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Green housing evaluation through carbon footprint dynamic model: questioned the urban policy sustainability

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Abstract

Tangerang local government's housing policy states that settlement area has to be rejuvenated through the 'green housing' development. This study suggest that urban planning policy has to consider about carbon footprint as one of sustainability indicator. Many studies reviewed from socio-economic issues to figure whether the policy is sustainable whilst there is lack of consideration about carbon footprint per-capita emitted. Employing carbon metric, GIS and system dynamic methods, carbon footprint per-capita was estimated based on the implementation of green housing development. This study was focus on whole life cycle of building: construction phase, operational phase and demolition phase . Demolition would be conducted to settlement area which is not suitable with RTRW (urban land use planning). The result show that in the early year of policy implementation, there would be an increasing number of carbon footprint per capita due to the demolition and construction phases. However, in the long term carbon footprint per capita would be less cause by implementation of green housing.

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1. Introduction

Rapid urbanization places a remarkable strain on housing and serviced land. Global population projections suggest that the world population of over 6 billion in 2000 will increase 20% to over 7 billion by 2015, and to 7.8 billion by 2025, a 30% rise (WHO, 2011). This translates into the need to complete 96,150 housing units per day including their infrastructures and the legal land title ownership between now until 2030 (UN-HABITAT, 2006a). In some cities, Asia already has more than half of the world's slum population (581 million), followed by sub-Saharan

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Africa (199 million), where 90% of new urban settlements are taking the form of slums. The latter also has highest annual urban and slum growth rates in the world, 4.58 per cent and 4.53 per cent respectively (UN-HABITAT: 2008). Mostly governments around the world have attempted to solve the problems of urban slum and squatter settlements by clearing old decrepit housing and replacing it with modern housing with better sanitation. In this case, slum clearance usually takes the form of eminent urban renewal projects. Current studies (e.g., Abebe & Hasselberg, 2013 ; Shankar & Vasanthi, 2015 ; Marx, Stoker, & Suri, 2013 ; Atlaw, 2012) mostly focused on the socio-economic impact of this government policy but rarely on the sustainability of the cities from carbon footprint indicator. This paper aims to fill this gap by evaluate carbon footprint emitted when resettlement is executed within a period of 30 years (2020 to 2050).

Provision of affordable housing and improvement of slums are challenges. Slum upgrading projects have been implemented worldwide usually implemented executed by external development agencies (NGOs, international organizations), or by the local authorities, sometimes under the pressure of grassroots associations, often with the support of foreign bilateral and/or multilateral donors. Different scholars have different insight on urban slum relocation. While some argue about the indispensability of slum relocation seeing that the areas need to be utilized for economically more productive purposes and thus indicated that individuals are expected to sacrifice for the state (e.g., Viratkapan & Perera, 2004 ; Meikle & Walker, 1999) others state that relocation creates tremendous negative impact on the socio-economic assets of communities (Cernea, 1996). In any way, this path of development is very rarely sufficient to bring sustainable urban development.

Sustainable urban development indicators have been widely discussed in the literature (Burton 2002; Hall 2010a).Urban sustainability indicators reflect the general well-being of urban built-up areas and should be integratable, forward-looking (Huang et al. 1998; Maclaren 2004), distributional and subject to feedback loops (Hall 2010a). Such indicators, particularly those relating to the built-up area of a settlement, are vital in the sustainability debate as they denote consequences of urbanization and human–nature interaction (de Noronha Vaz et al. 2012). One of the indicators of sustainability is carbon footprint. Originally carbon footprint can be seen as an instance of the ecological footprint expressed by Wackernagel and Rees (1996). The concept of the carbon footprint has been used since decades and is known as an indicator for global warming potential impacts of the life cycle (Finkbeiner, 2009).

This study will focus on urban policy implemented in Tangerang Municipality. Most of Tangerang area is cover by settlements. It is also considered to represent a typology of metropolitan cities in Indonesia which is dominated by residential building. That is why this study represent most of urban area in Southeast Asia with an accelerated urbanization. Based on State of Environmental Report, there were about 1,918,556 population in Tangerang Municipality with about 493,958 unit of housing, thus there is housing backlog about 5,605 unit in 2013(BPLH, 2014). Currently Tangerang has compiled a Strategy for Settlement and Urban Infrastructure Improvement (SPPIP). SPPIP is a strategy to guide construction of settlements and infrastructure in urban areas, manual for aligning and integrating policy of housing development and the urban planning policy . This paper aims to analyze how this policy affect to city sustainability from point of view carbon footprint as an indicator.

2. Methods

2.1. GIS Analysis

GIS analysis performed to count carbon footprint generated if spatial planning policies was implemented. GIS analysis performed as described in the following scheme. This scheme show that there would be potential of demolition and construction of new settlement which is calculated by integrating spatial planning policy analysis and map digitization. For those settlements which unsuitable with spatial planning, so there would be chance for demolition. As population grow, there are also chance that construction of new settlements would be conducted.