

GIS-based sustainable city compactness assessment using integration of MCDM, Bayes theorem and RADAR technology

ABSTRACT

In recent decades, compact urban development and smart cities are recognised as most sustainable urban form in an effort to protect natural environment. Therefore, evaluation of existing compactness and sustainability of an area is an essential task before the real development takes place. In the literature, it is possible to see some studies on city's compactness assessment and most of them have considered only a few aspects of compact development analysis. This paper aims to analyse urban sustainability of Kajang city (Malaysia) through a comprehensive city compactness assessment using geographical information system and radar remote sensing technology. To measure building density, a RADAR image of the study area was used to extract built-up areas with the aid of pixel-based and object-based classification schemes. Mixed land use development, urban density and intensity were the main indicators of the analysis. Finally, multicriteria decision-making and Bayes theorems were applied for overall compactness assessment. Building density analysis was validated using standard confusion matrix, which showed more than 90% accuracy. Similarly, the root-mean squared error showed 0.35 for object-based classification. The results classified the zones of the Kajang city in the range of least to most compact zones with the compactness value of 0.002736 to 0.0146, respectively. The results obtained in this study can help local government to improve the compactness of least compact zones to make Kajang city more sustainable. Furthermore, the results revealed that efficient public transportation and proper community facilities are the key factors to achieve sustainable urban development.

Keyword: Sustainable urban development; Compact city assessment; Remote sensing; SAR; GIS; Bayes theorem