DEVELOPING PIXEL GROWTH MODEL WHICH BASED ON MULTITEMPORAL IMAGERY SATELLITE DATA AND GIS TECHNOLOGY AS BASIC ESTIMATION OF SURABAYA CITY GROWTH

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ABSTRACT

Usually, urban growth become parameter of the succeed planning of a city. On the contrary, the unplanned urban growth will be a problem for a city. Physically, urban growth is a widely as horizontal and vertical. Nowadays, information of urban growth in horizontal is needed for urban land management which is very urgent, it’s in terms of very limited land availability. Most researchs of the urban growth have not given any precissions information. One of them is the result of the urban growth research model in Nanjing City–China (Luo, J., 2006), it does not give the growth direction information and urban growth location and it creates difficulties to give the accurate predictions of the urban growth. Moreover, relying on dynamic pixel characteristic, the research is implemented concerning to pixel growth model which develop from the previous urban growth model. So that, it gives the appropriate pixel growth model with the recent urban characteristic and city growth estimation will be more measured.

Pixel is a dot or smallest unit on satellite image. Each pixel has a value (digital number) which presents something, such as: height data (digital evaluation model format/DEM), land type and land function in a greyscale value. With Landsat Multitemporal satellite imagery data and GIS technology since 1990-2009 (19 years observation) in Surabaya, the classification is implemented towards to the pixel’s amount growth horizontally, and it’s to have the city growth information which become a basic for composing model. 3 (three) regression approaches are used for composing model of pixel growth prediction, which are; All Possible Regression, Stepwise Regression and Geographically Weighted Regression (GWR) in order having direction and the best/appropriate pixel growth model. Furthermore, Co-Kriging approach is used for finding out spreading data from selected variables.

The result from calculation of All Possible Regression approach that’s based on $R^2$ value and $\text{sig} (p \leq 5\%)$ with assumption that VIF<10 or free of multikolinear, it gives the best/appropriate of city growth model for Surabaya City in 2009, which is;

\[ Y = 6.298 - 0.040X_1 + 0.056X_2 + 0.141X_3 + 0.179X_4 - 0.260X_5 - 0.036X_6 - 0.650X_7 - 0.016X_8 + 0.182X_9 + 0.283X_{10} + 0.024X_{11} - 0.401X_{12} + 0.327X_{14} + 0.018X_{15} + 0.642 \]

Some selected variables using Stepwise Regression approach, constantly (1990-2009) show the pixel growth is totally influenced by the distance towards to
a central city (X7). Then, using Co-Kriging approach will have the spreading of the pixel data as a central city (X7) that has 137,717 pixels or 123,945 Km2 width. Based on GWR approach, it shows pixel growth potential in 2009 that’s very forceful for west area (Kec. Karangpilang, Kec. Sambikerep, Kec. Lakarsantri) and east area (Kec. Sukolilo, Kec. Rungkut and Kec. Gunung Anyar).

The potential area of the strongest pixel growth is recommended for the urban land use with the high economic value, it is followed by increasing the land price (Hasyim, A.W., et.al., 2011). The strong growth of the pixel towards the west is prioritised for the purpose of living property for upper class residential, commercials and industrials with the concern of protecting the conservation area. And on the strong growth of the pixel towards the east is prioritised for the purpose of living property for upper class residential, education, commercials and industrials with the concern of protecting the conservation area also. As result above is very potential to give information for making decision of urban land use policy especially in surabaya and this result is a transfer knowledge for other cities in indonesia which has identical characteristics and structures.

Keywords: urban growth estimation, pixel growth model, land use, direction of urban growth, location of urban growth