



## Abstract

# Measuring Urban Vitality and Typology of Urban Space Using Big Data

Urban researchers have sought to simplify and generalize the complex urban space and the everyday life of citizens. The concept of urban vitality and typology of urban space have been used to provide a bird-eye view of the complex urban structure. In particular, urban big data allowed researchers to revolutionize the process of selecting and developing indices that reflect the changing characteristics of citizen life. If the indices can catch them immediately and effectively, they can be used for a decision-making process to counter the new urban crises including COVID-19.

The concept of urban vitality has been used by urban researchers to evaluate the quality of life in cities and the best place to live. However, the concept has been also criticized as a fuzzy concept with a lack of clarity to identify and operationalize. To overcome the issue, this study conceptualized urban vitality in two dimensions, social and economic ones. The social vitality means the urban buzz made by pedestrian traffic passing through urban space and the economic vitality is aroused by economic activities such as consumption, transaction, and investment. Building on the conceptual framework, this study adopted datasets including residential population and pedestrian traffic data for the social vitality and employment and bank card transaction data for the economic vitality.

The empirical research shows that residence and activity on the social side are spatially divided while production and consumption on the economic dimension are spatially mixed. Residential population and pedestrian traffic are polarized in the same region mainly because the residential area in the city center is hollowed out. However, many employees contribute to the consumption level in the city center.

It is also notified that small data represent the stationary existence of urban vitality source while big data speak for the dynamics of that. A typology of urban space was made according to the comparison between small and big data. Type I (central business district) is the urban space to which citizens should go for their work, so COVID-19 would not bring an immediate decrease in urban vitality. Type II (shopping) is not a must-go region because visiting the region can be substituted by online and neighborhood shopping. It is a reason why urban vitality in Type II could sharply decrease due to COVID-19. In contrast, Type III (residential area) could be more vital as citizens are reluctant to travel to city centers. Type IV (education and administration), where the static indices are higher than the dynamic ones, would not be much affected in terms of urban vitality.

In sum, the new conceptual framework of urban vitality and its measurable indices are suggested in this study. It also took advantage of the complementary relationship between small and big data by combining them. When it comes to policy recommendations, it is suggested that urban vitality can be a policy target to counter a regional decline within a constraint of the diminishing residential population. In the future, policymakers need to seek more alternatives to the residential population as a reference to urban infrastructure and service.

**Keyword** urban vitality, urban typology, big data, geodemographics