Urban planning Jakarta settlement area based on earthquake mitigation: socio-cultural ecology study

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Abstract. Jakarta has the potential to be rocked by a large and proven earthquake, based on the historical record of the city of Jakarta. There are three occurrences of a devastating earthquake that once rocked Jakarta which damaged several houses and tall buildings and permanently stone walls. Conceptual and implementation readiness is needed when a major earthquake occurs, especially in terms of inspections of building structure capabilities, public education, and contingency plans that are in accordance with the conditions of the people of Jakarta. This research aims to build a conceptual framework for the readiness of Jakarta society through various approaches. The conceptual framework will be the theoretical basis of earthquake disaster profiling and disaster mitigation-based spatial planning. The study was conducted on exploratory research as part of the Neuroresearch research method. The results of the study were in the form of theoretical constructs of the study of socio-cultural ecology to realize the spatial layout of Jakarta residential areas based on earthquake mitigation.

Keywords: urban planning, earthquake mitigation, socio-cultural ecology

1. Introduction
Indonesia is known as one of the countries with the highest seismic activity. This condition is caused by Indonesia being surrounded by three main active tectonic plates of the earth namely the Eurasian plate, the Indo-Australian plate and the Philippines so that this active seismic activity must be the main consideration of construction design in Indonesia [1].

Jakarta is no exception as the capital city of Indonesia. Natural disasters such as rising sea levels, tropical storms and earthquakes are a real threat to Jakarta. However, it seems that Jakarta is not ready to face and is not aware of disaster management [2]. As a city located on the north coast of the island of Java, Jakarta needs to begin preparing itself [3].
Jakarta has the potential to be rocked by a large and proven earthquake, based on the historical record of the city of Jakarta. There are three occurrences of a massive earthquake that once rocked Jakarta which damaged several houses and tall buildings and was permanently stone walled. On January 5, 1699, Jakarta experienced a powerful and powerful earthquake for three quarters of an hour. An earthquake of great strength also lasted more than 5 minutes in 1757.

On the night of October 10, 1834, the land trembled several times in the areas of Batavia (Jakarta), Banten, Karawang, Bogor and Bandung. In the morning, a great shock occurs. So strong, the vibration was even felt up to Tegal in Central Java and Lampung in Sumatra. The earthquake damaged several houses and buildings firmly walled in stone, including a palace in Weltevreden. Paleis van Daendels, who is now the Indonesian Ministry of Finance Building. Several warehouses and houses are also flat on the ground, as is the case with the stone-walled buildings in Cilangkap partially damaged. This shock is believed to be the most severe earthquake that hit the region. Panic spread in Batavia, but no casualties were reported (Indonesian Historical Earthquakes from Geoscience Australia).

This condition is supported by the geographical location of Jakarta in sedimentary basins with slightly topographic reliefs whose altitude continues to increase [3].

In addition, the last two earthquakes that rocked Jakarta in January 2018, the 6.1 magnitude earthquake centered on the Indian Ocean, 6.1 kilometers from Lebak, Banten. An earthquake measuring 7.3 on the Richter scale rocked Tasikmalaya on Wednesday, September 2, 2009 at 14.55 WIB. The tectonic earthquake occurred due to the collision of the Indo-Australian plate against the Eurasian plate. Not only in West Java, tall buildings in Jakarta which are 200 km from the epicenter of the earthquake swayed violently.

Conceptual and implementative readiness is needed if there is a large earthquake, especially in terms of inspections of building structure capabilities, public education, and contingency plans that are in accordance with the conditions of the people of Jakarta. This study aims to build a conceptual framework for the readiness of Jakarta society through various approaches. The conceptual framework will be the theoretical basis for earthquake disaster profiling and disaster mitigation based spatial planning by considering the existing social cultural ecology.

2. Literature Review
An earthquake is a disaster that often causes many casualties and property damage [4]. Earthquakes cannot be rejected or prevented, so what needs to be prepared is mitigation of this disaster. In Oklahoma, earthquake mitigation is carried out by weekly reporting of injection volume and Arbuckle well pressure disposal wells, mechanical integrity test of injection wells and injection volume reduction around earthquake swarms [5].

For Indonesian countries that are in the disaster area and do not have sophisticated equipment such as in other countries, then the most basic and important thing to do is prevention of the risks produced. The first thing that is most often considered is the matter of building structure, it is necessary to examine whether all the buildings in Jakarta have met anti-earthquake standards, ranging from building codes, earthquake resistance standards, to SNI (Indonesian National Standard). The structural response of buildings to earthquakes is a dynamic phenomenon that depends on the dynamic characteristics of the structure and the intensity, duration, and content of the frequency of the movement of the soil itself. Dynamic seismic movements recommend buildings with static load analysis with earthquake resistant building designs that consider the complexity of the earthquake itself [6].

In terms of building construction, the USA and Japan collaborative research program (PRecast Seismic Structural Systems, PRESSS) which began in 1990 recommended guidelines for earthquake-resistant building design from concrete with building mechanisms for the integrity of precast concrete elements which were maintained as their structure due to lateral displacement demands large and post-earthquake residual drifts are minimized [7].

Risk mitigation is needed because of the amount of economic losses borne by the community. In the New Zealand Standard, it is stated that
1. Earthquake-resistant buildings must be able to support all loads that must be faced during the life of the building with adequate safety margins.
2. Buildings consider deformation restrictions, building structures are at the permitted limits
3. Buildings are considered in order to avoid structural damage
4. Buildings consider being able to prevent irreparable damage and minimize the possibility of injury and death of people inside the building [7].

In terms of building architecture, architects need to conceptualize and enrich their architecture with designs that consider the concepts of strength, weakness and fragility, for example with a single design that has a solid structure and is concentrated in one area of the building plan and light structure in another. What needs to be emphasized is that building safety features must be expressed in art form [8].

Requirements for earthquake-resistant multi-storey buildings have long been applied in Jakarta so that the issue of resilience of the multi-storey building to the earthquake should not be an issue anymore. BBC Indonesia stated that however, the earthquake resistant area only applies to high-rise buildings not for houses or settlements. Earthquake mitigation efforts continue to be carried out in a geographical context [9].

By paying attention to the impact that will be produced, in terms of architecture also need to consider the anticipation of disasters in designing buildings. Various countries have begun to implement laws to strengthen earthquake-prone buildings [10,11]. Layout of residential areas is a form of spatial structure and spatial patterns in residential areas with the aim of realizing harmony between the natural environment and the artificial environment, integration in the use of natural and artificial resources about human resources.

This basis becomes important when the concept of settlements built is faced with the social context of the community which still needs to be continuously improved in facing natural disasters. Many studies have been conducted to measure people's readiness in the face of earthquakes [12].

Community readiness in facing earthquakes can be seen from the response and activities they did before earthquake predictions were given. People tend to see potential risks based on the events that occur so that the community needs to emerge in the presence of a settlement that is able to accommodate various preventive measures to minimize the risk of natural disasters that occur [13].

Considering the study above, settlement planning in Jakarta is important to consider earthquake mitigation based on studies of socio-cultural ecology, or what is called socio-cultural ecology.

3. Research Method
This research is a preliminary research in developing a layout concept that considers the risk mitigation aspects of earthquake disasters. The study uses exploratory research as part of the Mixed Method Neuroresearh, which is an exploratory study that conducts studies from various sources to support the concept so that it can produce a construct or model that can be the basis for further research [14]. This research is also called literature study so that it can obtain a comprehensive picture of various matters relating to the research theme.

4. Result and Discussion
As a country in the disaster area, Indonesia needs to have a synergic and comprehensive natural disaster mitigation concept that not only concerns geographical conditions but also social and culture so that it is referred to as a socio-cultural ecology study. In the face of an earthquake, beautiful buildings are not enough but there needs to be integration between the aesthetics and resilience of buildings in the face of disasters. This is because strengthening buildings can not only minimize the number of victims but also can help reduce losses economically [10].

In anticipating it, one of the efforts taken through a disaster-based spatial planning approach is an effort to safeguard life and livelihood, especially in residential areas in Jakarta. The context of Indonesia as an earthquake crossing area makes people in terms of choosing and owning buildings, not just wanting to own or be able to inhabit the building. Communities need to
obtain several aspects including feeling safe about the building of their choice. So that the building is not only concerned with aesthetics, but there are psychological elements to the building.

The community's response to the building is very decisive and reflects the capacity of the architect to meet the demands of these needs.

5. Conclusion
The studies from the context of socio-cultural ecology, what is needed is comprehensive efforts and actions from the government, engineering, architecture, and society in realizing residential areas on the basis of natural disaster risk mitigation.

The government needs to accommodate these efforts with various supporting policies including policies on building standards and settlements that must be met by the developer. In terms of engineering, the construction of structures capable of meeting the requirements of earthquake resistant buildings must be carried out to minimize the risk of loss both materially and non-materially that will be faced by the community.

For architects, building design must consider preparedness in the face of natural disasters. Design must be able to facilitate the public to save themselves in an emergency. Design must also consider areas that can be a point of salvation. Next is the problem of education for the community when natural disasters or earthquakes occur. What must be done before an earthquake occurs, during an earthquake, and after an earthquake. The aim is to minimize casualties, because usually there are many casualties caused by the collapse of buildings, due to panic and especially because they are not ready to face natural disasters namely earthquakes. With this synergistic and comprehensive effort, it is expected that potential losses due to the earthquake can be minimized.

6. References

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