



News & Views

Urbanization: positive and negative effects

Chaolin Gu

School of Architecture, Tsinghua University, Beijing 100086, China

Urbanization is a sign of modernization, and both developed and developing countries attach great importance to this issue. It is also a process in which the population continues to flow in urban areas, the non-agricultural industries (manufacturing and service industries) concentrate and develop, and the structure of human society gradually transforms. Urbanization drives economic development, changes the urban form, and influences production technologies, citizen lifestyles, and societal values. However, urbanization can have negative impacts on social equity, public health, and the natural environment. Leveraging the positive effects of urbanization while mitigating the negative effects is necessary for sustaining urban progress and improving human settlements. Otherwise, the “urban disease” and regional inequalities caused by urbanization will become increasingly severe, especially in rapidly urbanizing countries.

- (1) Natural and geographical effects. Excessive exploitation of natural resources, particularly of land, has had a significant impact on the natural environment. Urbanization has changed natural geographies in the following ways: Alteration of topography and geomorphology has flattened the landscapes of built-up areas. Special topographic and geomorphic conditions have transformed local urban climate areas, resulting in heat islands and turbid islands. Urban spatial expansion has destroyed original river systems. The disruption of natural hydrological systems has, in some instances, led to urban flood disasters. Finally, urban construction waste has degraded urban land quality and reduced biodiversity. These natural and geographical effects of urbanization, if not effectively mitigated, will affect the survival and the development of human beings.
- (2) Urban agglomeration effects. The clustering of economic activities in urban areas promotes agglomeration economies. Spatial proximity in urban areas allows three benefits of agglomeration economies, identified by Marshall [1]. Firstly, urbanization allows access to a large labor pool from which employers can easily find employees with suitable skills and expertise. Similarly, employees are drawn to urban areas where abundant matching jobs are available. Secondly, urbanization allows information exchange. Even in the information technology era, face-to-face meetings are still the

most efficient means of communication, particularly for nuanced information. Urban areas allow opportunities for the informal and formal exchange of information and knowledge. Thirdly, urbanization allows input sharing, particularly as economic activities have become increasingly specialized and complex. Many firms need access to upstream and downstream suppliers and customers. The productivity of urban areas stems from agglomeration economies, which are the benefits firms and businesses derive from locating near to their customers and suppliers in order to reduce transport and communication costs. Therefore, large cities tend to represent diversified and intensive agglomeration economies. Research finds that large cities spur the creation of new, high-growth firms.

- (3) Shaping urban spatial structure. Urbanization naturally changes urban spatial structure, and the changes can be described at two spatial levels. One is the spatial and functional structure of the metropolitan area/city, and the other one is the structure of mega-regions. Spatial structure is shaped by two forces. The first is the above-mentioned power of agglomeration economies, and the second is the cost of negative urban economic externalities or agglomeration diseconomies. Examples of the latter include traffic congestion, air pollution, deteriorating natural environments, and high labor and land costs. The spatial form of cities or metropolitan areas is an outcome of the continuous interplay of these countervailing forces. Within a city or metropolitan area, when agglomeration diseconomies dominate, population and economic activities shift outward from the central city. This is typically termed suburbanization. Los Angeles is a well-known example of this type of urbanization. Eventually, population and economic activities may begin to cluster again to take advantage of agglomeration economics. The occurrence of “re-urbanization” and the gentrification of inner-city neighborhoods have partially reversed the trend of suburbanization. Large and small cities and metropolitan areas can expand due to continuous suburbanization and sometimes merge together to form urban corridors and mega-regions. These new configurations are spatially and functionally connected when agglomeration economies dominate. They can break apart when negative

E-mail address: gucl@tsinghua.edu.cn

externalities overcome agglomeration economies. Such changes are evident in many shrinking city regions, such as those of the Great Lakes region of the U.S.

- (4) Urban land appreciation effects. Living in cities offers spatial advantages associated with proximity and accessibility. As a result, land values continue to rise as the urbanization process continues, and rising land values drive increases in other costs in cities, including those of housing, labor, medical, and education. In China, urban built-up areas increased from 12,856 km² in 1990 to 52,102 km² in 2015, with a 6.8 percent annual increase. This has also contributed to a surge in soaring house prices. In the late 1990s, prime real estate in Shanghai's Pudong New Area sold for RMB 1,000–2,000 per square meter. Its price rose to RMB 13,000 in 2007 and RMB 33,023 in 2016. Of course, increasing land prices created expectations of continuously soaring housing prices among developers and consumers. The average housing price in Suzhou, a city near Shanghai, was only about RMB 500 per square meter in 2001, but by 2016 it had increased to more than RMB 15,300. Similarly, the rental price of housing also increased. In the first quarter of 2016, the average rental price of a housing unit rose to RMB 6,000 per month, more than 100 percent higher than that in 2008 [2].
- (5) Social and cultural effects as well as urban disease and problems. Urbanization is also a cultural transformation process, whereby village predominant culture has been replaced by urban predominant culture. Village culture refers to common bloodlines, intimate relationships, and communal behavior, but urban culture is characterized by distant bloodlines, unfamiliar relationships, and competitive behavior. Today, the world is facing the prospect of cities mushrooming to unthinkable sizes. Numerous problems are observed as a result of rapidly growing cities. These problems include depressed rural areas, urban traffic congestion, housing shortages, inadequate water supply, energy shortages, environmental pollution, social disorder, imbalance between input and output in material and energy flows, and growing mismatches between supply and demand for production and living in urban areas. These kinds of unbalanced urban developments result in huge wastes of resources, a declining life quality, and rising living costs, and eventually hinder sustainable urban development. In addition, some other social problems, such as income inequality, unemployment, homelessness and insufficient police expenditure, may result in increased urban crime. Urbanization has also changed the adaptability of the biological environment, including that of bacteria, animals and other forms of life [3].
- (6) Environment and public health issues. Although rapid urbanization significantly improves living standards, lifestyles, and social behavior, which can enhance public health by improving public hygiene and sanitation, urbanization can also negatively affect public health. Increased dietary consumption of fat, sugar, and salt by urbanites results in a greater risk of obesity, diabetes, and other chronic diseases. Residents in cities may also be prone to unhealthy lifestyles, particularly due to the mental stress resulting from urban life and the lack of physical activities. These public health issues may combine to increase mortality rates. As a result, urbanization does not necessarily translate into a significant increase in life expectancy. Gong et al. [4] found that industrialization, particularly in economies dominated by heavy industry, can result in environmental pollution and worse public health outcomes (e.g., rising cancer risks). Haynes' research [5] on cancer incidence and urbanization at the provincial scale in China reveals that various types of can-

cers were strongly correlated with the urbanization rate. Exposure to elevated levels of ambient air pollutants, such as nitrogen dioxide (NO₂), carbon monoxide (CO), and particulate matters with a diameter of less than 2.5 μm (PM_{2.5}), can cause DNA methylation of CpG sites in immune cells, increasing the risks of cough, asthma, and lung cancer. Liu et al. [6] also show that the impacts of non-communicable diseases continue to grow during the urbanization process in China.

- (7) Climate change and urban heat island (UHI). Rapid urbanization processes contribute to climate change by altering the carbon cycle and other bio-geo-chemical processes [7]. Large urban populations and economies produce significant carbon emissions from transportation, household, and industrial activities. Urban areas are considered to be the source of 80 percent of CO₂ emissions from global final energy use [8,9]. One outcome of rapid urbanization in China, where the urbanization level rose from 30.9 percent to 47.0 percent between 1999 and 2008, is that China became the largest CO₂ emitter in the world during the same period [10]. Land-use changes due to urbanization create UHI effects. In southeast China, the average surface temperature rose 0.05 °C per decade [11]. The increase was much larger than those recorded in other periods and locations [12].
- (8) Urban geological disasters and ecological damage. Rapid urban development causes long-term over-extraction of groundwater and a continuous decrease of groundwater levels. A direct consequence of ground subsidence is an increasing difficulty in flood preventions. Ground subsidence may also cause other problems, such as sea water intrusion, building damage, fracturing of underground pipes, lower bridge clearances, and cracking of roads. Shanghai has spent an extra 290 billion yuan over 40 years on tides, floods and city safety [13]. In addition, over-extraction of groundwater also causes land degradation, loss of biodiversity, and serious ecological damage, which may threaten human survival and sustainable development [14].

It is very clear that urbanization has changed natural and geographical as well as human social states, and exerts positive and negative effects. The positive effects are mainly derived from economic benefits such as urban agglomeration effects and the urban land appreciation effect. The negative effects are basically environmental and ecological ones such as environment and public health issues, climate change and urban heat island (UHI), and urban geological disasters and ecological damage. Regarding social benefits there are both positive and negative effects, such as a constantly evolving urban spatial structure that can result in urban disease and urban problems. For these reasons, when governments launch urbanization policies, they need to balance the economic, social and environmental benefits arising from urbanization and formulate health-oriented and sustainable plans for urbanization.

Conflict of interest

The author declares that he has no conflict of interest.

Acknowledgments

This work was supported by the Key Project of National Natural Science Foundation of China (41590844) and the Tsinghua University Initiative Scientific Research Program (2015THZ01).

References

- [1] Marshall A. *Principles of economics*. London: mMacmillan and Co; 1890.

- [2] Gu CL, Hu LQ, Cook Ian G. China's urbanization in 1949–2015: processes and driving forces. *Chin Geogr Sci* 2017;27:847–59.
- [3] Yu C, Xiao Y, Ni S. Changing patterns of urban–rural nutrient flows in China: driving forces and options. *Sci Bull* 2017;62:83–91.
- [4] Gong P, Liang S, Carlton EJ, et al. Urbanisation and health in China. *Lancet* 2012;379:843–52.
- [5] Haynes R. Cancer mortality and urbanization in China. *Int J Epidemiol* 1986;15:268–71.
- [6] Liu M, Liu X, Huang Y, et al. Epidemic transition of environmental health risk during China's urbanization. *Sci Bull* 2017;62:92–8.
- [7] Lankao PR. Are we missing the point? Particularities of urbanization, sustainability and carbon emissions in Latin American cities. *Environ Urban* 2007;19:159–75.
- [8] Dhakal S. Urban energy use and carbon emissions from cities in China and policy implications. *Energy Policy* 2009;37:4208–19.
- [9] Seto KC, Dhakal S, Bigio A, et al. Human settlements, infrastructure and spatial planning. In: *climate change 2014: mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press; 2014.
- [10] International Energy Agency CO₂ emission from fuel combustion; 2009 http://www.oecd-ilibrary.org/energy/data/iea-co2-emissions-from-fuel-combustion-statistics_co2-data-en. accessed February 3rd 2010.
- [11] Zhou L, Dickinson RE, Tian Y, et al. Evidence for a significant urbanization effect on climate in China. *Proc Natl Acad Sci USA* 2004;101:9540–4.
- [12] Li W, Jiang Z, Zhang X, et al. Additional risk in extreme precipitation in China from 1.5 °C to 2.0 °C global warming levels. *Sci Bull* 2018;63:228–34.
- [13] Gu C, Hu LQ, Zhang XM, et al. Climate change and urbanization in the Yangtze river delta. *Habitat Int* 2011;35:544–52.
- [14] Fang CL, Ren YF. Analysis of emergy-based metabolic efficiency and environmental pressure on the local coupling and telecoupling between urbanization and the eco-environment in the Beijing-Tianjin-Hebei urban agglomeration. *Sci China Earth Sci* 2017;60:1083–97.



Chaolin Gu is the professor of School of Architecture at Tsinghua University and the vice president of the Chinese Futurology Association, Councilman of China Society for Urban Sciences. He is mainly engaged in research work on urban and regional planning, regional economics, urban geography in China.