains that the sense of community in Jeron Beteng is at a very good level, while the participation in community socio-cultural activities in Jeron Beteng shows a good level. Similarly, the community's harmony in the neighbourhood also performs a good level condition. These results for intangible attributes imply a promising resilience of the settlements surrounding heritage entities. The value of the social attribute promises a good resilience future for the heritage entities. (Figure 5)

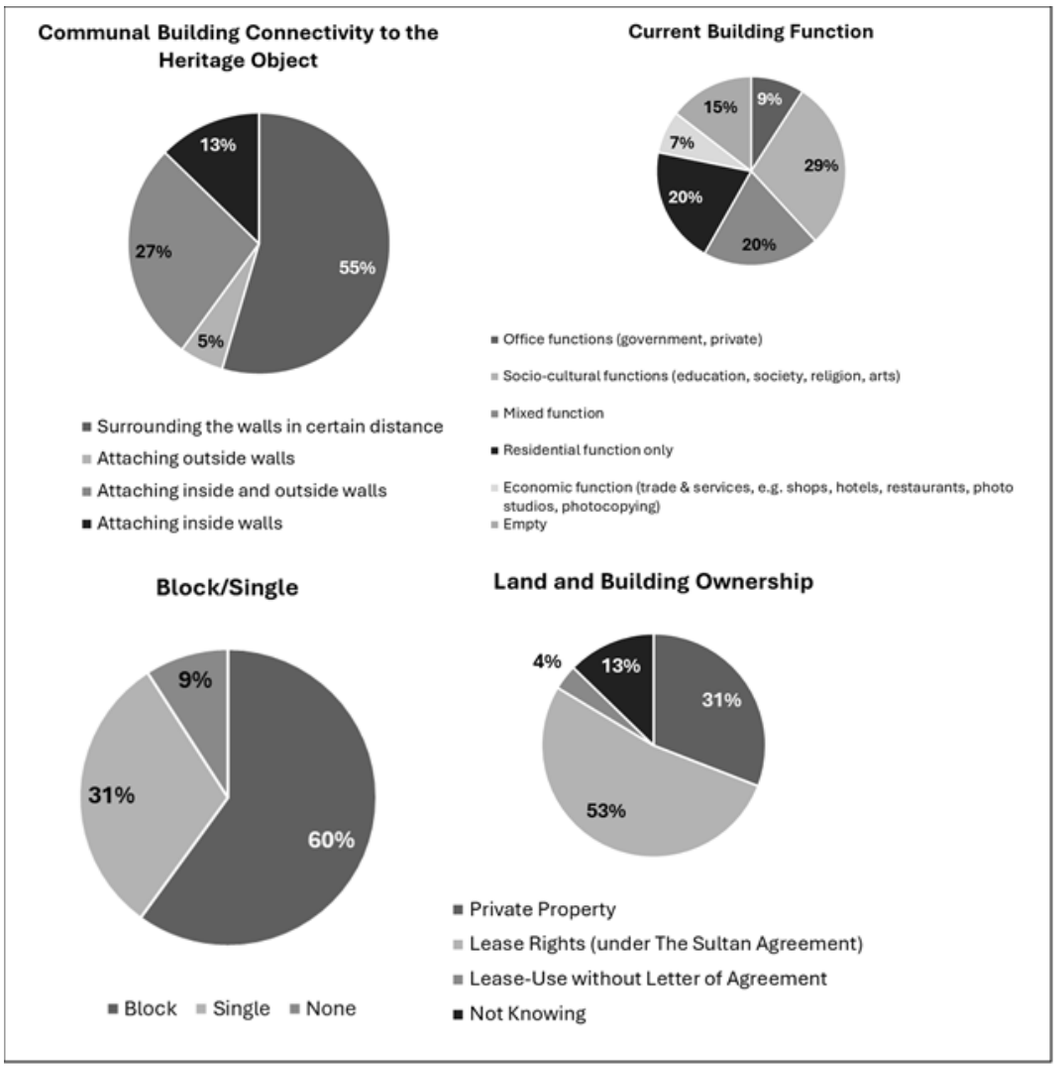
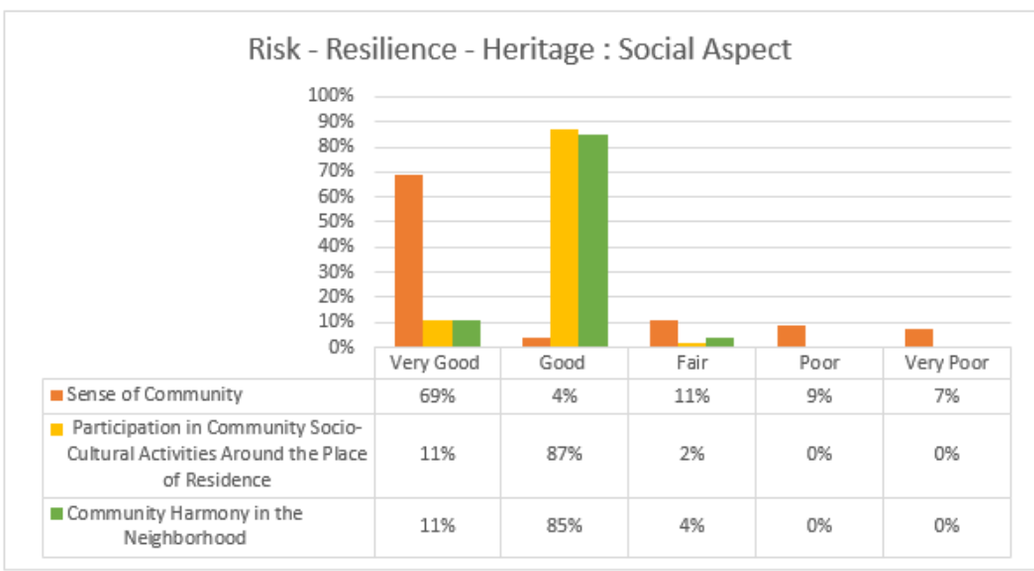


Figure 4. Data and analysis of 46 heritage buildings in the first questionnaire

Source: Author



	Very Good	Good	Fair	Poor	Very Poor
Sense of Community	69%	4%	11%	9%	7%
Participation in Community Socio-Cultural Activities Around the Place of Residence	11%	87%	2%	0%	0%
Community Harmony in the Neighborhood	11%	85%	4%	0%	0%

Figure 5. Intangible social attributes of surrounding residents of the heritage entities.

Source: Author

Figure 6. Taman Sari or Water Castle (GPS: -7.810085, 110.358958): Tourism activities, intervention, and local economic activities. Location numbers (1-6) are discussed directly in the main text.

Source: Dissertation of Urban Risk in Heritage Area of Jeron Beteng Yogyakarta (Author)

Figure 6 identifies specific locations that illustrate the relationship between heritage entities and surrounding settlement. Location 1 demonstrated an access space to the heritage entity of Taman Sari (Water Castle) blended with economic activities of local people. Location 2 represents old heritage walls intervened by settlement. Locations 3 to 6 represent the conditions after revitalization of Taman Sari. The relation of Taman Sari and the surrounding community represents the resilience of Jeron Beteng, although in some points the settlements evoked interdependency between them. The Regional Board for Disaster Management in collaboration with the local community conducted revitalization in Taman Sari. One of the programs was to create a distance of least one meter between the walls of Taman Sari and the settlements. The structure was evaluated and reinforced by new construction. (Figure 6)

6. Discussion

6.1 Factors in risk, resilience, and heritage

In a built-environmental heritage, the descendants and the residents who still live within and at the surrounding area of the buildings interact between heritage entities and the neighbourhoods. Based on the data collected from Jeron Beteng, there is evidence in explaining the resident's influence on the establishment and renovation of the neighbourhood buildings. The multiple families within a kinship often collectively live in a traditional old building. This communal lifestyle is pertinent to the fitness of spaces, the number of residents, and floor area of the houses.

Moreover, there have been several renovations in Jeron Beteng initiated by the descendants and/or the residents of the heritage entities. Most of the renovations aim to enhance the functionality of spaces. Currently, the existing functional categories are residential, economic, social, cultural, and intertwined functions. If there is financial support given to renovate the heritage entity, the support depends on the status of the heritage entity. The status of heritage entity is given based on its land ownerships, which are lease rights under the Sultan agreement, usufructuary rights given by the Sultan, lease-use without the letter of agreement, and private property.

Based on field observation, it is obvious that the communities who live in the blocks generally show a stronger sense of community compared to the residents who live in the neighbourhoods with single buildings. In addition, the communities who live in the blocks tend to develop closer and stronger interaction and participation in socio-cultural and risk mitigation activities.

Table 2 shows attributes and variables of risk and resilience. Variables with darker colour have an emphasis on community, which are environmental, economic, social, and hazard-disaster attributes. Variables with lighter colour have an emphasis on heritage entity, which are building and cultural attributes. The scale and category of attributes and variables help to determine the goals of the assessment from the initial stages. The macro-scale has impact on a wide area and community, whereas the micro-scale has impact on heritage entities as single units (Table 2).

Table 2. Categories of attributes and variables of integration (second questionnaire)

ATTRIBUTES	VARIABLES			
	RISK		*RESILIENCE*	
ENVIRONMENT ATTRIBUTES	1.	Water Resource for Drinking and Cooking	1.	Sanitary Facilities
	2.	Water Resource for Bathing and Laundrying	2.	Waste Management
	3.	Rain and Storm Water Drainage	3.	Sanitation and Hygiene Awareness
	4.	Ways to Direct Rainwater	4.	Open Spaces for public activities beside the square
	5.	The role of Vegetation in the Property		
BUILDING ATTRIBUTES	1.	Family Density	1.	Descendant Level
	2.	Building Area	2.	Status of Land (Land Ownership)
	3.	Establishment	3.	Functional Problems
	4.	Roof Materials	4.	Building Function
	5.	Wall Materials		
	6.	Visual Assessment		
	7.	Building Floors		
	8.	Modern Style Building in Jeron Beteng		
ECONOMIC ATTRIBUTES			1.	Alternative Economic Activities
			2.	Inhouse Information Communication
			3.	Possibility of Equal Economic Enhancement through Jeron Beteng Cultural Tourism
			4.	Feelings of Efficacy in Social Economic Activities in upcoming 5 years
SOCIAL ATTRIBUTES			1.	Accessible Health Facility in Neighborhood
			2.	Sense of Community
			3.	Cultural Activities in Neighborhoo
			4.	Multi-Families in One House Peaceful Society
			5.	Security, Mitigation, & Risk-Reduction Participation
CULTURAL ATTRIBUTES	1.	The influence of Urban Development toward Heritage Object and Old Buildings in Jeron Beteng according to Personal Experience	1.	Advantage of the Existence of Heritage Object
			2.	Multi-stories buildings in Jeron Beteng
			3.	Hotel and Exclusive Hostel/Dormitory in Jeron Beteng
			4.	Non-local Residents open business in Jeron Beteng
			5.	Willing to stay and preserve cultural values in Jeron Beteng
			6.	Main reason of willingness to stay in Jeron Beteng
			7.	Sense of belonging and personal relation to the closest heritage object
HAZARD AND DISASTER ATTRIBUTES	1.	Respond to Fire Hazard	1.	Neighborhood Security and Safety
	2.	Experience of Hazard: 1) Non natural disaster (fire disaster, fallen tree), 2) Crime, 3) Traffic accident, 4) Domestic and workplace accident, 5) Natural disaster	2.	Neighborhood responses and obedience in healthy life dan health protocols, especially during Covid-19 Pandemic
			3.	Scale of Mitigation Implementation
			4.	People understand in responding to disaster
	3.	Shelters for Disaster Preparedness	5.	Participate to Disaster Preparedness and Education Activities
	4.	Evacuation Route	6.	Self-responsive of People to Hazard and Disaster
			7.	Center of Joint Secretariat Volunteer in The Subdistrict of Kraton

Legend:

Risk of Heritage Entities	Risk of Community	Resilience of Heritage Entities	Resilience of Community

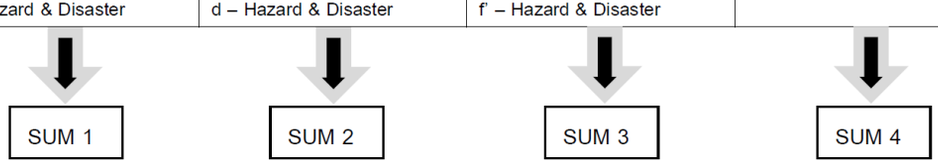
Source: Analysis from Field Survey and Urban Risk Assessments: Understanding Disaster and Climate Risk in Cities (Dickson et al, 2012)

The concatenation of the process and analysis implies that the existence of community is important for heritage entities and vice versa. Despite the physical risk that also may arise, the dwellings located in the surrounding spaces of heritage entities unexpectedly contribute to unique protection for the existence of the heritage entities. Their existence reinforces the existing traditional authority that is still applied in the neighbourhoods.

The loyalty and respect of people to noblemen provided opportunities to live nearby their majesty. This interaction implies the social dependence between people and the palace, which becomes a pattern of cultural and social resiliencies. This interdependency helps to protect the community and traditional supremacy. This condition unexpectedly generates resilience of the heritage entities. However, community settlement stays in a certain distance from a heritage entity for the purpose of their safety and heritage preservation. The distance is varied between 1.5 and 2 metres. However, based on Mayor Regulation of Yogyakarta Number 64 of 2012, the distance must be a minimum of 2.5 metres. Government regulations must be encouraged to be understood and implemented.

The discussion finally comes up with categories of factors for the integration strategy of risk and resilience. The process of analysis creates a matrix that can be used to determine the risk and resilience, then community or heritage site. Group A and Group B in Figure 7 are variables of risk and resilience that can be used to calculate Total Risk (A/B). The number of variables for the Community is greater than the number of variables for Heritage Entity in the control of resilience, which confirms that the data from the calculation of resilience assessment is more complex than risk assessment. The data of Building and Hazard & Disaster attributes are important for both Community and Heritage Entities. The matrix in Figure 7 leads to choosing categories and calculate risk or resilience. Heritage Entity calculation must stand together with the Community, but Community calculation can stand alone.

Community	**Heritage Entity**	**Community**	**Heritage Entity**
a - Environment		a' – Environment	
	c – Building	b' – Building	g' - Building
		c' – Economic Activity	
		d' – Social Activity	
	c - Culture	e' – Culture	h' - Culture
b – Hazard & Disaster	d – Hazard & Disaster	f' – Hazard & Disaster	



$$\text{TOTAL RISK} = \frac{A}{B}$$

$$\text{Community Risk} = \frac{Sum\ 1}{Sum\ 3}$$

$$\text{Heritage Entity Risk} = \frac{Sum\ 2}{Sum\ 3 + Sum\ 4}$$

A = a + b + c + d + e

B = a' + b' + c' + d' + e' + f' + g' + h'

Likerd-like Scale for a, b, c, ... and a', b', c', ... = 1-5 (low-high)

Figure 7. The distributed control between risk and resilience in community and heritage entity

Source: Author

7. Conclusions

To develop a new insight on assessment of risk and resilience in the context of heritage, this paper juxtaposes risk and resilience factors within the aim to determine integrated factors used in assessment and strategy. Risk and resilience have an equal importance although they can represent conditions of opposite direction. Study and discussion about risk and resilience in selected heritage area of Yogyakarta, Indonesia, were conducted separately.

Common experiences show that community and densities will endanger the built environments of heritage areas. Qualitative analysis and the scoring results from the questionnaires revealed that community is the most important attribute for resilience. The assessments related to the community shall be emphasized because a resilient community is a generator to achieving a resilient heritage entity.

Risk and resilience factors contribute to improving the policies of land use and building regulations in the heritage area. The recognition of heritage buildings should be supported by assistance and effective programs to generate resilience for surrounding community.

Risk, resilience, and heritage are linked by pertinent factors at the macro-scale and micro-scale levels. The first group of macro-scale characteristics comprises hazard, vulnerability, exposure, and asset value. The second group comprises mitigation, capacity, and resilience. These two groups are considerations for large area of risk and resilience. Micro-scale assessment consists of structural construction, architectural value, and historic value. This is for a single building of a heritage entity.

The macro-scale factors are shaped by social, economic, environmental, and hazard-disaster attributes, whereas the micro-scale factors are shaped by building and cultural attributes. Each attribute is elaborated into several variables. Risk assessment for single heritage building applies building and cultural attributes, whereas resilience assessment applies social, economic, environment, and hazard-disaster attributes. Macro-scale assessment as a single tool can be used to value the resilience and risk in certain areas of heritage entities by considering the existence of heritage buildings and surrounding community. (Figure 8)

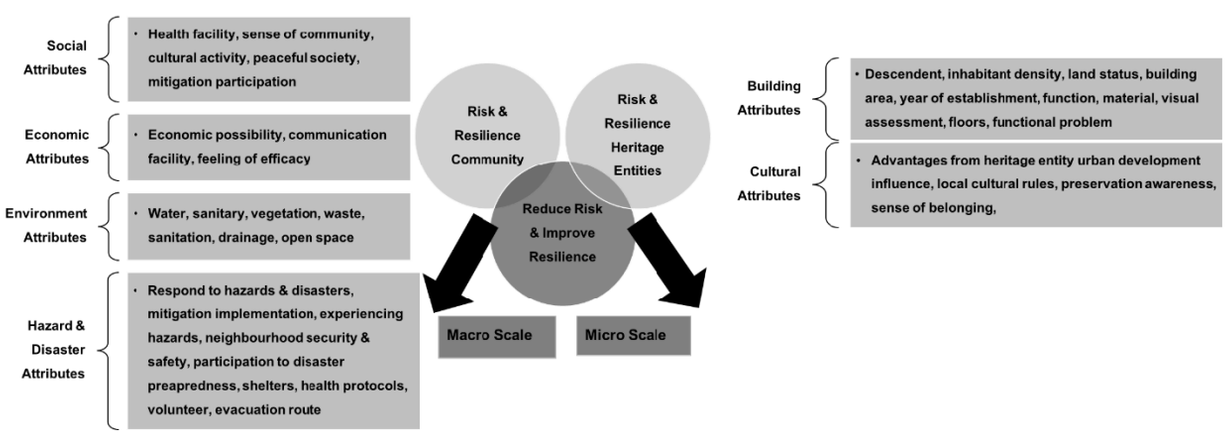


Figure 8. Linking risk and resilience in heritage area into scales, attributes, and variables

Source: Author

The existence of Jeron Beteng up till now with its local regulation and heritage entities illustrates how to deal with the urban risk and attain the resilience. Jeron Beteng can be a precedent through its condition. Therefore, the acknowledgment of the existing traditional regulation and consensus shall be maintained along with the supporting government's regulation. Community lives from the heritage and the heritage is shaped by the capacity of the community. People have roles in protecting, maintaining, and changing tangible and intangible values. The motto of "Throne for People" represents the concept of "to serve the people".

The next research steps should emphasize the specific functions of the heritage entities. The resilience could depend on the actual function and potential development according to the location, building condition, and the status of ownership. The triangle of risk, resilience, and preservation should be established for urban planning and development. Preservation in terms of mitigation can reduce risk related to old buildings, inhabitants, and community in the area. The configuration of single heritage entities come up with a place-based policy for heritage area.

Resilience represents community condition. The condition depends on the equilibrium between resilience attributes. Macro scale shows that the connection between buildings in Jeron Beteng can establish the equilibrium state. Traditional regulation must be implemented with the modern regulation through development planning.

Author Contributions

Conceptualization, G.O.I.C. and S.; Methodology, G.O.I.C., S., and D.M.; Validation, G.O.I.C.; Formal analysis, G.O.I.C., S., and D.M.; Investigation, G.O.I.C.; Resources, G.O.I.C. and S.; Data Curation, G.O.I.C., S., and D.M.; Writing - Original Draft, G.O.I.C. and S.; Writing - Review & Editing, G.O.I.C.; Visualization, G.O.I.C., S., and D.M.; Supervision, G.O.I.C., S., and D.M.; Project administration, G.O.I.C.; Funding acquisition, G.O.I.C. and S. All authors have read and agreed to the published version of the manuscript.

Human Subjects

The study was approved by Academic and Student Affairs of Gadjah Mada University (Letters of Permission: 3012/UN1/FGE.1.1/PPS/PT/2021 - 3017/UN1/FGE.1.1/PPS/PT/2021) which is signed by Vice Dean of Faculty of Geography, Gadjah Mada University, 6 July 2021.

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Data Availability Statement

Data may be obtained from the corresponding author upon reasonable written request.

Use of Generative Artificial Intelligence (AI) and AI-Assisted Technologies

During the preparation of this manuscript, Grammarly writing app and proofreader was used. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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