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Willingness to pay for climate change mitigation: application on big cities in Central Java, Indonesia

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Abstract

This research aims is to map the climate condition on the cities and to explore willingness-to-pay (WTP) for climate change mitigation. Geographic Information System (GIS) is mapped cities climate condition and Choice Modeling (CM) is measured the people's awareness for mitigating the impacts. The valuation variables are WTP, socio-economy and alternative mitigation choice. WTP is the maximum payment in various bid choices, it is between Rp 0,- to Rp 210.000,-. The alternative choices are plant trees, develop city forest, and public transportation improvement. Sample is defined by Watson formula, which is about 300 respondents in three cities, randomly. In terms of supports, the research's findings are on spatial analysis and mitigation choices. Spatial analysis shows the climate condition in the Surakarta, Semarang and Magelang. WTP survey with CM approach focuses on climate change mitigation in the three cities.

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Keywords: climate change; mapping; economic valuation; choice mitigation; willingness to pay

1. Introduction

Climate change happens as a natural process and human activities include in. Increasing of earth temperature makes ice smoothing, raising sea level, variability on nature temperature, and global warming. It causes arid, paddy

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failed, hampered ecosystem, clean water scarcity, biodiversity degradation, forest fire, and disease. Stern (2007) says climate change is part of economy problem. On business as usual situation, when developed countries ignore the emission effect, the loss is 14 percent of global Gross Domestic Product (GDP) in twenty one century. The replacement cost is about 2 percent to 5 percent of global GDP and adaptation cost is 0.5 percent of developed countries' GDP. It shows adaptation cost is lower than replacement cost. Indonesia has 132.4 million hectare forest for reserve of CO₂ (*carbon sink*). The forest is important to share 85 percent on emission descent. Community involvement is doing by reforestation and planting the tree.

This research focuses in mapping the cities and people's WTP of climate change impact in urban areas. GIS is used to map the climate condition in three cities . Saptutyningsih and Suryanto (2009), Sen, *et al* (2010), Yusuf, *et all* (2010) and Cowell and Zeng (2003) using GIS to map the vulnerability of flood in DIY province, typhoon, climate change in Southeast Asia and also modelling of vulnerability of weather change. People's awareness to pay to reduce the climate change impacts is measured by WTP. WTP also analyzes individual characteristics and personal motives related to other people's interest and alternative to avoid the risk. Le Van An, *et.al* (2006) do the research on community participation to overcome typhoon. Socio-economy condition has significant influence on decision making process by stakeholders. Sen, *et.al* (2010) found the gap on need and socio-economy condition to overcome the disaster. The community condition influence to their ability to adaptation. Vulnerability of climate change in South East Asia mostly happen in region which is has low to middle income (Yusuf and Fancisco, 2010). Dell, *et al* (2008) used panel data to analyze the impact of long term climate change. This study found the impact of climate change is influence to worse economy growth in poor countries. Choice Modeling (CM) is used by Chaisemartin & Mahe (2009) to estimate people's awareness to pay for planting the tree on climate mitigation. Roson (2003) used Computable General Equilibrium (CGE) to do an economy analysis on climate change. Cost-Benefit Analysis (CBA), Multi Criteria Analysis (MCA) is used by Brouwer and Van Ek (2004) to control flood. The study showed traditional control is more effective than technical control, such as build the new dam.

2. Methods

2.1. Geographic Information System (GIS)

This study used by Geographic Information System (GIS) to map the vulnarable areas of climate change in two big cities in Central Java Province. GIS is a set of hardware, software, geography and personal data to show the information on geographycal reference. GIS can be used to access potential risk (Connors, 2006). **Wood dan Good (2004) uses GIS to identify earthquake and tsunami on airport and harbour.** Rashed (2003) estimates the social vulnerability on earthquake, Dai (2003) estimates rainfall characteristic to minimize sag risk. Parson, *et.al* (2004), Zenger (2002), dan Cowell and Zeng (2003) use GIS to identify flood risk and mitigation and the model of risk.

2.2. Choice Modeling

Choice modeling (CM) is valuation technique to estimate the value the environment as non market goods. It is a stated preference technique, which estimates the people' s preference for climate mitigation choices. CM requires primary data and uses a survey on people to choose the mitigation choice. The questions, called choice set, present to the respondents for bidding mitigation choices. CM study requires the amount of sample size around 1000 valid responses (Bennet, 2008). Smaller samples are possible where respondents can be expected to answer a big number, more than eight of choice sets in each questionnaire.

Sample of primary data is gathered by random sample (Scheaffer *et.al.*, 1996). The sample size based on Watson formula (1993)

$$n = \frac{4Z_{1/2\alpha}^2 p(1-p)}{(\omega)^2} \quad (1)$$

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