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Urban Perforation and Regeneration in Japan: The relationship between Urbanization Characteristics, Network Centrality and Population Distribution

Joan Perez¹, Yukio Sadahiro², Giovanni Fusco¹

¹University of Cote d'Azur, UMR 7300 Espace-CNRS, France / ²The University of Tokyo, Japan

Japan experienced spectacular urbanization and population growths over the course of the last hundred years. With a population of 57,963 million of inhabitants in 1920, its count more than doubled when the population reached its highest level in 2010 with 128,057 million of inhabitants. These trends have been accompanied by a massive urbanization dynamic, massive to such extent that with an urbanization rate now reaching 93.0% (UN, 2014), the distinction between urban and rural spaces is becoming pointless. The Japanese system of cities is mostly made of a rather limited number of overlapping megapolises characterized by a hyper-dense population distribution. Japan is meanwhile also referred to as a post-growth society, being ahead of other developed countries in some sociodemographic and economic trajectories. Increased longevity combined with a very low fertility rate show that the population is expected to shrink by one-third by 2060, with a remaining count composed of a proportion of population aged 65 (or older) of at least 40% (IPSS, 2012). The interesting phenomenon is that the Japanese society is expected to keep urbanizing despite the population decrease (97.7% urban by 2050; UN, 2014). It thus presents new challenges, never seen before on such a large scale, regarding the spatial distribution and evolution of intra-urban population densities that are already in place. Dedensification leads to urban perforation, a process characterized by the concentration within metropolitan areas of vacant plots and buildings, store closures, etc. Conversely, perforations are accompanied by a density increase in others locations. Anticipating and planning a sustainable shrinkage, a successful regeneration and/or maintaining an equilibrium in some spaces has become a priority for the government.

Researchers are increasingly trying to understand the spatial logic behind these perforations and regenerations (Fujii, 2008; Sorensen, 2019). Yet, in the absence of strong theories on the spatial dimension of metropolitan shrinkage, we decided to go for an inductive search of relation using a dataset made of indicators related to three categories: urbanization characteristics, network centrality and population distribution. Urbanization characteristics concern mainly the form of the urban fabrics (Araldi and Fusco, 2017), which includes indicators like the average and variability of setbacks, height, convexity and elongation of buildings, etc. while centrality indicators (Porta et al., 2010) are related to network connectivity characteristics such as the number of destinations reachable in a given radius. Finally, for population distribution, the 2005 and 2015 official censuses have been used. The scales of the calculated and gathered indicators are categories related i.e. a 250-meter grid for the censuses, the building level for centralities and the street proximity bands for urban characteristics.

The case study for this research is the metropolitan region of Osaka, which stabilized (2010-2015 population growth rate of -0.01%). As compared to Greater Tokyo (which is still slowly growing), a stabilization means an enhanced logic of hot- and cold-spots of metropolitan life, hence the selection of this case study. More specifically, a hyper-urbanized sub-space of 2,500 km² including Osaka and Kobe and accounting for around 10 million inhabitants has been selected. All indicators have subsequently been gathered to a homogeneous scale following a tessellation-based assignment to links (Okabe and Sugihara, 2012). The assignment has been made using a Voronoi diagram based on the road network (excluding highways). Gathering the data to a homogeneous scale ultimately allowed running several models in order to analyze the relationships among these categories. Geographically Weighted Regression (GWR) provide for example insights into the local



relationships between population dynamic and some of the variables belonging to this study. New hypotheses regarding the link between the locations of hot- and cold-spots and their inner features (morphological, demographic and configurational) will be presented. Understanding this link can help anticipating, tackling and/or planning urban perforation and regeneration in the long run.

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KEYWORDS

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