Does urban land expansion affect the village's development? A geospatial study of 615 peri-urban villages of Gujarat, India

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Theoretical focus

The social and economic development of rural areas largely depends on the basic infrastructure facilities. Infrastructure can be broadly categorized as social and economic. The social infrastructure is composed of health, education, housing, and other facilities whereas transportation, communication, irrigation, banking, market centers are the components of the economic infrastructure. Development and improvements in these basic infrastructure facilities are vital to enhance the efficacy of the productive process and to increase the productivity of any economic entity (Patra & Acharya, 2011).

Rural infrastructure plays a major role in increasing literacy, economic growth, and empowerment of rural poor. Accessibility to educational institutions, medical facilities, telecommunication, roads, and highways, etc. are major factors to reduce vulnerabilities and increase prosperity. In the process of urbanization, villages are becoming parts of the cities, and are becoming almost irreversibly transformed as a result. Peri-urban villages, now parts of the cities, are on the margins of and urbanizing India. They are lagging behind other parts of the cities in terms of receiving basic urban services and infrastructure (Kumar, 2015).

The peri-urban land-use patterns transforming under the huge demand generated by the big cities. Moreover, the peri-urban areas experience a complex interplay of urban and rural characteristics, it is critical to address the question: Does the land development induced by metro cities transform the peri-urban infrastructure or not? This study attempts to analyses the trends and patterns of key infrastructure facilities in 615 peri-urban villages and to link it with the land consumption rate from 1991 to 2011.

Data and methods

Data: The village infrastructure data has been collected from respective village and town directories of Census of India 1991 and 2011. To estimate land consumption, high-resolution satellite data (Landsat TM5) from NASA has been used.

Study area: To conduct the spatial analysis, the first step of this research was to make a digitized shapefile of the 615 villages. Considering Ahmedabad city as a center, a total of 615 villages surrounding the city are selected for the study. The base maps from Census Administrative Atlas, 2011 of various subdistricts were geo-referenced and village boundaries were digitized in ArcMap 10.2. These villages were grouped into three proximity zones (i. < 26 km, ii. 26-35 km, and iii. > 35 km) according to their distance from the city. The study area map is presented in Figure 1.

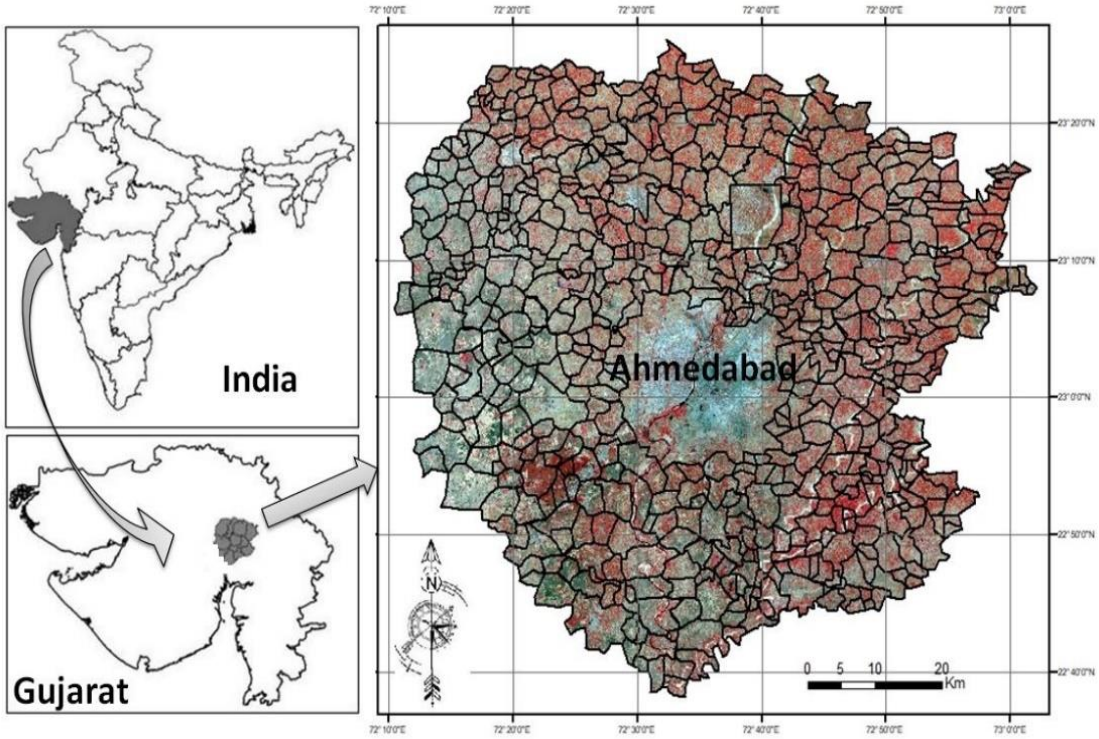

Figure 1 Location map of study region showing selected peri-urban villages around Ahmedabad city

Infrastructure Facility Score: A composite score 'Infrastructure Facility Score (IFS)' for availability (yes = 1 and no = 0) of infrastructure facilities is calculated by adding the available facilities and converting the score into percentage values. The selected infrastructure facilities are High school, Primary Health Centre, Maternal and Child Welfare Centre, Tap water, Post Office, Public Bus Service, All-Weather Road, ATM, Commercial Bank, and Power Supply for Domestic Use. Considering the nature of the data, the IFS is divided into five categories: (a) lowest (< 20), (b) low (20-40), (c) moderate (40-60), (d) good (60-80), and (e) better (> 80). The IFS is analyzed at the village, proximity zone, and regional levels.

Land Consumption Rate: To calculate land consumption rate, village-level built-up land extent for 1991 and 2011 is derived with the use of geospatial techniques. The land consumption rate is estimated as

$$Land\ Consumption\ Rate\ (LCR)\ = \frac{LN\left(\frac{Built\ (t+n)}{Built\ (t)}\right)}{Y}$$

Where, Built (t) is the extent of built-up land in the village in 1991 in km^2, Built (t+n) is the extent of built-up land in the village in 2011 in km^2, and Y is the number of years between the two measurement periods (20 years).

To understand the association between land consumption and village development some other important village-level variables such as population growth, density, distance from the main city, main towns, and major road network are also being considered in the analysis. The study will incorporate Geographically Weighted Regression, Spatial autocorrelation, Correlation matrix, and other techniques with ArcGIS, R, and Stata.

Findings

Figure 2 presents the spatial patterns of Infrastructure Facility Score (IFS) in the studied region for 1991 and 2011. It is observable that there are noticeable changes in the IFS of the villages over the considered time (Figure 3). In 1991, 4 percent of villages had the lowest IFS. Around 96 percent of villages were equally divided under the low, moderate, and good IFS categories. Moreover, not a single village had better IFS. In 2011, a maximum number of villages 438 (71 percent) were under the low IFS category.

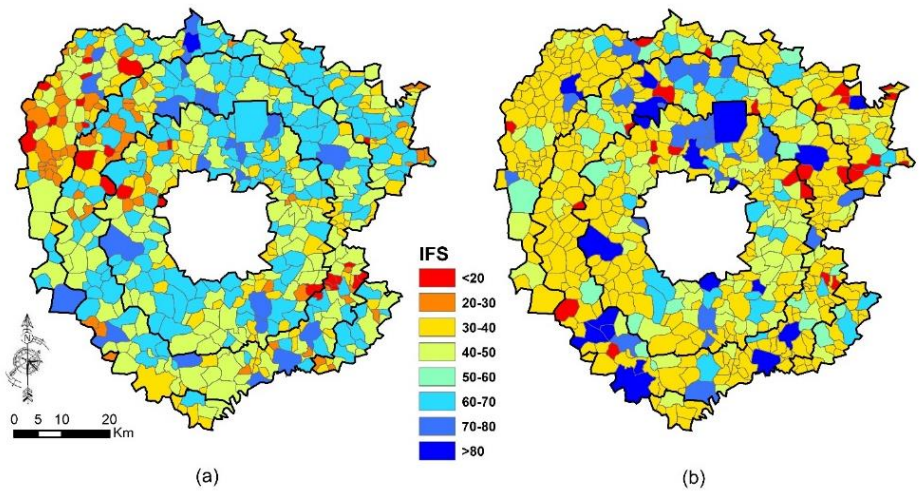

Figure 2 Spatial Patterns of Infrastructure Facility Score (IFS) in the studied region

Figure 3 Distribution of villages under five IFS categories

Figure 4 demonstrates the extent of built-up land during 1991 (with red color) and its expansion in 2011 (with blue color). It is evident that the study region has experienced significant new development in built-up land over twenty years.

The results indicate that there has been huge land development that took place in the studied region but the status of infrastructure facilities has not improved up to the mark. Surprisingly, more than half of the villages have witnessed a negative change in infrastructure. The villages which are away from the city, major towns and major road networks are identified as the most deprived and they need immediate policy attention.

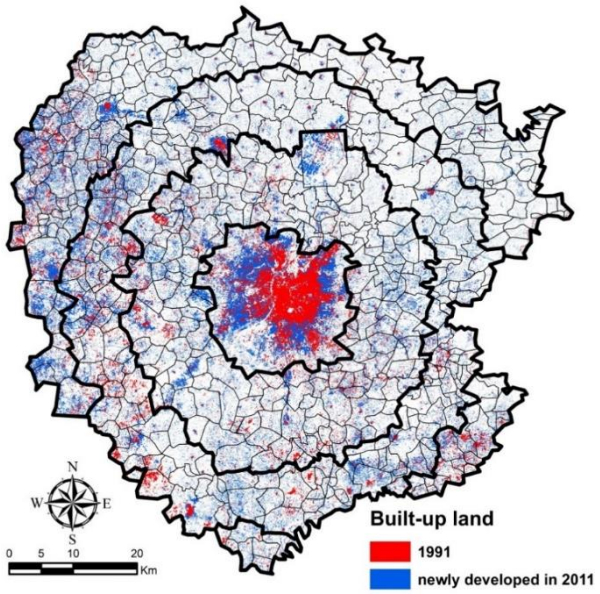

Figure 4 Spatial extent of built-up land in 1991 and newly developed built-up land in 2011

Note: Results of Geographically weighted regression, spatial autocorrelation, and correlation matrix are not presented here.

References:

Kumar, M. (2015). Erstwhile villages in urban India. Development in Practice, 25(1), 124-132.

Patra, A. K., & Acharya, A. (2011). Regional disparity, infrastructure development and economic growth: An inter-state analysis. Research and Practice in Social Sciences, 6(2), 17-30