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An Objective Measure to Assessing Urban Quality of Life based on Land Use Characteristics

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Abstract

Quality of life (QoL) is a comprehensive concept used to assess a society's standard of living in all aspects of life. This research aims at developing an objective measurement of urban QoL by considering land use aspect at the neighborhood level and applying the geographic information systems (GIS) technology to extract land use characteristics. It proposed two land use indicators, namely compatible land use diversity and site coverage. Statistical analysis was employed to categorize the selected neighborhoods based on these land use indicators. The GIS-based method demonstrated in this study can serve as a simple, direct and objective way to compare urban QoL among different cities and their neighborhoods.

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Keywords: Quality of life; Objective measure; GIS; Land use characteristics

1. Introduction

The terminology of Quality of Life (QoL) was coined at the end of World War II and the concept has progressed alongside rapid urbanization and globalization (Farquhar, 1995). QoL plays an increasing role in boosting the development of the local economy because better QoL can help attract foreign investments and skilled labors

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(CHEN S., 2015). Studies on QoL also offer planners and policymakers valuable insights to inform planning and development directions. The three pillars of QoL comprise social, economic and environmental aspects which can be evaluated by using both subjective and objective measurements. Subjective measures based on personal judgement or evaluation have been the research focus in extant literature (Costanza et al., 2007) although the method could be easily affected by personal biases of the surveyed individuals (Cummins, 2000). It has been argued that objective measures based on quantitative or secondary data are not affected by personal feelings and more suitable for comparative assessment among different entities. This paper assesses QoL from the land use aspect by using compatible land use mix and site coverage as objective indicators.

2. Data and method

2.1. Study Area

The proposed study was conducted in Hong Kong, one of the most densely populated cities in the world. Hong Kong is located in southern China and geographically enclosed by the Pearl River Delta and South China Sea. Although the territory measures around 1,104 km^2 with 7.24 million residents, most of its land is mountainous with 440 km^2 of the total area (or about 40%) reserved for country parks and special areas (Agriculture, Fisheries and Conservation Department of HKSAR, 2013). As the urban morphology of Hong Kong varies a great deal, this study was conducted at the neighborhood level fixed at 800m×800m. The 89 selected neighborhoods cover all key housing estates and various urban morphologies.

2.2. Digital Data

Data on land use and building footprints were needed for the study. Since digital land use maps are not publicly available in Hong Kong, the land use layer was created by combining Outline Zoning map series from the Planning Department and B5000 and B10000 digital map series from the Lands Department. Satellite images were also used to add supplementary information. Data about building footprints were abstracted from the B5000 digital maps of the Lands Department and verified against data from the Census and Statistics Department.

2.3. Method of Analysis

Land use characteristics for each 800m×800m neighborhood were extracted from digital maps by using the ArcGIS geographic information system (GIS) (ESRI, 2015; see also Burrough, 1986). Two indicators representing land use characteristics, namely compatible land use diversity and site coverage, were computed.

Compatible land use diversity is a revised index of land use mix (Duncan et al., 2010). It represents the degree of diversified land use types (viz., commercial, institutional, recreational, residential, and greenery) in which higher diversity is presumed to have positive effects on the personal life. All industrial-related land uses were excluded in the calculation, expressed in equation (1) below.

$$CLUM = -\sum_k (p_k Inp_k) / InN \quad (1)$$

where N is the number of compatible land use types;
k is the type of land use; and
p is the proportion of a specific type of land use within a neighborhood.

Site coverage is a percent measure of land areas occupied by buildings (Chen & Ng, 2011) or the 2-demensional building density. In practical terms, lower site coverage indicates better air ventilation within a neighborhood. Reduced site coverage will open up the sky to ease urban heat island effects (Chen et al., 2012). Site coverage for each land use type was calculated according to equation (2).