How to Integrate Urban Health into Planning Urban Public Amenities in Innovation Districts: Case Study of Optical Valley, Wuhan, China

Wenjing Luo
Han Zou
Bei Yu

Figure 1. Optical Valley. © China Daily, 2019

How does Urban Health Relate to Urban Public Amenities in Innovation Districts?

—

The features of innovation districts

Innovation districts, by their definition, are 'geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators' (Katz & Wagner, 2014). The key distinguishing feature of innovation districts are that they constitute the ultimate mash-up of entrepreneurs, researchers, college teachers, and students, who can all be called knowledge workers or creative classes (Arup & UK Innovation Districts Group, 2018). Usually, at the age of between 25 and 45, knowledge workers in innovation districts suffer from pressures of high-intensity knowledge-related work. Thus, they tend to enjoy the high accessibility and highly mixed functions of urban public amenities which can save time in satisfying their various living needs and provide accessible spaces for timely communication (Cai, 2007; Dalvai, 2016; Wang et al., 2016b). Due to the uncertainties and complexity inherent to the process of innovation, another feature of innovation districts is that their development stages are slow to change compared to other districts (Yin, 2018). Thus, the provision of urban public amenities for innovation districts should not only satisfy the various needs of knowledge workers but also match with the development stages of innovation districts (Huang et al., 2012).

Innovation districts have been divided into three models including the 'anchor model', 're-imagined urban areas' and 'urbanised science park' (Katz & Wagner, 2014). As distinct from the 'anchor model' and 're-imagined urban areas', which can share urban amenities with the surrounding urbanised areas, the 'urbanised science park', which is usually located in suburban areas without sophisticated facilities to share with, would require establishing a whole system of urban public amenities on its own. Optical Valley, a typical urbanised science park located on the outskirts of Wuhan, builds up the whole system of urban public amenities, which could be used as an example to illustrate the topic.

Integration between health and urban public amenities in innovation districts

Although health as a concept should affect entire urban population, healthy city projects, which many cities have launched recently, mostly target the elderly and children. Knowledge workers, usually aged between 25 and 45, are easy to be neglected as they are assumed to be inherently healthier than the elderly and children. However, as a special group of young people, knowledge workers tend to have sub-optimal health problems more often due to their living habits and working pressures. Meanwhile, innovation districts which usually play the role of nodes of information flows, capital flows, and human flows in regional networks are susceptible to urban crises due to their frequent exchanges with other districts or cities. Thus, epidemic crises should be paid special attention to in the urban development of innovation districts.

Based on the above-mentioned points, two questions can be raised with regard to integrating urban heath into planning urban public amenities in innovation districts:

1. How can we prepare innovation districts for appropriate access to services and living needs of knowledge workers, to promote healthier living?

2. How can we use all the capabilities and abilities of innovation districts to prevent and prepare for epidemic crises?

To the first question, healthier living can be achieved by encouraging knowledge workers to be more physically active (Wang & Zhou, 2019). Studies show complicated systems are at play in the interaction between physical activities and physical environments, where the accessibility of urban amenities exerts a direct influence on health by determining active transit (Lu & Tan, 2015; Wang et al., 2018a; Wang et al., 2018b; Wang et al., 2016a; Tang et al., 2014; Zhang et al., 2017). When urban public amenities are at an accessible distance to homes or workplaces, knowledge workers will be more likely to access the facilities by means of active transit, such as walking and biking, which could promote greater physical activity.

As for the second question, to prevent and prepare for epidemic crises, strategies can be made in planning urban public amenities, including isolating sources of infection, cutting off transmission routes, and protecting contagious individuals (Wang et al., 2020). To isolate the sources of infection, community centres can be used to provide spaces for epidemic prevention. During epidemic outbreaks, sports centres and exhibition centres could also be transformed into isolation spaces for patients. Then, to cut off transmission routes, community centres should be provided with various facilities to lessen the range of activities to decrease the risk of transmission. Last but not the least, contagious individuals can be protected by improving the accessibility of medical facilities.

The Planning of Urban Public Amenities in Innovation Districts towards the Goal of Urban Health

—

Based on the features of innovation districts, with a view to achieving the goal of integrating urban health into urban amenity planning, the Optical Valley case study proposes strategies to deal with dilemmas in the four aspects of planning indexes, planning systems, spatial layouts, and planning implementation.

Adjusting the planning indexes of urban public amenities to the social structure of innovation districts

The planning indexes of urban amenities usually focus on residents, and, as such, apply to residential districts rather than innovation districts. It is thus necessary to develop planning indexes of urban public amenities in innovation districts to meet the requirements of both knowledge workers and residents based on the social structures of innovation districts.

Age distribution is the main factor affecting the development of planning strategies for urban public amenities. On the one hand, it is necessary to define the key focus of urban amenity supply according to the age distribution of knowledge workers and residents in innovation districts. Taking Optical Valley as an example, the elderly, middle-aged, and junior groups account for 10, 75, and 15 percent of the population, respectively. Although age distribution continues to fluctuate, there is increasing demand from the young and middle-aged group for high-quality urban public amenities with mixed functions, especially highly accessible cultural and sports facilities. Thus, the goal of planning urban public amenities at the current stage of development of Optical Valley should be focused on meeting the diverse requirements of young and middle-aged groups as well as other social groups.

Figure 2. Optical Valley Marathon, 2019. © Hubei Daily, 2019

On the other hand, a system of urban public amenities is suggested to be established according to the behavioural patterns of knowledge workers in innovation districts. The findings of the Optical Valley questionnaire suggest that knowledge workers and residents have different requirements for urban public amenities, especially in terms of the type of facilities, spatial preferences, and frequencies of use. Accordingly, the planning indexes of urban public amenities in Optical Valley are proposed to be adjusted, also in consideration of the age distribution. To meet the growing demands for sports activities, it is suggested to improve the planning standards of sports amenities beyond the baseline of national and municipal standards by applying the coefficient of 1.3 derived from the questionnaire to promote healthier living (Figure 2).

Considering that only residents are often considered when calculating the scales of urban public amenities, facilities tailored to knowledge workers, namely industrial service centres, should be established, which could be divided into industrial cluster levels and industrial park levels. While industrial cluster level centres are suggested to be established for every 50,000 knowledge workers with functions of culture, gyms, leisure, communication, and industry services, industrial park level centres are proposed to be set up for every 20,000 knowledge workers mixed with culture and sports facilities at a smaller scale (Figure 3).

Establishing the system of urban amenities to match the development stages of innovation districts

Innovation districts at different stages tend to be equipped with different systems of urban public amenities and present distinct spatial structures (Huang et al., 2012). Taking innovation districts undergoing urban expansion as an example, the spatial structure of urban public amenities usually ranges from the simplex model in centred layouts to the complex model in networks. At their early stages, innovation districts usually take the form of newly developed industrial parks,

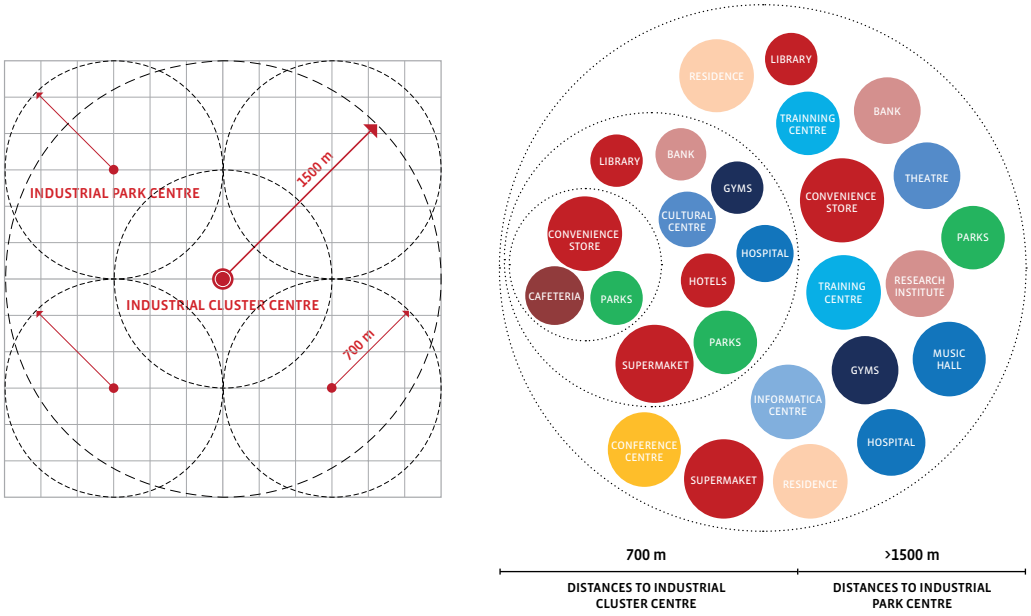


Figure 3. Models of industrial service centres tailored specifically to knowledge workers. Source: Authors

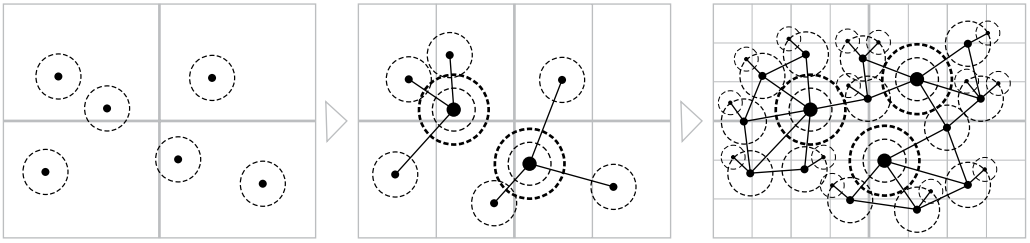


Figure 4. Evolution of spatial structures of urban public amenities. Source: Authors

and urban public amenities are usually distributed at random. With the development of innovation districts, new urban public amenities are often located in areas surrounding planned urban centres and have agglomeration effects. Once an innovation district has grown into the stage of urban centre, with the transition from industrial park to new town, more urban centres will emerge surrounded by larger numbers of urban amenities, which will then help establish a system of urban amenities in network patterns (Figure 4).

Therefore, a flexible system of urban public amenities, which could be divided into three phases corresponding to early, middle, and late periods, is suggested to be established to dynamically match the development stages of innovation districts. As Optical Valley is undergoing a transition from industrial park to new town, the current spatial structures of urban amenities in centred layouts fail to meet requirement stemming from the current population and development stage, which demand high-quality, high-level amenities and high-accessibility, low-level amenities. Thus, a system of urban amenities is suggested to be established including centred high-level amenities and scattered low-level amenities together in networks to match the development phase of Optical Valley.

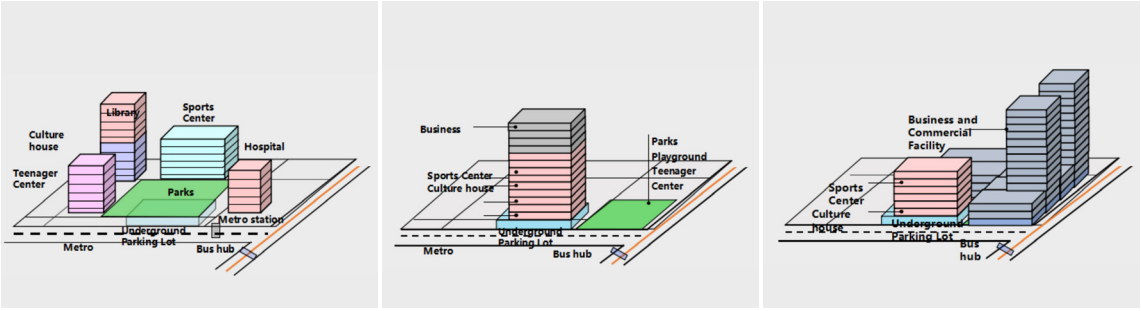
Figure 5. Community centres in Optical Valley. © Administrative Committee of Wuhan East Lake High-tech Development Zone, 2022

Given the experience of other cities, municipal and district-level amenities could be considered high-level, while community amenities and industrial service centres could be defined as low-level. On the one hand, the quality of high-level amenities should be improved, and these ought to have particular distinguishing features. In Optical Valley, high-level amenities are suggested to provide comprehensive services, especially for technology and industrial developments, based on the development stage of the area. On the other hand, the accessibility of low-level amenities should be strengthened to establish a network of community centres reflecting the behaviour patterns of both residents and knowledge workers. Based on an analysis of the relationship between current living, working, and leisure activities in Optical Valley, community centres located within 15-minute walking distances from homes and workplaces are suggested to be established (Figure 5).

Developing co-location spatial layout models for different types of urban public amenities

The uneven distribution problems of current urban public amenities, which seemingly result from an imbalance between people, land, and buildings, are actually due to a mismatch between the spatial pattern and land use resources. Given the experiences of other innovation districts, a centralised layout of urban public amenities, which are usually located alongside commercial services and parks, has been identified as a reasonable model, especially for megacities. However, if adjusted to local conditions, the model can be used as a key for dealing with problems of uneven distribution.

Based on the current urban planning regulation of Wuhan, three spatial layout models of co-location have been explored for urban public amenities. First, urban public amenities of different types but at the same levels are suggested to be co-located on the same parcels or inside the same buildings, given limited land resources and high densities. The second model applies to district-level amenities, which are suggested to be located on the same parcels in a situation of abundant land resources and low densities. Quite differently from the previous two models, the third model attempts to locate urban public amenities in areas zoned for commercial facilities, which mainly applies to community amenities, especially in newly built areas (Figure 6).



Co-locating the urban amenities in the same plots	Co-locating the urban amenities in the same buildings	Co-locating the urban amenities with commercial facilities
The urban amenities in district-levels	The urban amenities of different types but in the same levels	The urban amenities in the lands planed as commercial facilities
under the conditions of abundant land resources and low densities	under the conditions of limited land resources and high densities	community amenities especially in newly-built areas

Figure 6. Co-location spatial layout models for different types of urban amenities. Source: Authors

TEMPORAL FACILITIES **ESPECIALLY FOR** EPIDEMICS	**High-level medical amenities** are suggested to save spaces for public health events, which should be embodied in the whole process of design and construction.	TEMPORAL FACILITIES **REUSED FOR** EPIDEMICS	**High-level sports and cultural facilities** with the benefit of open structures and large spaces are suggested to be reused as temporal hospitals for epidemic crisis.

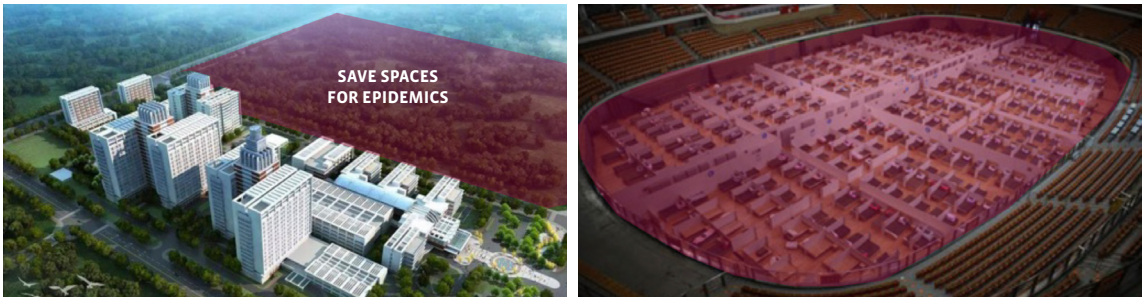


Figure 7. Multiple uses of urban public amenities. Source: Authors

Analyses of co-location layout models have resulted in the development of strategies for different types and levels of urban public amenities, considering the land use resources in the various areas of Optical Valley. Areas with limited land resources can be defined as high-intensity zones, where all community-level amenities are suggested to be co-located in the same buildings. By contrast, areas with sufficient land resources in Optical Valley can be defined as low-intensity zones, where district-level and newly built community-level amenities are suggested to be co-located on the same parcels. The rest can be defined as medium-intensity zones, where only community-level amenities are suggested to be co-located on the same parcels. Application of those co-location strategies has improved the overall indexes of urban public amenities in Optical Valley have been improved to a level beyond national standards. In addition to this, to prevent and prepare for an epidemic crisis, high-level amenities should be equipped with multiple functions. For example, medical amenities should contain spaces for public health events, while sports and cultural facilities, which benefit from open structures and large spaces, are suggested to be reused as temporary hospitals for epidemic crises (Figure 7).

Establishing a mechanism to implement urban public amenities

The failure of implementation of urban public amenities in innovation districts is actually due to disagreement between the development, evaluation, administration, and implementation of planning, which fails to account for the uncertainty of development. Thus, a dynamic system covering the entire process of the development, evaluation, administration, and implementation of planning is suggested to be established especially for urban amenities.

On one hand, in the process of making planning regulations, specialised separate strategies have been introduced, including strict regulations on high-level, high-demand amenities and flexible guidance for low-level, low-demand ones. For example, high-level amenities in newly built areas are suggested to be represented in bold lines while low-level amenities in built-up areas are suggested to be regulated by indexes of building scales. On the other hand, the flexibility of planning regulations is suggested to be improved to meet the various and unpredictable requirements of building construction. Co-located urban amenities are suggested to be regulated in dashed lines as a whole, which could facilitate the adjustment of boundaries and location of each urban amenity according to the planning schemes (Figure 8).

Then, in the process of planning administration and evaluation, an intelligent evaluation and early warning system is suggested to be established as part of the planning information and management platform to assess current urban public amenities. The result of this effort can then be fed back into the process of planning development, regulation and implementation. For example, the Wuhan Planning Lab, intended as an intelligent planning information and management platform, has developed additional functions allowing it to evaluate the current population and urban public amenities online. This could help establish a 'traffic light' early warning system, where the 'red', 'yellow', and 'green' signals mean, respectively, failing to meet, coming close to, and reaching planning standards (Figure 9). Based on the result of the evaluation, strategies can be developed to examine and approve plans for newly built residential districts. Online evaluation can also be applied to the planning approval process, which is to set up the various thresholds of requirements for urban public amenities in residential developments based on evaluations of current situations and plans. Finally, an annual list of urban public amenities scheduled for construction could also be made based on the evaluations to improve implementation rates of urban public amenities.

Conclusions

—

An increasingly topical subject, urban health bears a complex relationship to urban planning, where the provision of urban public amenities not only directly determines the health of populations, but can also improve a city's resilience, in particular to epidemic crises. Innovation districts are an emerging global urban model and have been considered a major economic boon. Both the attractiveness and the resilience of innovation districts can be increased by improving the quality of their urban public amenities.

Hence, the integration of urban health into the planning of urban public amenities for innovation districts has proven to be an important issue for discussion, which appears to be lacking both in planning research and practice. Innovation districts differ from other areas both in terms of their population, which mainly consists of knowledge workers, and their development stages, which are subject

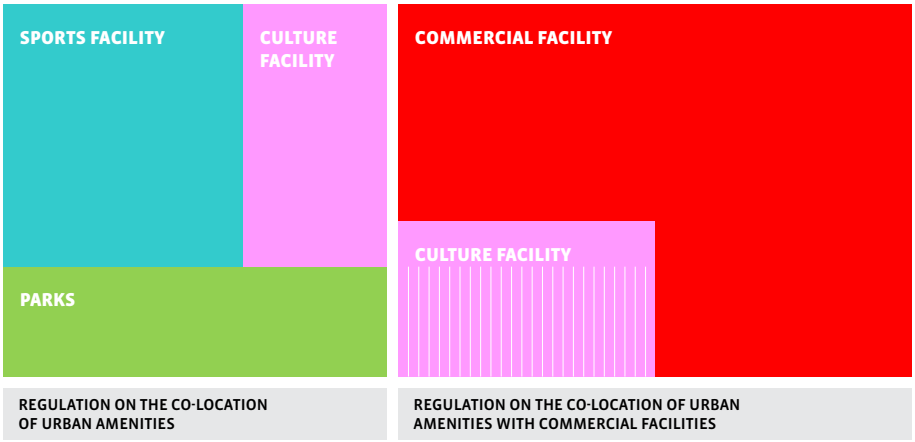


Figure 8. Regulation governing the co-location of different types of urban public amenities. Source: Authors

Figure 9. Wuhan Planning Lab early warning system for urban public amenities. Source: Authors

to change due to the uncertainty of innovation. With the goal of integrating urban health into urban public amenity planning, specific strategies should be developed that correspond to the features of innovation districts.

This research attempts to develop planning strategies based on an analysis of the features of innovation districts, as well as the relations between urban health and urban public amenities. The case of Optical Valley demonstrates that the differences between innovation districts and other districts lie in their populations and development stages, which directly determine the strategies governing the development of urban public amenities. On the one hand, the population of innovation districts mainly consists of knowledge workers aged between 25 and 45 who prefer to use mixed-use, high-accessibility urban public amenities. On the other hand, the uncertainty and complexity of innovation drive the dynamic development of innovation districts. These two primary features of innovation districts also require distinctive strategies of planning urban public amenities with the goal of achieving a healthy city. Not only should the accessibility of urban public amenities be improved to promote healthier living for knowledge workers, but the roles of urban public amenities should also be reconsidered to prevent and prepare for epidemic crises.

Based on the analysis above, strategies have been proposed for the planning of urban amenities that cover four aspects.

1. To meet the requirements of knowledge workers, the planning indexes of urban public amenities in innovation districts are proposed to be adjusted based on standards, and specialised amenities – industrial service centres – are proposed to be established.
2. A flexible system of urban public amenities is suggested to be set up, not only to match the development of innovation districts, but also to promote healthier lifestyles of knowledge workers.
3. Co-location layout models are discussed in terms of the levels of urban public amenities, the spatial resources of areas, and resilience requirements. These models could both increase access to urban public amenities and improve resilience.
4. Strategies are proposed for planning development and implementation, including improving the flexibility of regulations and setting up dynamic evaluation and early warning systems. Strategies that have been applied to the planning of urban public amenities in Optical Valley have proven effective in achieving the goal of a healthy innovation district, which may be reflected in the recent population growth of the area.

Thus, the experience of Optical Valley, a typical innovation district, with setting up a system of urban public amenities could both serve as a reference point for the planning practices of innovation districts, but also fill research gaps in the fields of both healthy cities and knowledge-based urban developments.

—

References

Arup & UK Innovation Districts Group. (2018). *UK Innovation Districts and Knowledge Quarters: Driving More Productive Growth.* London: UK Innovation Districts Group.

Cai, L. (2007). *Research on the Urban Amenities of High-tech Industrial Park* [Master's thesis, Tongji University].

Dalvai, W. (2016). *Urban Cultural Amenities and the Migration of the Creative Class Thünen-Series of Applied Economic Theory, Working Paper 143*. Rostock: Universität Rostock, Institut für Volkswirtschaftslehre.

Huang, S., Zhang, Y., Hua, C., & Tang, J. (2012). Supply and Demand of Public Services in Development Zone: Changes of Age Gradient and Evolution of Needs Hierarchy. *China City Planning Review*, *36*(2), 16–22.

Katz, B. & Wagner, J. (2014). *The Rise of Innovation Districts: A New Geography of Innovation in America*. New York: Brookings.

Lu, F. & Tan, S. (2015). Built Environment's Influence on Physical Activity: Review and Thought. *Urban Planning International, 28*(2), 46–54.

Tang, Y., Liang, S., & Guo, L. (2014). Neighbourhood Planning Towards "Healthy Cities" – Introduction of Shaping Neighbourhoods: For Local Health and Global Sustainability. *Urban Planning International, 29*(6), 120–125.

Wang, L., Jia, Y., Li, X., & Yang, X. (2020). Urban Spatial Intervention Strategies for Infectious Disease Prevention and Control. *China City Planning Review, 44*(8), 13–32.

Wang, L., Jiang, X., Sun, W., Zhao, X., & Tang, J. (2018a). Impact of Urban Built Environment on Respiratory Health and its Planning Strategy: A Case Study of a District in Shanghai. *China City Planning Review, 42*(6), 15–22.

Wang, L., Liao, S., & Zhao, X. (2016a). Exploration of Approaches and Factors of Healthy City Planning. *Urban Planning International*, *31*(4), 4–9.

Wang, L., Sun, W., & Gu, J. (2018b). The Methodological Development of Health-oriented Urban Design and its Practical Exploration: A Case Study of Huangpu District, Shanghai. *Urban Planning Forum, 245*(5), 71–79.

Wang, L., Wu, Z., & Qiu, S. (2016b). Creative Community Planning in the Context of Urban Regeneration: Based on a Study on Spatial Demand of Creative Class and Residents. *Urban Planning Forum, 230*(4), 54–61.

Wang, L. & Zhou, K. (2019). Performance Assessment of the Distribution of Community Sports Facility from the Perspective of Healthy Equity: A Case Study of the Central City of Shanghai. *Journal of Human Settlements in West China, 34*(2), 1–7.

Yin, Z. (2018). *Research on the Functions and Spatial Layout of Innovation Districts*. Beijing: Qinghua University Press.

Zhang, Y., Cai, C., & Wang, L. (2017). Application of Health Impact Assessment (HIA) in Urban Redevelopment: A Case Study of Atlanta Beltline. *Planners, 33*(11), 113–119.