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Procedia - Social and Behavioral Sciences 227 (2016) 334 – 340

Procedia Social and Behavioral Sciences

CITIES 2015 International Conference, Intelligent Planning Towards Smart Cities, CITIES 2015, 3-4 November 2015, Surabaya, Indonesia

Toward resilient and sustainable city adaptation model for flood disaster prone city: case study of Jakarta Capital Region

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Abstract

Flood disaster is one of the problems that could threaten the sustainability of Jakarta. The intensity of major floods continues to increase as a result of high rainfall and land conversion as well as poor urban drainage system. Therefore, the city requires an increased capacity to face flood disaster. The enhancement of the city capacity needs to be well designed to achieve a state of city that is resistant to disaster or what is known as a Resilient City. The purpose of this research is to develop an adaptation model of flood disaster prone city resilience to actualize the sustainability of the city of Jakarta. Based on the position analysis results using Structural Equations Model (SEM), 4 (four) factors affecting the adaptation model of resilience disaster prone city of Jakarta were found, which are spatial arrangement, technology innovation, disaster mitigation, and disaster adaptation. To form a resilient city, resilient ways are required. The effective resilient ways to be implemented in the city of Jakarta are the implementation of orderly spatial management, the enhancement of the adaptive capacity of society and a dynamic and planned urban systems to actualize a resilient and sustainable.

Peer-review under responsibility of the organizing committee of CITIES 2015

Keywords: Disaster Prone City; Flood; Resilience City; Adaptation Model; Sustainability; Structural Equations Model (SEM).

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Peer-review under responsibility of the organizing committee of CITIES 2015
doi:10.1016/j.sbspro.2016.06.079

1. Introduction

Jakarta as the capital city of Indonesia is one of the city which is susceptible to flooding (Yoo et al., 2014). Flooding and puddle of water occuring in Jakarta become one of the problems of the city sustainability issues (Nawangsidi, 2009). Density of undeveloped land and the irregularity of spatial management cause high sensitivity to flooding (Woobe, 1999; Brath *et al.* ,2006). Floods in Jakarta is not a new issue, Marfai (2013) mentions that Jakarta has experienced major flooding since 1621, 1654, 1876, 1976, 1977, 1984, and 1989. A 5 (five) years periodical flood in 2002 caused a 5.4 trillion rupiahs worth of damages. The same kind of flood in 2007 caused 5.2 rupiahs worth of damages (Bappenas, 2007), while the one in 2013 caused up to 7.5 trillion rupiahs of damages (Nugroho, 2014). Flood impacts is likely to increase, a well prepare to disaster mitigation planning, integrated with spatial management, is therefore required. Excelent disaster mitigation planning should include efforts to increase the capacity of communities to cope with disasters. These things need to be well planned in order to create a city that is resilient to floods.

A disaster resilient city is a city that is ready to face the attacks of all types of threatening hazards (Oetomo, 2012). Disaster resilient city also has the ability to quickly return to its original condition prior to the occurrence of disaster (Godschalk, 2003). The realization of the city's stakeholders that Jakarta should become a city that is resistant to disasters is indispensable to achieve a sustainable city. It is important since Jakarta is the capital of Indonesia, which means it has an important role in the welfare of the people.

The research problem is: *flood risk mitigation efforts that have been* conducted in Jakarta are *still inadequate*, which can be seen *from spatial management implementation that deviates from the plan, and limitations of green open space*, while *the threat of impending floods could potentially increase*, so that adaptation efforts are needed to increase the resilience of the city through a model of resilience to achieve the sustainability of Jakarta. Thus, a model that can be implemented to create a city that is resilient and to support the sustainability of Jakarta is necessary.

2. Theoretical Basis

Sustainable city is a city that allows all the citizens to fulfil their needs and improve their welfare, without reducing the natural environmental conditions or other people's lives in the present and in the future (Girardet, 2004), while Godschalk (2003) stated that a resilient city is a city that is able to deal with various types of pressure without causing chaos or permanent damage at the time of pressure. Resilient City was designed with the aim to anticipate, survive, and recover from the impact of disasters. The city will be flexible to various disorders, in this case is a disaster.

According to Mandala (2014), the concept of resilience city is a concept that has a relationship with the concept of sustainable development, which is also built on the three dimensions of mitigation, adaptation, and innovation. The three dimensions will be explained as follows:

1. Mitigation is the reduction of risk relative to the object capacity, the object itself in accordance with its capacity.
2. Adaptation is the self adjustment to risk, which is adapted to the hazards and vulnerabilities that exist at the object.
3. Innovation is the time frame to consider the implementation of new activities in the treatment of actual risk which falls outside the existing capacity on the object, such as creating new technologies to reduce disaster risk.

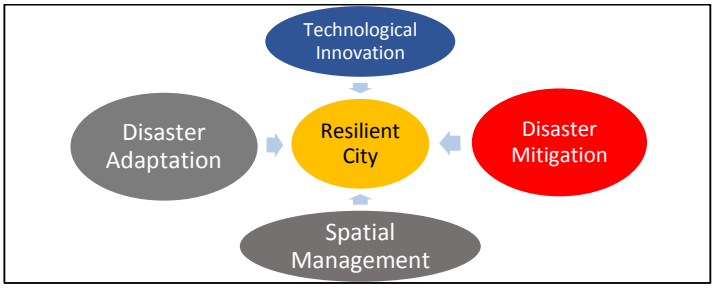

Fig 1. Framework of Resilience of Disaster Prone Cities