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Rethinking Third Place in Innovation District: A Case Study of Keyun Innovation District

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Rethinking Third Place in Innovation District——
A Case Study of Keyun Innovation District

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华南理工大学硕士学位论文

创新区中的第三空间研究——以科韵路创新区为例

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摘　要

目前我国经济社会发展已从高速增长转向高质量发展阶段，创新成为当前建设现代化经济体系的重要驱动力和战略支撑。作为承载创新活动开展的城市创新空间建设肩负我国城市创新驱动发展的重要使命。随着创新技术和创新企业的发展，知识型工作者对创新环境提出了新的要求，但是城市创新空间的发展较为滞后，导致了现阶段我国城市创新空间品质较低，城市发展没有特色，创新活力不足等问题，陷入对知识型工作者工作者吸引力下降的困境，进而难以步入创新驱动的良性循环阶段。我国面临传统科技园区转型升级的挑战，“城市创新区”概念 的提出引起了学界广泛讨论。科技园区的建设在促进广州市国民经济增长方面的作用不可置否，但是随着经济驱动要素的转变，传统科技园区逐渐暴露出时代局限下的阶段性问题。

广州传统科技园区多数分布在城市配套设施完善的中心城区，盘活既有科技园区存量空间，发挥中心城区资源优势，是提升广州市创新驱动发展竞争力、实现科技园区跨越式发展的突破点，对正在进行中的创新型科技园区建设具有重要参考意义，因此，对城市创新区理念的研究有利于广州市实现创新驱动发展和推动科技园区高质量的可 持续发展。在此背景下，如何将创新产业园升级为功能复合且对知识型工作者具有吸引力的创新区，打造吸引知识型工作需求的第三空间系统形成良好的创新生态十分的重要。

本文试图通过解读城市创新区概念，结合广州科韵创新区发展阶段，以知识型工作者对第三空间所提出的需求进行切入，采用理论研究与发展现状调研相结合展开阐述，探讨广州传统科技园区现状发展存在的问题，结合知识型工作者对第三空间所提出的需求进行切入，通过文献分析法分析了当前我国城市创新驱动发展的新趋势和新要求，从交通、用地、设施、生态等方面构建适应知识型工作者需求的创新区发展策略，致力于形成“知识型工作者需求导向下的创新区中的第三空间发展策略”的系统性论述。

通过分析当前我国城市创新驱动发展的新趋势和新要求，对知识型工作者，创新产业，创新街区和第三空间等核心概念进行梳理总结，其次明确本文的研究目的及意义，最后提出本文的研究内容、研究方法和研究框架，本章内容为全文内容的整体概述。理论研究主要对创新空间，第三空间的定义、特征、分

类进行了归纳总结。并以知识型工作者为载体，在创新区中工作需要通过第三空间来实现工作和生活的平衡，激发创新能力。为后续策略的提出提供理论依据。通过国内外优秀创新区建设为例，进行城市创新区及其第三空间的案例剖析，总结经验，提出科学问题，为后续章节理论架构进行铺垫。

基于科韵创新区现状和知识型工作者视角下的创新区中第三空间发展策略研究。基于科韵创新产业园区场地现状进行分析，总结场地目前存在空间要素的不足。在目前的科韵创新产业园区中，存在对于公共空间的开放度还有待提高；商业服点的丰富度与创新产业空间的发展成都不匹配；创新活动门槛高，对产业园区的创新带动作用不足等问题。提出韵创新区在创新理念下的城市设计总体策略和第三空间系统设计策略。总结基于对于场地现状的不足，结合创新区对城市空间结构的设计要求，提出创新理念下道路规划，功能分布的总体策略。建立创新区的第三空间设计理论框架，结合创新城市总体设计理论指导，对科韵创新区进行总体的城市设计，利用第三空间理论结合场地功能特征建立系统的第三空间网络，进行科韵创新区的城市设计实践。

关键词：城市设计，第三空间，创新区，知识型工作者

Abstract

Currently, China is experiencing a transition in its economic and social development, shifting from a period of rapid growth to one focused on high-quality development. In this context, innovation has emerged as a crucial driving force and strategic pillar in the ongoing establishment of a modern economic system. The creation of urban innovation spaces, which serve as the foundation for innovative activities, assumes a pivotal role in fostering the development of innovation-driven urbanization within China. As innovative technologies and enterprises continue to advance, knowledge workers have begun to express new demands for the innovation environment. However, the progress of urban innovation space development has somewhat lagged, resulting in suboptimal quality of such spaces and giving rise to issues such as the lack of distinctiveness in urban development and insufficient vitality for innovation. Consequently, these challenges have diminished the appeal of cities to knowledge workers, impeding the transition into a virtuous cycle driven by innovation. Notably, China faces the challenge of transforming and upgrading traditional science and technology parks, prompting widespread academic discourse on the concept of " innovation district." While it is undeniable that the construction of science and technology parks has played a significant role in bolstering the national economy, these traditional parks have gradually revealed certain periodic shortcomings when constrained by contemporary factors of progress.

The majority of conventional science and technology parks in Guangzhou are situated in central urban regions that boast comprehensive support facilities. Revitalizing existing science and technology parks and leveraging the resource advantages of central urban areas constitute pivotal factors for enhancing the competitiveness of Guangzhou's innovation-driven development and facilitating the transformative growth of science and technology parks. The ongoing establishment of innovative science and technology parks carries significant implications for future endeavours. Consequently, investigating the concept of urban innovation districts proves beneficial in realizing

innovation-driven development in Guangzhou and promoting sustainable, high-quality progress within science and technology parks. In this context, upgrading the innovation industrial park into a multifunctional innovation area that effectively appeals to knowledge workers and cultivating a comprehensive third place system that caters to the requirements of knowledge-based work play a critical role in fostering a favourable innovation ecosystem.

This article aims to elucidate the concept of urban innovation districts by integrating it with the developmental stage of the Guangzhou Keyun Innovation District. By delving into the demands of knowledge workers for the third place, a comprehensive analysis combining theoretical research and the examination of the current state of development in Guangzhou's traditional science and technology parks is conducted. Through the utilization of literature analysis methods, this study explores the emerging trends and novel requirements associated with the present innovation-driven development in cities within our country. The investigation encompasses various aspects such as transportation, land utilization, facilities, and ecology, to formulate a development strategy for innovation districts that cater to the needs of knowledge workers. The study is dedicated to offering a systematic exploration of the "third place development strategy in innovation district guided by the needs of knowledge workers.

This analysis delves into the new trends and requirements of urban innovation-driven development in our country. It proceeds to organize and summarize the key concepts of knowledge workers, innovative industries, innovative neighbourhoods, and the third place. Additionally, the purpose and significance of this research are clarified. The chapter then outlines the research content, methods, and framework to be employed in this paper, providing an overall overview of the entire study. The theoretical research primarily focuses on characterizing, classifying, and identifying two key theories' requirements and design strategies: innovation district and third place. It aims to explore the relationship between these theories. As knowledge workers serve as the focal point, the research emphasizes the need to strike a balance between work and life within the innovation district, while stimulating innovation ability through the third place. This approach provides a theoretical foundation for subsequent strategies. Furthermore, the

paper conducts case analyses of domestic and international exceptional innovation districts, paying specific attention to their third place. These case studies serve to summarize valuable experiences, raise pertinent scientific questions, and pave the way for the theoretical framework in the ensuing chapters.

Based on the analysis of the current status of the Keyun Innovation District and research on the development strategy of the third place within the innovation district from the perspective of knowledge workers, the chapter identifies certain shortcomings in the spatial elements of the Keyun Innovation Industrial Park. The current Keyun Innovation Industrial Park exhibits several deficiencies: the degree of openness to public space requires improvement; the richness of commercial services does not match the development of innovative industrial space; the threshold for innovation activities is high, leading to an insufficient innovation-driving effect on the industrial park.

An overall strategy for road planning and function distribution is proposed under the innovative concept to address these issues and based on the design requirements of the innovation district for the urban spatial structure. The chapter introduces the theoretical framework of the third place design within the innovation district and combines it with the guidance of the overall design theory of the innovative city. As a result, the overall urban design of the Keyun Innovation District is carried out, incorporating the third place theory along with the functional characteristics of the site to establish a systematic third place network. Subsequently, the details of the urban design practices implemented in the Keyun Innovation District.

Keywords: Innovation district, Knowledge worker, The third place, Urban design

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1. INTRODUCTION

1.1 Research Background

Currently, the Chinese economic society has undergone a transition from a phase characterized by rapid growth to one emphasizing high-quality development. Innovation has emerged as a critical impetus and strategic foundation for the present-day socio-economic landscape. Consequently, locales that serve as hubs for knowledge workers have assumed pivotal roles in urban spatial expansion. In tandem with the burgeoning progress of innovation districts, the provision of a third place within these innovation districts that effectively caters to and entices knowledge workers has gained paramount significance, aligning with the imperatives of novel technologies, ideas, and trends. The third place is a place between the first place (home) and the second place (work place), which can provide a place for knowledge workers to rest and work flexibly, as well as informal communication. Knowledge workers can communicate with each other and stimulate the creative vitality of the site.

1.1.1 The Growth of the Creative Industry

To solve the employment problem in 1997, Britain made rapid economic development through industrial restructuring and proposed the development of creative industries. The success of the UK's rapid economic expansion through the development of creative industries has received attention from other countries around the world. The United States announced that "the era of the creative economy has arrived and the creative class has risen" in the book The Rise of the Creative Class; Germany launched the "Cultural and Creative Economy Initiative"; Japan put forward the national policy of "Culture as a Nation" to support the development of creative industries[1].

Because of the rapid expansion of technology and industry since the twenty-first century, the world's competitive landscape has undergone fundamental changes. In 2006, China determined the development strategy of "building an innovative country".

The "National Eleventh Five-Year Cultural Development Planning Outline" has clearly defined the industrial development direction of the development of creative industries, and China's creative industries have also been fully developed. China has repeatedly emphasized the importance of innovation at the national level, elevating the innovation drive to the height of national strategy. In 2015, under the national development call of "Mass Entrepreneurship and Innovation", the creative industry, which is the carrier of innovative economic development, has been vigorously developed again, and the number of employees in the creative industry has further increased. The development of a country's innovation capability has a significant impact on the country's progress.

China has repeatedly emphasized the importance of innovation at the national level, elevating the innovation drive to the height of national strategy. In 2015, under the national development call of "Mass Entrepreneurship and Innovation", the creative industry, which is the carrier of innovative economic development, has been vigorously developed again, and the number of employees in the creative industry has further increased.

At present, the driving force of urban development gradually changes to innovation-driven and the development mode changes from extensible expansion to connotative growth. As a spatial carrier for carrying innovation and entrepreneurship, urban innovation space plays an important role in the development of innovation, which is conducive to the development of the knowledge economy and also has an important impact on the urban pattern.

Guangzhou City puts creative industries in an important strategic position and proposes to build the innovation curatorial area around the five mountains and the scientific and technological achievement transformation base around the university city. The creative industry has become a new economic development driving force, and the scale of the creative population has gradually increased[2].

1.1.2 The Need for Transformation from Industry to Innovation District

(1) Problems in the existing creative industry

In the process of urban planning and construction in China, functional zoning is emphasized. The single land use model limits the types of supporting auxiliary functional spaces for industrial land, and it is difficult to meet the needs of creative people in terms of quantity and space quality. Under the new economic conditions, a large number of new business forms and models, new products, new business forms, and new business models have emerged in cities. The corresponding space requirements have also changed, putting forward higher requirements for urban space construction. The space types of traditional industrial parks cannot adapt to the new requirements of innovative subjects for innovative life, nor can they adapt to the new trend of innovative development. What the innovative crowd needs is the superposition of work, network, social, and resource-sharing space elements, not a space with a clear hierarchy, clear structure, and single purpose in the traditional sense.

The main users of the innovation space are knowledge workers. Through the connection between existing innovation space and urban space and functions, the allocation of urban resources is improved, and the efficiency of innovation activities is improved, which helps to stimulate the inspiration of innovation subjects and promote urban innovation. With economic development, innovation space has become an important carrier for promoting urban development. Many cities' master plans and strategic plans have interpreted and deployed innovative spaces, further promoting the development of innovative spaces.

(2) Special working space needs of creative people

With the fact that innovation drives the development strategy, the subject of innovation is gradually shifting to small and minimally invasive enterprises, and the diversity of innovation subjects also gradually diversifies the space requirements. Innovative people, generally have a higher income, so they have a higher pursuit of quality of life. They advocate freedom and do not want to be bound by existing conditions. They are willing

to communicate with people and are open to hearing a variety of points of view. They yearn for an efficient and convenient living space and pursue an inclusive atmosphere and diverse cultures. In general, they need a comfortable public space for communication and interaction, to inspire innovation; they must have green, friendly and convenient transportation; they must have complete living facilities and shared facilities to reduce daily communication costs and transaction costs; they must have diversification , layout flexible and flexible space units to face the uncertainty of urban development, etc. Different from workplaces and homes, they prefer a comfortable and open third place[3].

1.1.3 The Increase of Knowledge Worker's Demand for Third Place

The primary contributors in the innovation district are knowledge workers, and the quality of space provided by the third place must cater to their urban space requirements. The attributes of the third place are closely linked to the values upheld by knowledge workers. Given the heightened demands placed on knowledge workers for the efficient development of the innovation district, the third place must adequately meet the needs of a diverse range of knowledge workers, creating a conducive environment for innovation.

The flexible and unrestricted ambiance of the third place caters to the individual spatial preferences of knowledge workers, while the warm, comfortable, and harmonious atmosphere offers diverse choices for office work and informal communication[3]. Moreover, the third place plays a pivotal role in fostering an innovative atmosphere within the innovation district. According to Kim, the third place drives innovation activities for several reasons: firstly, it serves as a platform for informal company meetings; secondly, it offers a space for knowledge workers to share ideas; thirdly, it encourages cultural and intellectual exchanges between acquaintances or strangers; and fourthly, it has become an alternative office space for startup workers. By increasing the number of weak connections between individuals, the third place becomes a source of inspiration and relaxation for knowledge workers[4].

Numerous businesses and retail outlets often serve as the heart of the local social fabric,

influencing and shaping the networks and connections within the community and local supply chains. These establishments often function as 'third places,' referring to spaces where community interactions between individuals from different groups are most likely to occur and flourish. In particular, pubs or bars play a crucial role in the local community, acting as incubators for various activities, such as forming sports teams, organizing charity events, volunteering, and hosting arts, culture, and market fairs. These activities and initiatives foster socialization, engagement, and active participation among residents, thus enhancing the quality of social networks and providing valuable social capital at the local level.

Many third places serve as incubators for a wide range of relationships and activities, both formal and informal, by providing physical spaces that facilitate community gatherings. Moreover, third places create an ideal setting for establishing and defining social order, drawing frameworks and boundaries for individuals and groups. Higher levels of social capital facilitate the flow of knowledge and information, making it more accessible and reliable, while also promoting community cohesion and participation. Therefore, the establishment of a comprehensive third place system within the innovation district plays a pivotal role in stimulating the innovation vitality of knowledge workers[5].

1.2 Related Concepts

1.2.1 Knowledge Worker

Numerous researchers have attempted to characterize the emergence of a novel economic class in the knowledge economy of the twenty-first century. In the 1960s, Peter Drucker and Fritz Machlup delineated the growing role and significance of the new group of workers they labelled knowledge workers. More recently, Richard Florida's concept of the creative class has become a commonplace description of the new highly-educated population that is driving the postindustrial economy. According to Florida, the creative class consists of two distinct subclasses. The first tier is the super creative class, which encompasses artists, filmmakers, scientists, and engineers. The

second tier is the creative professionals, which includes professional service workers[4]. Keyun Innovation Industry's core economic activities may be classed as game and technology entrepreneurial activities, and many people, such as game designers and engineers, fall under the concept of the super creative class. The word "knowledge worker" is used instead of "creative class" to avoid the ambiguity of the term "creative class"[4]. People working in the innovation district are referred to collectively as knowledge workers in this thesis to more thoroughly summarize innovative talents.

Under the background of the development of the Chinese creative industry, creative people are still facing problems such as high work pressure, long working hours, fast-paced life, and tight living time. Henceforth, knowledge workers articulate their requisites encompassing informal collaboration, heightened avenues for communication, and flexible, easily accessible reservoirs of resources, all with the overarching aim of attaining a harmonious equilibrium between their professional undertakings and personal lives through spatial modifications.

Chen Jiaxiang (2012) believes that innovative talents need group-based industrial space, high-quality social services, and innovative environment[6]. He Zhihua (2015) summarized the development of incubators in the Nanjing metropolitan area and studied the preferences and choices of innovative talents for different employment spaces[7]. Yin Zhi (2018) believes that innovative enterprises' requirements for parks have evolved from basic physical space needs to environmental value needs, and then to soft environment needs such as technology, innovation, communication, information sharing and smart operations[8]. In her master's thesis, Xia Meiling (2019) started from the needs of innovative people and constructed an innovation space development strategy that adapts to the needs of innovative people from aspects such as transportation, land, facilities, and ecology[9].

For knowledge workers, the inclusion of a third place within the innovation district can engender an atmosphere that is characterized by a heightened sense of relaxation and informality. In such a setting, knowledge workers are afforded the liberty to engage in spontaneous dialogues, exchanges, and collaborations that extend beyond the confines of the formal office environment. These instances of informal cooperation hold the

potential to serve as catalysts for creativity, nurturing innovation, and generating novel insights and solutions. Additionally, third places present avenues for knowledge workers to establish networks with professionals hailing from diverse industries or disciplines. These interactions facilitate not only the cultivation of valuable professional relationships but also the exchange of differing perspectives, thereby fostering networking opportunities. Such connections play an instrumental role in the advancement of career trajectories, knowledge dissemination, and future collaborative endeavours. Furthermore, the imperative for a third place stems from the aspiration of knowledge workers to achieve a more salubrious work-life balance. By offering an opportunity to demarcate between work and personal life, the third place affords individuals the chance to replenish their energies, unwind, and partake in activities that lie beyond the purview of their occupational duties. For those inclined towards novel environs, necessitating a respite from the confines of the home office, or seeking a more dynamic and interactive work environment, the third place serves as a wellspring, providing knowledge workers with an alternative setting to undertake their tasks and stimulating their creative faculties.

1.2.2 Innovation Industry

The British Creative Industry Task Force defined "creative industries" in 1998 as "those industries that have the potential to create wealth and employment through the development and use of intellectual property arising from individuals' creativity, skills, and talent." Other countries have also researched the definition of creative industries, as represented by Richard Caves, who believes that creative industries, in a narrow sense, refer to the commercialization path of cultural creativity from the micro level, emphasizing the economic contribution of culture.

In modern cities, the creative industry is a knowledge-intensive, intelligence-intensive, information-intensive, and technology-intensive industrial type. It has multiple meanings, including creativity, creative class, creative activity, creative products, and creative space. There are two defining conditions: the first is to consider creativity as the primary production element, resulting in value-added products and services; the

second is the outcome of entering the production system to produce wealth and grow employment through consumption. Creativity is the most important economic driving force in the post-industrialization stage, "knowledge" and "information" are the tools and materials of creativity, and "innovation" is the product of creativity, which can be expressed as new art, new technology, or a new business model or approach[1].

An innovative industry commonly manifests as a substantial undertaking that furnishes the requisite infrastructure, amenities, and services to accommodate diverse industrial operations. The principal objective underlying the establishment of industrial parks is to allure enterprises spanning various sectors, encompassing manufacturing, logistics, and warehousing, to foster the consolidation of industrial activities within a central nucleus. These parks are typically equipped with readily available industrial premises, well-connected transportation systems, utility services, and supplementary infrastructure that is tailored to cater to the specific demands of industrial operations. However, with the advancement of innovative industries, the spatial requirements of innovation districts have transcended the confines of mere foundational facilities.

An innovation district is a geographic area, usually located in urban settings, that aims to stimulate innovation, entrepreneurship, and collaboration across multiple sectors. Unlike an industrial park, the primary focus of an innovation district is not limited to industrial activities or manufacturing. Instead, it seeks to create an ecosystem that brings together companies, research institutions, startups, entrepreneurs, and other stakeholders to foster creativity, knowledge sharing, and innovation. Innovation districts often integrate various elements, such as research centers, universities, business incubators, coworking spaces, cultural institutions, residential areas, and public spaces, to promote collaboration and create a vibrant environment that encourages the exchange of ideas and the development of new technologies, products, and services. In summary, an industry park is primarily focused on providing infrastructure and facilities for industrial activities and attracting businesses from diverse industries, while an innovation district emphasizes creating an ecosystem that supports innovation, entrepreneurship, and collaboration across sectors.

1.3 Aims and Significance of the Study

1.3.1 Research Aim

Currently, the progress of urban innovation districts has fallen behind that of innovative enterprises, resulting in the abandonment of numerous well-established innovative industrial parks situated in city centres. This discrepancy can be attributed to the inadequate adaptability of spatial organization within urban innovation district to cater to the needs of innovative individuals. Consequently, prevalent issues such as functional monotonousness, inadequate infrastructure provisions, and inconvenient commuting arrangements afflict industrial parks. Furthermore, challenges arise about the allure of innovation districts for knowledge workers and the achievement of sustainable individual development. These circumstances contribute to a deficiency in fostering a robust atmosphere of innovation and a scarcity of impetus for innovation within the innovation district, thereby impeding the virtuous cycle of innovation-driven activities. In light of these challenges, this study addresses the concerns by drawing upon both domestic and international development theories pertaining to innovation district. Through extensive research and urban design, it examines the spatial layout of urban innovation districts, while also incorporating considerations of regional ecology, workspace, third place, living space, and the requisite service facilities within these zones. With a particular focus on the third place, the study proposes a design strategy that encompasses an integrated system of indoor and outdoor third places, along with the implementation of a slow walking system and a green space system accessible to the public. These measures aim to augment the activity space available to knowledge workers within the innovation district and foster the gathering of knowledge-based workers, thereby invigorating their innovative capabilities. The adoption of this approach offers a fresh research perspective and strategy for the advancement of innovation-driven urban innovation districts.

1.3.2 Research Significance

To establish a virtuous cycle model driven by innovation, the innovative crowd is a crucial element for any city. This paper adopts a problem-oriented approach to discuss the role of the third place in the innovation district, based on the innovative crowd's requirements for the third place. The objective is to promote the urban creative class by replacing the urban industrial space, focusing on the endogenous formation of the innovation block, its driving force, and construction path. The research findings will provide decision-making support for the formulation of urban renewal policies and the promotion of urban connotative development in China. This paper is of great practical and theoretical significance for the construction of urban innovation districts.

(1) Theoretical significance

Currently, there is a growing scholarly interest in the concept of the third place. However, existing research on the third place primarily focuses on the internal material space design within urban settings. In contrast, this study examines and consolidates the environmental characteristics of the external innovation district where the third place is situated. It conducts a detailed analysis of the environmental design and facilities within the third place and proposes a comprehensive set of space design strategies aimed at enhancing the appeal of knowledge workers and fostering innovation vitality. Existing research on the third place within the innovation district predominantly concentrates on spatial design methods pertaining to outdoor third places, such as squares, parks, and green areas. Insufficient attention has been given to the selection and layout of indoor and outdoor third place typologies from the perspective of knowledge workers' demands. Given that creative individuals possess distinctive group characteristics and lifestyles that differ from those of the general populace, they exhibit specific requirements for their working environment. Different types of third places cater to the varying needs of knowledge workers. Neglecting systematic, targeted research during the planning and design stages of the innovation district can potentially overlook the space requisites of creative individuals in their working environment. In light of this, by analyzing the behavioral characteristics of

knowledge workers, this study investigates their needs for various third places and proposes a configuration strategy for both indoor and outdoor third places based on their behavioral attributes. This achievement holds theoretical significance in enriching research pertaining to third place planning and the allocation of public service facilities within innovation district. Moreover, it contributes to the design research of the third place within the innovation district and enhances our understanding of knowledge workers' demands for the third place, thereby maximizing the utility of the innovation district.

(2) Practical significance

In recent years, the trend of China's innovation project construction with knowledge workers as the main users has become increasingly obvious. Creating a working environment that meets the unique needs of knowledge workers and providing targeted service facilities has become a focus of research in the urban design process of such innovation districts. This study aims to conform to the life logic of knowledge workers, summarize the characteristics of the spatial layout of innovation districts, analyze the needs of knowledge workers in the third place, and propose a third place system strategy to meet their needs. The results of this study will have important reference significance for the third place urban design in the innovation district.

1.4 Research Content and Methods

1.4.1 Research Content

The main research content of this paper includes introduction; theoretical research on innovation space, innovation district and third place; domestic and foreign case analysis; research on the development strategy of urban innovation district based on the demand for third place from the perspective of knowledge workers; The background analysis of the Keyun Innovation District in the innovation source area as the research object; the application and design of the third place system strategy in the Innovation District in the Keyun InnovationDistrict; the conclusion and the outlook and other seven parts.

The first part is, introduction. This chapter first analyzes the new trends and new

requirements of the current innovation-driven development of cities in China, then sorts out and summarizes the core concepts of knowledge workers, innovative industries, innovative neighbourhoods and third places, and then clarifies the purpose and significance of this research. Finally, Put forward the research content, research method and research framework of this paper. The content of this chapter is the overall overview of the full text.

The second part is theoretical research. This chapter mainly summarizes the characteristics, classification, requirements and design strategies of the three theories of innovation space, innovation district and third place. It also expounds the relationship between the three theories. With knowledge workers as the carriers, working in the innovation district needs to achieve the balance between work and life and stimulate innovation ability through the third place. Provide a theoretical basis for the subsequent strategy.

The third part is case analysis. This chapter takes Silicon Valley in California, Kendall Square in Boston, Zhongguancun in Beijing, China, and One-north City in Singapore as examples to analyze the cases of urban innovation districts and their third places, sum up experiences, raise scientific questions, and pave the way for the theoretical framework of subsequent chapters.

The fourth part is based on the current situation of Keyun Innovation District and the research on the development strategy of the third place in the innovation district from the perspective of knowledge workers. This chapter is based on the analysis of the current situation of the site of Keyun Innovation Industrial Park, and summarizes the lack of spatial elements in the site. In the current Keyun Innovation Industrial Park, the degree of openness to public space needs to be improved; the richness of commercial services does not match the development of innovative industrial space; the threshold for innovation activities is high, and the innovation-driving effect on the industrial park is insufficient And other issues.

The fifth part is the overall strategy of urban design and the third place system design strategy of Keyun Innovation District under the concept of innovation. Based on the deficiencies summarized in the fourth part of the current situation of the site, combined

with the design requirements of the innovation district for the urban spatial structure, an overall strategy for road planning and function distribution under the innovative concept is proposed.

The sixth part, according to the theoretical framework of the third place design of the innovation district summarized above, combined with the guidance of the overall design theory of the innovation city, conducts an overall urban design for the Keyun Innovation District, and uses the third place theory combined with the functional characteristics of the site to establish a "spot". The space system of "-line-surface" verifies the operability of the theoretical results of this paper through the urban design time of Keyun Innovation District.

The seventh part, the conclusion and outlook. Based on the previous theoretical analysis and case verification, this chapter summarizes the full text, puts forward the shortcomings of current research, and at the same time opens up the possibility of multi-angle development prospects of urban innovation district in my country.

1.4.2 Logic Framework

This study focuses on the fact that the functions of the Keyun Road Innovation Industrial Park are too scattered, the old urban buildings restrict the development of innovative industries, and the well-developed innovative industries gradually move away from the Keyun Road Innovation Industrial Park, and the road traffic is too chaotic and the space quality is not good. High, it is difficult to attract many knowledge workers. Through the study of the third place theory, research on public space and semi-public space. According to different building functions, the third place is implanted to form a third place network system and create a dynamic innovation district.

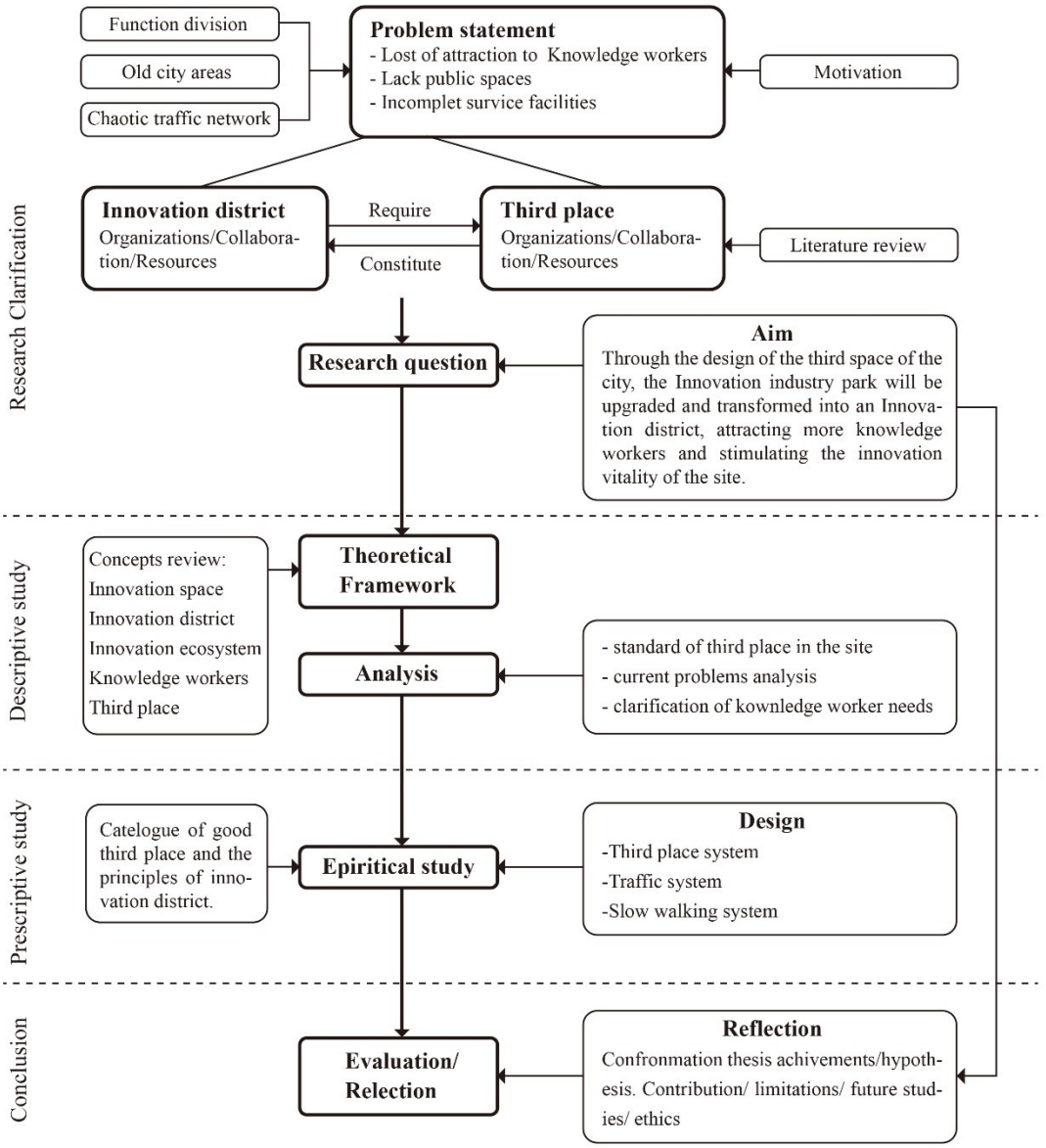


Figure 1-1 Framework of this research. Source: made by the author.

1.4.3 Research Methodology

(1) Literature research

In this paper, a large number of literature retrieval and current situation research are carried out in combination with keywords such as knowledge worker, innovation space, innovation district and third place. Including domestic and foreign journal literature, professional books and practical cases, it comprehensively and systematically analyzes the current successful experience of the development of urban innovation districts in

China and abroad and lays a solid foundation for this research on the basis of summarization.

(2) Comparative research

This paper takes the classic practices of the development of science and technology innovation districts in the Silicon Valley Science and Technology Park in the United States, the Kendall Square Innovation District, the Beijing Zhongguancun Innovation District in China, and the Milano Innovation District in Italy as examples to conduct in-depth excavation and comparative analysis to discuss knowledge-based. The internal relationship between knowledge workers' space needs and the development of the third place in the innovation district, and thus proposes a space organization strategy that adapts to the needs of innovative people from the four levels of transportation, land use, facilities, and ecology, and lays a theoretical basis for putting forward the leading point of view of the article.

(3) Case study

On the basis of theoretical research, this paper takes the construction of the Keyun Innovation District, Tianhe District, Guangzhou City, Guangdong Province as an example for practical verification. To solve the dilemma, put forward relevant development strategies, and use actual cases to demonstrate the operability and feasibility of the viewpoints in this paper.

(4) Systematic analysis and evaluation

This paper draws on the innovative urban spatial organization models at home and abroad, adopts a similar method in the research on the third Place development strategy in Keyun Innovation District, Tianhe District, Guangzhou City, and draws on its network, systematization, and composite It explores the scientificity and operability of the development of urban innovation space under the policy-driven background, and provides a scientific basis for putting forward the main points of the article

2. THEORETICAL RESEARCH

2.1 Innovation District

2.1.1 Definition of Innovation District

In 2014, the Brookings Institution of the United States released a report titled "The Rise of Innovation District: A New Geography of Innovation in America." This report systematically explored the resurgence of innovative enterprises in metropolitan areas of the United States, specifically returning to the central urban areas and forming distinct geographical spatial organizations. It introduced the concept of "innovation district" and served as a foundation for subsequent in-depth studies on the topic[10].

An innovation district denotes a delimited geographical region, predominantly situated within urban contexts, strategically conceived to catalyze inventive processes, entrepreneurial endeavors, and inter-sectoral collaborations. In contradistinction to conventional industrial parks, the primary thrust of innovation districts transcends the confines of industrial undertakings or manufacturing pursuits. Instead, they aspire to nurture an intricately woven ecosystem that convenes corporate entities, research establishments, nascent enterprises, visionaries, and assorted stakeholders, all with the explicit objective of engendering ingenuity, disseminating knowledge, and propelling innovation. Innovation districts frequently incorporate constituent elements such as research hubs, academic institutions, business incubation facilities, communal co-working spaces, cultural bastions, residential enclaves, and communal expanses, orchestrating an environment conducive to collaborative synergies and cultivating a dynamic milieu that stimulates the cross-pollination of ideas and the genesis of pioneering technologies, commodities, and services. In sum, while industrial parks predominantly focus on provisioning infrastructural amenities and accommodations to accommodate diverse corporate entities, innovation districts underscore the imperative of fostering an environment synergistic with innovation, entrepreneurship, and

transdisciplinary collaboration.

The spectrum of innovative industries encompasses a diversified array of domains, embracing profit model innovation, network innovation, structural innovation, process innovation, product performance innovation, product system innovation, service innovation, channel innovation, brand innovation, and customer-centric innovation. The categorizations delineated within this exposition primarily expound upon the ten aforementioned classifications of innovative industries.

In accordance with the nature of innovation, the prevailing classification encompasses knowledge innovation, technological innovation, product innovation, service innovation, system innovation, and management innovation. In respect to the organizational modality of innovation, it can be categorized into autonomous innovation, collaborative innovation, and externally introduced innovation. Delineated by the depth of innovativeness, it bifurcates into incremental innovation, disruptive innovation, and transformative innovation. Among the myriad paradigms of innovation, the innovation district model aligns with the collaborative approach to innovation. Specifically, it represents a collective innovation endeavor involving enterprises, research institutions, and academic entities, fostering cooperation across various phases such as ideation inception, novel product development, and commercial realization. This collaborative innovation consortium constitutes an instrumental mechanism for enterprises to fortify their mutual cooperation and innovative capacities through spatial agglomeration, harmonizing with the fundamental tenets inherent to the innovation district concept within regional spatial domains.

Bruce Katz (2014) formally proposed the concept of innovation districts, arguing that innovation districts are urban comprehensive development areas where innovation subjects, service organizations, industrial clusters, incubation accelerators, etc. gather, which can provide convenient production and living supporting facilities, and are active in innovation. , intensive technology, compact space, convenient transportation, smooth communication, etc[10]. Li Jian (2015) posits that urban innovation districts lack distinct spatial boundaries but are characterized by a high concentration of high-end scientific research institutes, R&D institutions, start-up companies, and incubators. These areas

are complemented by certain financial institutions and exhibit economic traits such as vibrant innovation activities and active interaction among innovation stakeholders[11]. Deng Zhituan introduced the concept of "innovation block," referring to city blocks with a high concentration of innovative and entrepreneurial enterprises, thus emphasizing the block-level characteristics of innovation activities. To distinguish it from the "Innovation District" proposed by the Brookings Institution, he translated it into English as "Innovation Square"[12]. Additionally, Deng Zhituan (2015) introduced the concept of "Central Intellectual District (CID)," based on the Central Business District (CBD), positing that it, along with the Central Business District (CBD), collectively shapes the city centre and enhances urban functions[13]. As nascent epicenters fostering innovative endeavors within urban landscapes, urban innovation districts manifest themselves in diverse configurations within the context of specific projects in our country. These configurations encompass knowledge innovation communities, science and technology innovation corridors, as well as innovative science and technology parks, among others. In 2016, Hu Linna postulated that the crux of these innovation enclaves resides in constituting regional innovation systems wherein various entities, encompassing universities, governmental bodies, and corporate enterprises, engage in robust interactive dynamics and facilitate knowledge diffusion. Building upon this perspective, Ren Junyu, in 2018, advanced the concept of innovative urban zones as they congeal around innovative and entrepreneurial actors, including enterprises and talents, while being underscored by a foundational framework encompassing scientific research institutions, incubation accelerators, and service agencies. These elements collectively serve as the bedrock for propelling innovative and entrepreneurial undertakings within a designated urban comprehensive development precinct[14].

Table 2-1 Scholars have different definitions of innovation Districts. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou [15]

Scholar	Year	Concept	Location	Characteristic

Katz B, Wagner J	2014	Gather leading "anchor institutions", business clusters and start-ups, and all kinds of incubation facilities in a geographical area with compact space, convenient transportation, and common network, mixed office, commercial, residential, retail and other functions.	Central City, Urban Waterfront and Suburbs Outer Suburbs	High-density urbanized areas, suburbs and urbanized areas in the outer suburbs of cities; clusters of innovative and entrepreneurial enterprises
Jian L, Qiyu T	2015	A new urban economic space where high-end scientific research institutes, R&D institutions, start-ups, incubators and financial auxiliary institutions are highly concentrated, innovation activities are vigorous, and the characteristics of networked interaction of various entities are obvious.	City center area, metropolitan area fringe	Compact physical space, accessible public transportation, public network sharing, knowledge sharing and technical cooperation, mixed layout of residential, office and commercial functions, and complete public services
Zhituan D	2016	A block space with a high concentration of innovative and entrepreneurial enterprises in the city.	Central city, urban waterfront	High-density urbanized areas; clusters of innovative and entrepreneurial enterprises
Lingna H,Suodi Z.	2016	The essence of an innovation block is a regional innovation system with full interaction and knowledge overflow among multiple subjects such as universities, governments, and enterprises.	Surrounding areas of universities and innovative enterprises	In terms of spatial scope, its distribution is concentrated at a distance of one to two stations
Junyu R, Xiyu L	2018	A comprehensive urban development area formed by carrying out innovative and entrepreneurial activities within a certain area.	City centre	Convenient access to public transportation, high density, floor plan, mixed-use land functions, and good living environment creation.

In the early 21st century, urban knowledge (community) precincts[16] emerged as the prevailing centers of knowledge and innovation, supplanting the once prominent suburban and exurban science and technology parks from the late 20th century. These transformative shifts have subsequently necessitated the rebranding of these spaces as innovation districts[17]. The proliferation of innovation districts in numerous cities reflects a novel form of land utilization, characterized by the deliberate endeavor to invigorate urban spaces through the stimulation of activities within the innovation economy[18].

In broad terms, previous research has provided comprehensive analyses and evaluations of the developmental models, trajectories, and strategies employed in urban innovation districts both domestically and internationally. These studies offer valuable guidance

for the practical implementation of urban design in domestic innovation districts, while also enriching the knowledge base by offering in-depth insights into the spatial layout, transportation systems, and public space characteristics of representative foreign innovation districts. However, there remains a notable dearth of systematic investigations into the allure of innovation spaces for knowledge workers within innovation districts.

This study undertakes a conceptual examination and comparative analysis of the constituent elements underpinning innovation districts. It delves into an in-depth analysis of the evolutionary trajectories of innovation districts at varying developmental phases, presenting a systematic evaluation and enhancement approach for industrial parks across their developmental continuum through the establishment of an innovation district element framework. By fostering an environment characterized by a robust culture of innovation and high spatial quality, this approach aims to attract and congregate knowledge professionals, thereby engendering a convergence of innovative activities that, in turn, catalyze the overarching advancement of the innovation district. This, in essence, leads to the formulation of a virtuous developmental cycle.

2.1.2 Characteristics of Innovation Districts

During the latter half of the 20th century, the primary focus of cities was to accommodate occupational and industrial advancement, predominantly in the form of science and technology parks, as a means to enhance economic activities and bolster employment rates[19]. The spatial configurations of these development inadvertently rendered them isolated, inward-looking, and singularly focused controlled environments[17]. However, in the 21st century, the ascendancy of knowledge generation and innovation has taken precedence in numerous global cities. As a result, a more comprehensive and integrated approach has been adopted to address the interconnected issues relating to the economic, societal, and spatial/environmental aspects of urban economic hubs[20]. Consequently, this has been given. rise to the emergence of novel innovation spaces, branded as innovation districts[21] Characterize by an extraverted and mixed-use nature, these innovative districts represent a new

category of land utilization[22].

Given the socioeconomic diversity of cities and the marked differences in regional economies, various categories of innovation districts have been developed to facilitate diverse innovation economy activities worldwide[23]. In this study, the term 'innovation districts' serves as an overarching concept encompassing 'knowledge and innovation spaces'[24], 'innovation clusters'[25] (Huggins, 2008), 'innovation milieu'[26], 'knowledge (community) precincts'[16], 'innovation precincts'[17], and comparable models that are predominantly mixed-use (sub)urban land uses[27].

The aforementioned concepts are predicated upon the physical coalescence of corporate entities, wherein innovation is harnessed through collaborative endeavors aimed at fostering economic development. While inter-enterprise cooperation may engender overlaps and conflicts concerning innovation focal points, the discourse on exchanges among divergent innovative enterprises, as discussed herein, pertains to the realization of theoretical or material complementarity among enterprises from distinct domains, achieved through reciprocal interactions and collaborative efforts, thereby yielding incremental innovation while cost-effectively exchanging resources to attain a mutually beneficial outcome. Consequently, the attainment of innovation by knowledge professionals affiliated with diverse enterprises is not a remote possibility, facilitated by cost-effective communication and cooperation. Such low-cost communication and collaborative innovation can be facilitated through informal interactions within public spaces interlinking corporate entities.

Tu Qiyu (2010) believes that innovative urban areas are urban functional areas that focus on knowledge creation and technology transformation, and gather a large number of core support, service facilities, and derivative innovation elements[28].

Bruce Katz (2014) formally proposed the concept of innovation districts, arguing that innovation districts are urban comprehensive development areas where innovation subjects, service organizations, industrial clusters, incubation accelerators, etc. gather, which can provide convenient production and living supporting facilities, and are active in innovation. , intensive technology, compact space, convenient transportation, smooth communication, etc[10]. Li Jian (2015) believes that an innovative urban area is a district

that gathers various innovative elements within the spatial scope of the city's established districts and central districts, including universities, enterprises, research and service institutions, and is characterized by active innovation and obvious network interaction, knowledge sharing and technical cooperation, fuzzy spatial boundaries, convenient transportation, mixed functions, compact space, and adequate facilities[11].

As depicted in the Table 2-2, innovation districts represent spatial domains engendered by the confluence of enterprises characterized by varying developmental stages, concomitant with the enhancement of foundational service infrastructure. The delineation of the components comprising innovation districts within the table 2-2 is contingent upon the distinct levels of agglomeration exhibited by innovative industries. Innovation clusters epitomize geospatial concentrations of interlinked corporate entities encompassing diverse sectors, while also encompassing essential entities vital for competitiveness, including specialized input suppliers. The innovation environment designates a milieu wherein novel innovations gestate, characterized by a procession of collective and dynamic processes involving actors forming collaborative networks and fostering mutually beneficial relationships.

High-tech districts constitute clusters of high-tech industries, manifesting as an assemblage of meticulously designed structures harmoniously coexisting within a campus-like ambiance. Science and technology parks serve as hubs that amplify local innovation outcomes by catalyzing the development and diffusion of knowledge amongst co-located enterprises. Creative communities denote multifunctional urban enclaves characterized by a proliferation of knowledge-based enterprises and advanced network infrastructure, thoughtfully cultivated to blur the boundaries demarcating residential, commercial, recreational, and professional domains within knowledge communities. The Innovation and Cultural District serves as a precinct exemplifying innovation, research, training, and entrepreneurship, functioning as a nucleus for innovative, cultural, and entertainment pursuits. Innovation districts epitomize crucibles of urban knowledge-driven progress, wherein public and private stakeholders synergize to nurture, allure, and retain investments and talent, thereby reinvigorating urban locales while bolstering knowledge-based and innovative economic pursuits.

While these conceptual clusters share a common composition of innovative enterprises, nuanced distinctions in their conceptual definitions stem from variations in the inclusion of other constituent elements.

Table 2-2 Definitions of concepts related to innovation districts. Source: How can contemporary innovation districts be classified?[27]

Term	Definition	Reference
Innovation cluster	The geographic concentration of interconnected companies in a field that encompasses an array of linked industries and entities important to competition, including suppliers of specialised inputs.	From fragmentation to integration: development process of innovation clusters in Korea.
Innovative milieu	The location that concerned with an incubation place of new innovation, and is characterised by a set of collective and dynamic processes incorporating actors that lead to networks of synergy producing interrelationships.	Critical surveys edited by Stephen Roper innovation and space: a critical review of the literature.
High-technology district	High-technology industry cluster that consists of a series of buildings set amidst impeccable landscaping in a campus-like atmosphere.	Alternative forms of the high-technology district: corridors, clumps, cores, campuses, subdivisions, and sites.
Science and technology park	Location that improves local innovation outcomes by promoting knowledge development and transmission among the co-located firms.	Knowledge spillovers in science and technology parks: how can firms benefit most?
Knowledge (community) precinct	Mixed-use urban settings that include a critical mass of knowledge enterprises and advanced network infrastructures, and developed with the aim of collecting and benefits of blurring the boundaries of living, shopping, recreation, and the working facilities of knowledge community.	Does size matter? Knowledge-based development of second-order city-regions in Finland.
Innovation and Cultural District	The district that showcases innovation, research, training, and entrepreneurship as the hub of innovation, cultural creation, and entertainment.	Regenerating urban waterfronts-creating better futures- from commercial and leisure marketplaces to cultural quarters and innovation districts.
Innovation district	Nexus of knowledge-based development in cities, where public and private actors work towards fostering, attracting, and retaining investment and talent with an aim of revitalising urban areas, and boosting knowledge and innovation economy activities.	Conceptual frameworks of innovation district place quality: an opinion paper.

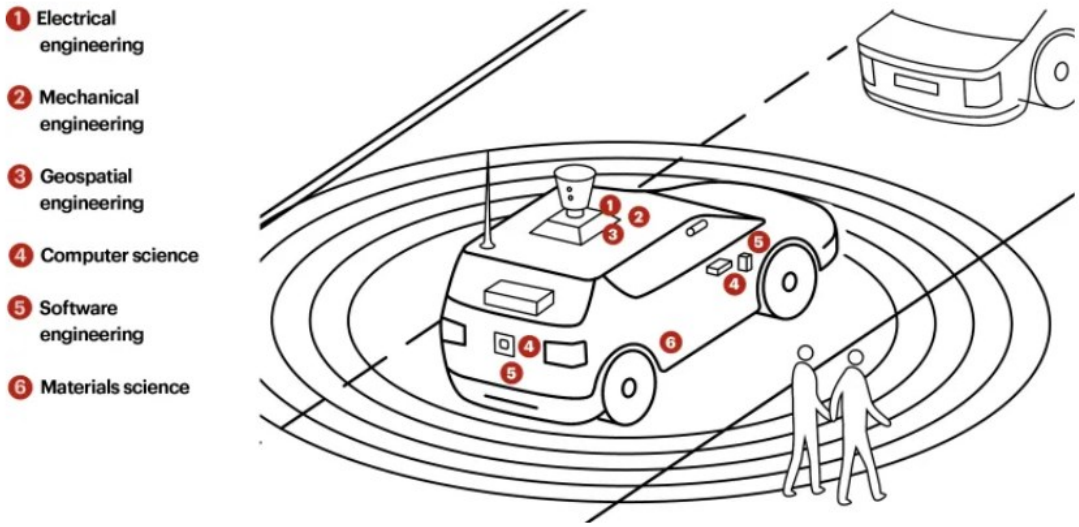


Figure 2-1 Innovations conceived through the convergence of disparate disciplines and sectors. Source: Brookings.

In an innovation district, it should mainly include the following elements: 1.) The agglomeration of innovative industries with different levels of development; 2) A good transportation environment; 3) Interaction and collaboration between companies and knowledge workers ; 4) Disclosure of innovation to a certain extent; 5) Good basic service facilities and innovation environment; 6) Good innovation atmosphere. The expansion and meaning of each element are as shown in Table 2-3.

Table 2-3 Main factors of innovation districts. Source: author.

Factor	Significance
Cluster of innovative industries	The concentration of innovative sectors and research strengths has been the driving force behind the Innovation District from the very beginning.
Integration of departments within the industry	As hubs for research and next-generation technologies, innovation districts are better defined by these horizontal platforms rather than by departmental silos. Connecting seemingly disparate industries through collaborative research, dialogue, and cross-cutting technology.
Diverse companies and start-ups	Part of the Innovation District's power comes from this eclectic mix. Regions made up primarily of large institutions often lack the accelerated innovative growth that nimble small businesses can provide. And regions characterized by startup density have fewer opportunities to build well-funded partnerships and alliances.
good transportation	Connectivity and proximity are the foundation of strong regional ecosystems. The physical concentration of companies, workers, and activities—is what differentiates "busy" areas from boring ones.
social interaction among employees	Essential for collaboration, learning, and inspiration—happening in centralized "hot spots." A few social hot spots in an area may play a role in community building far beyond their own capabilities.

disclosure of innovation	Daylight innovations in public and private spaces help spark the curiosity of aspiring innovators, spark conversations among neighbors, and convey the Innovation District's story to potential recruiters or investors. It also transforms public spaces into "living laboratories" to test prototypes. Finally, greater transparency at the building's ground level allows pedestrians to connect with the innovative activities within.
Collaboration with other institutions (Figure 2-2)	The work ethic and culture of the Innovation district is "cooperation and competition." A bottom-up, horizontal model of governance—involving businesses, academic and civil institutions, governments, workers, and residents—can best coordinate the work that must be done collectively: identification of assets; design, financial, and strategic initiatives; management of public spaces; and evaluate progress.

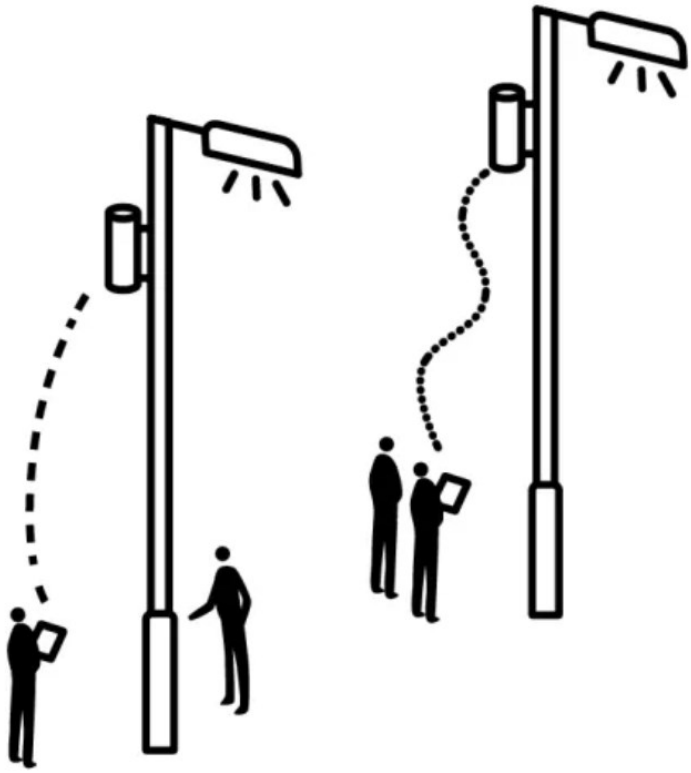


Figure 2-2 Some districts are testing innovations in public spaces. Source: Brookings.

Previous research has conducted a comprehensive analysis and evaluation of the development models, trajectories and strategies of urban innovation districts at home and abroad. These studies provide valuable guidance for the practical implementation of urban design in domestic innovation districts, while also enriching the knowledge base through in-depth understanding of the spatial layout, transportation systems and public space characteristics of representative innovation districts abroad. However, there is still a distinct lack of systematic investigation into the attractiveness of innovation spaces for knowledge workers within innovation districts.

2.1.3 Types of Innovation Districts

Although innovation districts share common attributes in terms of general economic, spatial, and networking assets [10], it is important to acknowledge their distinctiveness in terms of unique functions, features, and spatial qualities.

Innovation districts exhibit varying compositions of industries and business sectors, each characterized by distinct business functions. Broadly, they can be categorized as either: (a) high-technology-intensive innovation districts or (b) creativity-intensive innovation districts. Additionally, there are instances where both industrial functions coexist within a single district. Another significant aspect is the presence of knowledge-intensive service activities which are commonly found in both types of innovation districts[29]. However, it should be noted that KISAs primarily serve as support functions and do not operate as independent districts, thus not constituting a separate category of the innovation district.

Furthermore, innovation districts exhibit notable variations in their features. These distinctions encompass aspects such as: (a) the presence of innovation and R&D companies as well as a skilled workforce within the district; (b) spatial characteristics and the territorial jurisdiction of the district and its host city; (c) the level of proximity and connectivity among actors or stakeholders within the district; and (d) social attributes of the district, including demographic composition and social capital.

Finally, it is noteworthy that most innovation districts possess distinct characteristics in terms of their spatial utilization. These divergences encompass (a) variations in spatial design and configurations; (b) the utilization of open and/or closed innovation systems; (c) disparities in development size and scale; (d) differences in land use composition, including single-use or mixed-use activities; and (e) the adoption of diverse governance models such as double, triple, and quadruple helix partnership models.

From the perspective of space design and space configuration,Zeng Peng (2007) provided a comprehensive overview of the arrangement of innovation spaces, identifying three distinct modes: the parallel strip mode, the central axis mode, and the shared layout mode characterized by a combination of circles and sectors[30]. On the

other hand, Yuan Xiaohui (2014) synthesized the optimal spatial structure for an innovation-driven science and technology city, highlighting a circular layout featuring a core circle comprising the innovation park, the knowledge-sharing platform, and the technology service platform[31].

From the perspective of whether to open the innovation system, Liu Shuai (2020) based on the innovation models of different types of parks, divided the innovation blocks into R&D-leading, industry-guiding, and environment-supporting. It is proposed to change from a single park to a complex park, from traditional public space to new public space, emphasizing the creation of third place and street space. The new public space should be multifunctional, public innovation, open space, and precise matching[32].

From the perspective of development scale, Yin Zhi (2018) delineated three fundamental categories of innovation space groups, proposing the establishment of a spatial organizational model that prioritizes research and development functions, embraces adaptability, and promotes the integration of industry and city[8]. Notably, large-scale parks adopt a circular layout centred around a shared innovation comprehensive service core and platform.

From the perspective of land use, Ren Junyu and Liu Xiyu (2018) proposed an innovative city conceptual model of innovation, industry, and urban environment, and concluded that innovative cities have the characteristics of convenient public transportation, dense streets and lanes, mixed functions, high density, and high density. Good living environment, formal and embedded three evolution models [14]。

Based on the differences in innovation motivation and the development stages of innovative enterprises, innovation districts are also classified into: atmosphere R&D institution-leading, enterprise development-leading and environmental support shown as Table 2-4.

Table 2-4 Type analysis of classic innovative blocks. Source: How third places foster and shape community cohesion, economic development and social capital: The case of pubs in rural Ireland

Classification	R & D Pilot	Industry-guided	Environmental Support
The case	Silicon Valley	One-North Singapore	Silicon Alley, New York
Position	Research-oriented high-tech industrial park, the most innovative and dynamic science and technology city.	Form a comprehensive modern service area through industrial introduction.	A hub for start-ups.
Scale	The open area is not a fixed administrative unit. The core area is about 800km². There are more than 1 million scientific and technological personnel, 60% of which integrate R&D, production and sales, and 40% are tertiary industry companies that provide various supporting facilities.	Covering an area of 2km², there are nearly 47,000 employees, more than 400 advanced enterprises and global institutions, more than 700 start-up companies, 16 public research institutions and 5 corporate universities and colleges.	In essence, there is no fixed spatial boundary. It is a dynamic and open concept. It is not a science and technology park in the traditional sense. It gathers thousands of start-ups.
Innovation model	Enterprises, universities, and research institutions, as the main body of innovation, form high-tech industrial clusters and become expanding innovation areas.	Integrate "work, study, life and leisure", gather all kinds of talents, experts and entrepreneurs, pay attention to the communication between people, create opportunities and space, and enhance interaction.	Provide a certain amount of innovation space, integrating technical service platforms and public innovation facilities; relying on various innovation subjects and profound innovation culture and cultural atmosphere, it is not acceptable to attract enterprises, funds, and talents to gather in the region.
Functional composition	High-tech enterprises, research institutions, residences, living facilities, financial institutions, intermediary services and business services, etc.	Industrial crackdown, scientific research institutions, public services, education, residence, commercial leisure and other supporting facilities.	With complete infrastructure, it can combine technology, media, commerce, and service industries.

Liu Wei (2022) summarized the related theories of innovative space and the spatial form network. The urban renewal models based on the production of innovative space mainly include the innovation anchor model, the old city regeneration model and the industrial park transformation model[33].

Table 2-5 Typical models and cases of urban renewal based on innovative space

production in the world. Source: Urban Renewal Strategies Based on Innovation Space Production: Theories, Methods and International Experiences

Model	Characteristics	Case	Case Characteristics
Innovation Anchor Model	With R&D institutions, universities, innovative enterprise innovation centers, etc. as the anchor points of location innovation, it has a city center with great location advantages, such as Zhigu and Chuanggu, and other innovative ecological rings	Silicon Alley	Innovative enterprise (cluster) drive
		Central Keystone Innovation district	Universities, governments, and business alliances
		University City. Philadelphia	University Alliance Drive
		Kendall Square	College Drive
		St. Louis City	Universities, governments, and business alliances
		Medellinnovation District	Universities and Government Cooperation Alliance
Old City Regeneration Model	Inefficient urban development areas (industrial areas, storage areas, brownfields, etc.) activate urban industrial transformation and upgrading through renewal, thereby forming a comprehensive innovation area	Mission Bay	Waterfront Renewal
		Boston Innovation District	Port Update
		Midtown Detroit TechTown District	Old City Renewal
		Barcelona 22@ creative community	Waterfront Renewal
		South Lake Union	Warehouse Update
Park Transformation Model	Most of them focus on the transformation of parks in the far and near suburbs with low economic benefits, and the construction of new science and technology cities, etc.	Research Triangle Park	Park Transformation
		Texas Medical Center	Park Transformation
		Arizona Tech Park	Park Transformation
		One-north District	New construction in the park
		Banqiao Technology Valley	New construction in the park

In conclusion, despite several endeavours to identify and classify types of innovation districts, the literature reveals the absence of a comprehensive or widely accepted typology framework for innovation districts. The development of such a typology necessitates a thorough classification of innovation districts as distinct (sub)urban land use types. Therefore, further investigations into innovation district typologies are warranted to enhance our understanding of this domain. The lack of a consistent typology will inform decision-making, planning, and development processes about innovation districts[27].

2.1.4 Space in Innovation District

Innovation activities: Refers to innovation behaviour activities related to high-tech industries, involving the entire process of innovation. Including knowledge acquisition, knowledge processing, and knowledge output, that is, research and development, learning, communication, and production in the innovation process.

Innovative regions, innovative cities, innovative space groups, innovative R&D buildings, and innovative space units are another set of concepts. They relate to spatial scales, from the level of the region, and the city, down to the level of buildings and their internal spatial units[30].

With the construction of innovative cities and the increasingly active urban innovation activities, it is increasingly necessary to build space carriers and environments that can meet the needs of innovative activities, and innovation space has become a hot topic in space research. At present, research results on innovation space mainly focus on the connotation, spatial structure, scale, and spatial classification of innovation space[34].

The research on innovation space at home and abroad mainly focuses on the formation, structure, form, organization and operation of innovation space[33].

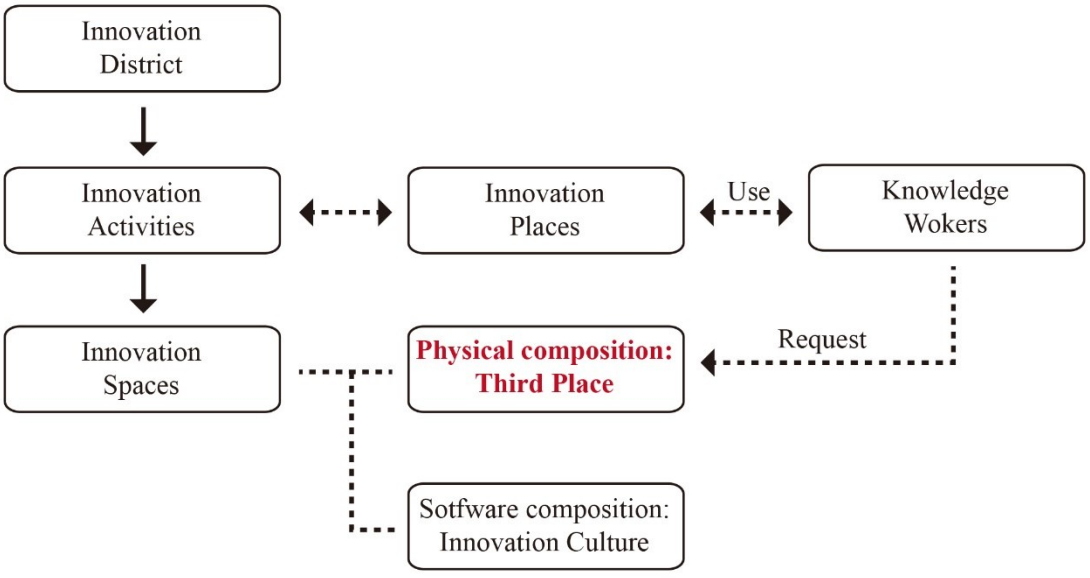


Figure 2-3 The Relationship Between Innovation District and Knowledge Workers.

Source: made by the author.

Zeng Peng (2007) believes that innovation space is a place to carry innovative

activities, "with innovation, research and development, learning, communication and other industrial activities dominated by knowledge economy as the core content"[30]. Guo Jianke (2012) believes that innovation space is a subsystem of the urban complex regional system including innovation subject, elements and supporting environment, which can promote innovation generation, agglomeration and diffusion, and is a complex hard and soft environmental spaces such as infrastructure and policy services[26]

In the study conducted by Wang Xingping (2015), the categorization of innovation spaces resulted in two distinct classifications. The first category encompasses knowledge-based innovation spaces, which include entities such as university research institutes, laboratories, and research institutes. The second category pertains to industrial innovation spaces, which comprise incubators, science and technology parks, high-tech zones, and similar establishments[36]. According to the perspective of Li Xiaojiang (2016), innovative activities necessitate distinct, pre-existing, and interconnected novel spaces, which can be classified into four categories. Firstly, incremental spaces found in certain suburban and urban regions serve as optimal environments for the cultivation and advancement of innovative spaces. Secondly, underdeveloped areas possess the potential for growth through the establishment of innovative spaces, thereby fostering regional development. Thirdly, the revitalization and modernization of existing spaces within older urban areas contribute to the transformation of innovation-driven ecosystems. Lastly, attention should be directed towards rectifying scattered and inefficient spatial configurations within urban settings, facilitating their optimization and consolidation for enhanced innovative endeavours.

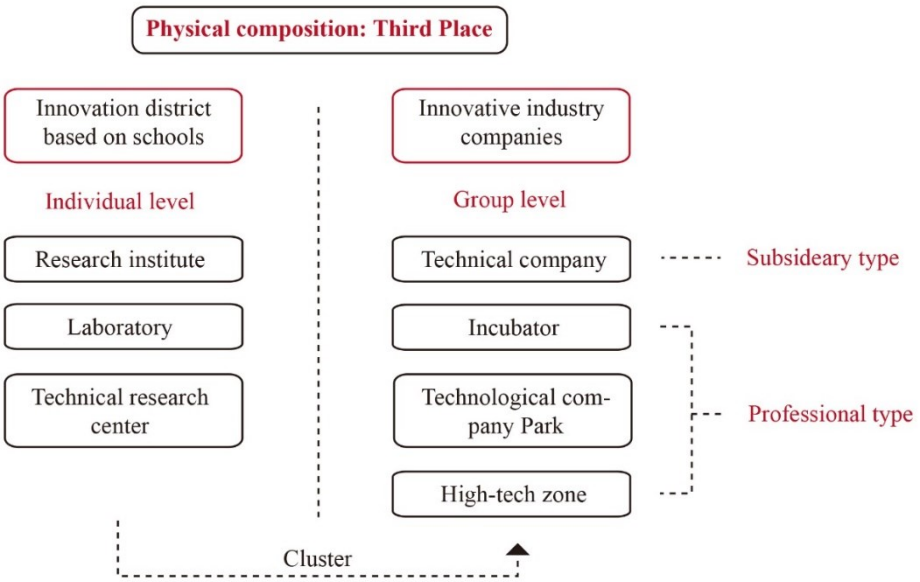


Figure 2-4 Innovation district types. Source: made by the author.

2.2 The Third Place Theory

2.2.1 Difference Between Third Place and Third Place

(1) Third Place

The concept of the "third place" was popularized by sociologist Ray Oldenburg in his book "The Great Good Place." Oldenburg argued that besides the first place (home) and the second place (work), people need a third place to socialize, relax, and foster community engagement. A third place is typically a public or semi-public location where individuals can gather and interact outside of their usual routine. Examples of third places include cafes, community centres, parks, libraries, and barbershops[37].

Key characteristics of third places:

a. Accessibility: Third places are easily accessible to a wide range of individuals.

b. Inclusivity: They provide a welcoming and inclusive environment for people from diverse backgrounds.

c. Neutral ground: Third places are typically neutral and free from the constraints of formal roles and responsibilities.

d. Regular patrons: Third places often have a core group of regular patrons who contribute to the establishment of a sense of community.

(2) Third Space

The concept of the "third space" originates from sociocultural theory and was introduced by cultural theorist Homi K. Bhabha. The notion of the third space refers to a conceptual or theoretical realm that emerges through the interaction between different cultures, identities, and social locations. It is an in-between space that transcends traditional binary categories, such as the colonizer/colonized or dominant/subaltern and allows for the creation of new hybrid identities and cultural expressions.

Key characteristics of the third space:

a. Hybridity: The third space is characterized by the blending and negotiation of different cultural, social, and historical influences.

b. Ambiguity: It challenges fixed definitions and categories, often embracing ambiguity and fluidity.

c. Resistance and subversion: The third space provides a platform for marginalized voices and can be a site of resistance against dominant narratives and power structures.

d. Dialogic interactions: It emphasizes dialogic interactions and recognizes the value of multiple perspectives and knowledge.

(3) Comparison

While both concepts use the term "third" to connote an alternative or additional space, they differ significantly in their focus and implications. The third place primarily relates to physical locations where people gather for social interactions and community-building, whereas the third space is a theoretical framework that explores cultural hybridity, identity formation, and the dynamics between dominant and marginalized groups.

In summary, the third place highlights the importance of physical spaces for social cohesion, while the third space emphasizes the fluid, transformative nature of cultural interactions and the emergence of new hybrid identities.

2.2.2 Relatonship Between Third Place and Innovation District

The third place within the urban innovation district constitutes a significant component of its tangible assets and serves as a vital indicator for assessing the environmental quality of said zone. The third place, in order to facilitate the sustainable development of urban innovation districts, should embody attributes of diversity, inclusivity, and flexibility. These characteristics are crucial in enabling a conducive environment that promotes the advancement of urban innovation districts.

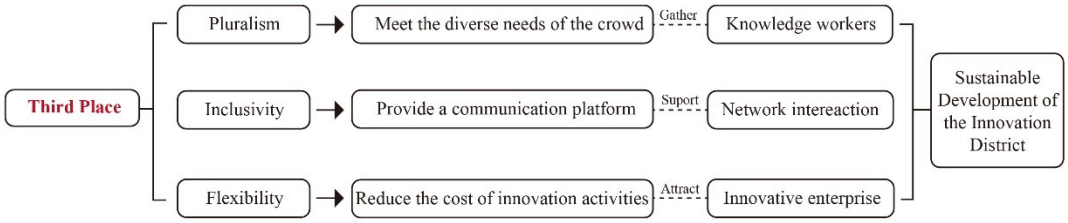


Figure 2-5 The role of the third place in innovation districts. Source: made by the author.

To begin with, the diverse array of third places within urban innovation districts exerts a magnetic pull on innovative talents. These talents constitute the core assets of high-tech enterprises, and their spatial preferences have emerged as pivotal factors influencing enterprise location choices[38]. The varied forms and functions of the third place in urban innovation districts aptly cater to the multifaceted environmental requirements of innovative talents, thereby consistently enticing them to settle in and fostering mutually beneficial interactions among the urban innovation district, innovative talents, and enterprises. This dynamic relationship formation has played a crucial role in the ascent of certain urban innovation districts in the United States, exemplified by Kendall Square[10].

Secondly, the inclusivity of the third place within the urban innovation district serves as a pivotal communication platform for informal exchanges among diverse innovation actors, thereby invigorating innovation dynamics. Urban innovation districts concentrate a multitude of innovation entities such as innovative enterprises, innovation and entrepreneurship groups, and innovation service organizations, necessitating extensive interactions among these entities. An inclusive third place, characterized by

an open environment, a liberated ambience, and diverse functionalities, provides an optimal platform for facilitating knowledge dissemination and sharing among innovative actors. Consequently, it fosters the generation of robust information flows and networked interactions among these actors, thereby promoting the accumulation of social capital, heterogeneous information, and other critical elements of innovation within urban innovation districts[39].

Thirdly, the adaptability of the third place within the urban innovation district plays a pivotal role in reducing the costs associated with innovation activities, thereby facilitating the development of enterprises, particularly small and medium-sized enterprises (SMEs) and start-ups. The third place, especially shared office spaces, within the urban innovation district serves as an innovative environment for individuals or small companies seeking flexible working arrangements. By providing cost-effective spaces and convenient services that accommodate diverse functions such as work and social gatherings, it fosters the sharing of innovation resources within the urban innovation district. This, in turn, aids in curbing the expenses associated with space utilization and knowledge acquisition, notably tacit knowledge, for SMEs and start-ups. The significance of third places becomes particularly pertinent in densely populated contexts due to their role in fostering community cohesion and establishing social connections (Kuo et al. 1998, Oldenburg 1999, Soukup 2006, Jeffries et al. 2009), while still respecting personal privacy boundaries (Oldenburg 1999). Moreover, Kingsley and Townsend (2006) posit that in high-density environments, group memberships are less likely to overlap, necessitating the cultivation of "bridging" relationships across different groups to engender a unified community. Third places are argued to facilitate the formation of these essential "bridging ties" (Oldenburg and Brissett 1982, Hawkins and Ryan 2013).

Prior to Oldenburg's explicit articulation of the third place concept, the existence of such spaces predates it significantly. However, during that time, the academic community had yet to establish a systematic comprehension of the third place. Discussions primarily revolved around the notion of public space, emphasizing its role in facilitating social interactions, serving as a critical conduit[40]. Beginning in the 1960s,

the rise of consumerism and the emergence of the experience economy propelled the proliferation of privately owned spaces like cafes and bars, blurring the boundaries between public and private realms. Attributes such as accessibility and inclusivity gradually gained recognition within society[37], infusing urban spaces and public life with renewed vibrancy. Concurrently, spurred by ongoing globalization and informatization, the connotation of the third place has evolved, accompanied by a diversification of its typologies. Notably, novel forms such as shared office spaces that integrate work and social requirements have emerged[41], exhibiting a dynamic responsiveness to spatial and communal dynamics. Over time, driven by the evolving needs of distinct epochs, the third place has progressively transformed into a hub for social interactions extending beyond residences and conventional workplaces.

In recent years, the emergence of urban innovation districts has engendered transformative shifts in the conceptualization of the third place. Diverging from the "Silicon Valley model" situated in suburban areas, which necessitates car-dependent commuting and entails a relatively lower quality of life [42], the urban innovation district embodies a land use layout characterized by mixed functionalities such as work, residence, and entertainment. Emphasizing the close proximity between diverse innovation actors and the quality of their living environment[43], this model represents a novel scenario and platform for fostering the interplay of innovation processes across the realms of public and private domains within the framework of open innovation [10]. Consequently, it facilitates the integration of the third place into the public sphere through the active involvement of enterprises, talent pools, universities, research institutions, and innovation service providers. Within this innovation ecosystem composed of multifarious entities, the third place assumes fresh connotations, acquiring new dimensions and significance.

This thesis posits that the third place serves as the fundamental domain for communication, entertainment, leisure, and consumption activities of innovative and entrepreneurial communities within urban innovation districts, along with resource utilization. Contrasting the third place found in general regions, the third place within urban innovation districts exhibits distinctive characteristics concerning function, scale,

and typology. Regarding function, the third place in urban innovation districts primarily serves to facilitate the dissemination of tacit knowledge and cultivate a robust atmosphere of innovation, placing heightened emphasis on offering a platform for information exchange and experience sharing among innovative and entrepreneurial groups. In terms of scale, the third place in general regions encompasses both large-scale commercial complexes and small-scale establishments. Conversely, due to the relatively compact size of urban innovation districts themselves, the organization of the third place within them predominantly consists of small-scale areas, characterized by high compactness and spatial flexibility. Public spaces, catering venues, and retail spaces feature prominently in general regions, whereas the third place within urban innovation districts predominantly comprises catering spaces, public spaces, and shared office spaces[4].

Table 2-6 The comparison between the third place of general area and the third place of the urban innovation district. Source: Spatial qualities of innovation districts.

Contrast Aspect	General Area Third Place	The Third Place of Urban Innovation District
Function	Facilitate communication and interaction	Promote the dissemination of tacit knowledge and create a strong atmosphere of innovation
Scale	Various scales are included	Small size
Type	Mainly public space, retail space and dining space	Mainly public space, catering space and shared office space

2.2.3 Types of Third Place

（1） Basic types of physical space:

In the book The Great Good Place(1989), Ray Oldenburg summarised the commonly mentioned third place types[44]:

Coffee Shops and Cafes: In the realm of communal settings, coffee shops and cafes have garnered widespread popularity as quintessential third places, facilitating the convergence of individuals seeking social engagement, work opportunities, or moments of repose. These venues offer an inviting and relaxed ambience, fostering an environment amenable to unhindered discourse and interpersonal connections.

Parks and Public Spaces: In the realm of communal domains, public parks, squares, and akin open spaces frequently assume the role of third places. These locales proffer a cost-free and easily accessible milieu, thereby affording individuals the opportunity to partake in a diverse array of activities encompassing picnicking, engaging in sports, or immersing themselves in the sheer tranquillity of natural surroundings.

Libraries: Within the annals of societal spheres, libraries have long been regarded as pivotal third places. Imbued with an aura of serenity and intellectual provocation, these enclaves furnish a hushed milieu that engenders scholarly pursuits, enabling individuals to peruse literary tomes, engage in diligent study, partake in enriching events, and actively participate in an array of community programs.

Community Centers: Community centres epitomize purposeful establishments aimed at unifying individuals and endowing them with a diverse gamut of services and activities. These multifaceted hubs frequently serve as venues for educational classes, immersive workshops, recreational pursuits, and culturally enriching events, all of which collectively foster robust social bonds and galvanize active community involvement.

Bars and Pubs: Bars and pubs assume the role of quintessential third places, catering to the innate human desire for social interaction and recreational endeavours, predominantly during nocturnal hours. These establishments cultivate an ambience of relaxation, wherein individuals congregate, savour libations, partake in convivial dialogue, and occasionally revel in entertainment spectacles such as live musical performances or pub quizzes.

（2） Transformation of Physical Spaces:

With the emergence of new information technology appliances, knowledge workers are no longer restricted to permanent offices.

In the present milieu, the multifarious functions of the third place are undergoing an increasingly intricate amalgamation. No longer confined solely to fulfilling the rudimentary requirements of social interaction, these spaces are now expected to accommodate a spectrum of activities encompassing knowledge dissemination, business negotiations, online and offline engagements, as well as fostering innovation

and entrepreneurial endeavours. The library serves as an exemplary case study, where the assimilation of novel information technologies has assumed a catalytic role, propelling the transformation of the library into an eminent knowledge nexus, uniquely positioned to amalgamate traditional knowledge reservoirs with cutting-edge information technology[45]. Within its confines, users can access not only physical volumes but also avail themselves of information services and network technology training. Thus, its function surpasses that of a conventional library, evolving into a multifunctional domain facilitating collaborative learning and the formation of cohesive communities. Such a new iteration of the library carries profound social significance, amplifying access to information and knowledge, and advancing democracy, equality, and social justice on a broader societal plane.

（3） Network third place:

Constance A. Steinkuehler conducted a comparative analysis between the multiplayer online game Lineage and Ray Oldenburg's central place theory, considering aspects such as activity level, prevalent discussions, accessibility, and participant consistency. In light of the characteristics attributed to the proposed third place, Steinkuehler contends that the Paradise Game Platform can be classified as a third place[46]. These online communities have emerged as endeavours by individuals seeking to rebuild deteriorating physical communities they have lost[47]. The third network space possesses distinct advantages, overcoming the constraints of physical distance and enabling seamless communication [48]. Nevertheless, it does not exist in isolation from the physical third place nor aims to replace it. Instead, certain physical spaces that integrate online and offline activities are assuming the role of dynamic nodes within cities, merging the virtual and real realms.

（4） Innovative third place

Within the era of globalization and the advent of the information age, novel third places have emerged, including co-working spaces, Internet cafes, and public study rooms. These third places exhibit notable characteristics, characterized by their dynamic nature, the abundance of information, and the fusion of physical and virtual elements . As an illustration, the rise of knowledge-intensive work and the growing independent labour

force has given rise to co-working spaces, providing a flexible shared environment for mobile, decentralized individuals or small companies[49]. Originally, individuals would convene in coffeehouse-like settings to collaborate, leading to their rapid popularity. Co-working spaces offer a multitude of advantages, encompassing opportunities for remote work, face-to-face interactions, heightened productivity, and enhanced creativity. Distinct from conventional office spaces, co-working spaces carry unique implications, fulfilling the demands for flexible work hours and social connections. They transcend mere shared office spaces and desks, resembling creative hubs where social freelancers, entrepreneurs, technical professionals, writers, designers, architects, and others may congregate. These spaces offer physical accommodations, service facilities, and regular interactive activities that deviate from traditional work environments. Some even label co-working spaces as social enterprises, fragmented assemblages of creative intangible production. As a multifaceted and innovative third place, co-working spaces can enhance users' creativity and spatial productivity[50]. Regarding their physical manifestation, co-working spaces exhibit diverse forms, predominantly selecting urban hubs and highly accessible areas. Consequently, they introduce new possibilities for specific professional collectives and exert a tangible influence on urban and community development[49].

2.2.4 Characters of Third Place

Oldenburg's(1999) emphasis on third places in the social infrastructure of cities and the conviviality of public life tended to overlook the complex power relations that entangle gender identities within the sociocultural, political, historical and economic context of leisure practices. In the book Celebrating the Third Place (2001), before unifunctional zoning dictated land use, little stores, taverns, offices, and eateries were located within walking distance of most town and city dwellers and those places constituted "the stuff of community." Oldenburg argues that third places, such as coffee shops, bars, parks, and community centres, are essential for fostering a sense of belonging, community, and social interaction. These places provide a relaxed and informal setting where people from diverse backgrounds can come together, engage in conversations, and build social

connections. The book emphasizes the importance of third places in promoting democracy, civic engagement, and overall well-being. Oldenburg believes that these spaces play a vital role in facilitating public discourse, generating ideas, and cultivating a sense of community ownership. Throughout the book, Oldenburg explores various aspects of third places, including their historical significance, their impact on individual and community health, and the challenges they face in modern society. He offers insights and suggestions for creating and revitalizing third places in communities, recognizing their value in enhancing social capital and improving quality of life[44].

In the book Rethinking Third Places and community building (2019), the focus is on creating inclusive and diverse third places that go beyond physical locations and encompass digital spaces as well. The goal is to enhance community building and social interactions through various means, including technology, design, and programming[51]. Key elements of this rethinking include:

(1) Inclusivity: Emphasizing the importance of creating third places that are welcoming to all individuals, regardless of their background, age, or social status. This involves designing spaces that cater to diverse needs and interests, promoting accessibility, and fostering a sense of belonging for marginalized groups.

(2) Multifunctionality: Recognizing that third places can serve multiple purposes and cater to various activities. For instance, a coffee shop might host book clubs, art exhibitions, or community events, transforming it into a hub for different forms of engagement.

(3) Digital Integration: Acknowledging the increasing significance of online platforms and virtual communities in contemporary society. Incorporating digital tools.

(4) Collaboration and Co-creation: Encouraging collaboration among community members to actively participate in shaping and maintaining third places. Engaging locals in decision-making, design processes, and programming fosters a sense of ownership, empowering individuals to contribute to their community's development.

(5) Sustainability, With the increasingly serious problem of climate change and the development of science and technology, as the source of high-tech research and development, the innovation district should reflect its sustainability.

3. CASE STUDY

3.1 Silicon Valley, San Francisco, USA

3.1.1 Site

Silicon Valley is geographically situated within a slender corridor at the southern terminus of the San Francisco Bay Area in the United States. Encompassing four counties and encompassing thirty distinct communities spanning the vicinity of the San Francisco Bay, its overall landmass extends to approximately 4801 square kilometres.

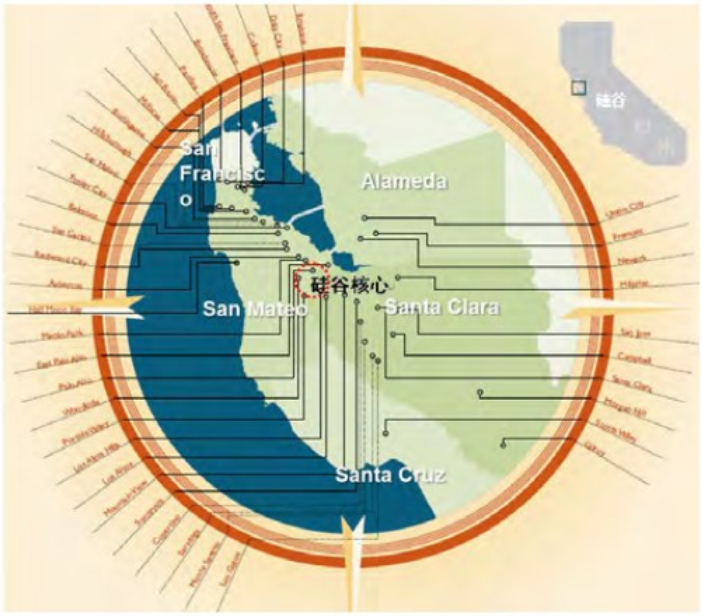


Figure 3-1 Silicon Valley consists of 4 counties and 30 communities surrounding the San Francisco Bay. Source: Research on spatial layout and planning control of Silicon Valley in the United States from the perspective of technological innovation

Attributable to advancements in high-tech technology, it has emerged as a prominent exemplar of an innovative region. It serves as a convergence point for esteemed universities renowned for their robust scientific research capabilities, including Steins University, University of California, Berkeley, and Santa Clara University, among others. Additionally, it attracts a multitude of high-tech industrial enterprises, alongside globally recognized internet giants such as Google, Facebook, Apple, and Yahoo,

primarily engaged in knowledge-driven innovation. The confluence of these entities contributes to the region's innovation ecosystem and fosters the presence of unicorn companies.

3.1.2 Design Features

（1） Cellular growth

Silicon Valley has experienced a transformative evolution, transitioning from dispersed autonomous municipalities into a network of urban agglomerations. Each city within this region exhibits a comprehensive functional framework, characterized by a hierarchical arrangement of distinct functional cell clusters such as commercial service areas, scientific research office zones, residential sectors, and industrial precincts. These cell clusters are demarcated by verdant ecological corridors, serving as flexible boundaries that accommodate urban land expansion. Furthermore, the interlinking of these cells is facilitated through a transportation network comprising major traffic arteries, employing a Transit-Oriented Development (TOD) mode of development[52].

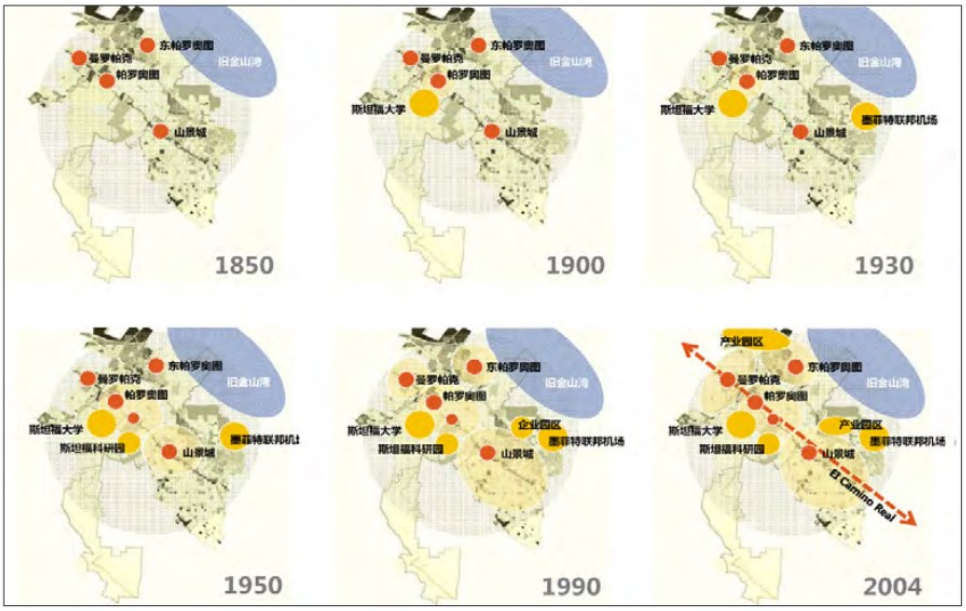


Figure 3-2 The Evolution of Silicon Valley's Core Space. Source: Research on spatial layout and planning control of Silicon Valley in the United States from the perspective of technological innovation.

（2） Circular layout

Silicon Valley, centered around San Francisco, manifests a concentric spatial

arrangement. The immediate vicinity of the San Francisco Bay waterfront assumes a recreational zone, succeeded by scientific research office precincts and corporate headquarters, further followed by residential communities. The outermost periphery encompasses an ecological conservation area. Nestled between the residential community and the ecological conservation area lies Stanford University, while major office complexes are strategically positioned in close proximity to the institution, thereby establishing an interconnected service network. To facilitate seamless connectivity, Silicon Valley employs a public communication corridor that sequentially links each concentric circle. Notably, this area boasts a plethora of cafes, restaurants, and bars, serving as focal hubs for social gatherings, business negotiations, and creative ideation. Public transport stations are strategically situated at the intersections of vital arterial roads and transportation corridors, while the adjacent areas along the transportation route are equipped with complementary amenities catering to diverse functions, including scientific research, business activities, and residential accommodations.

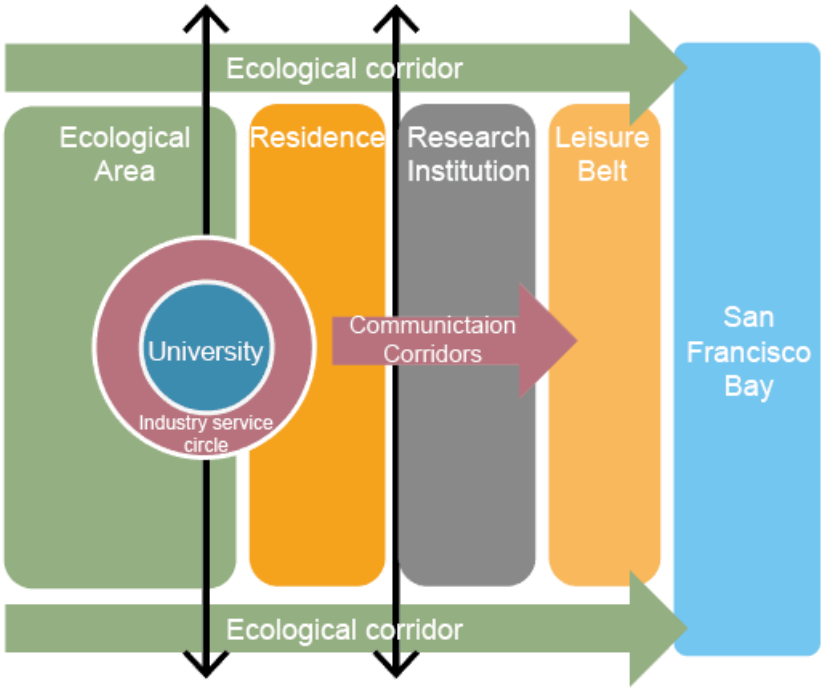


Figure 3-3 Schematic diagram of a typical cluster space structure. Source: Research on spatial layout and planning control of Silicon Valley in the United States from the

perspective of technological innovation

（3） Industry-University close layout

The industrial sector exhibits extensive interconnections with universities and scientific research institutions, fostering innovative and collaborative relationships such as industry-university-research cooperation programs. Taking Stanford University as a case in point, the older section of the city is positioned to the north, with University Street and Dune Street serving as central axes, and California Street positioned towards the eastern side. Notably, Shaqiu Road, commonly referred to as "VC Street," represents a distinctive commercial thoroughfare, attracting a concentration of venture capital firms. Surrounding this street are numerous innovative enterprises, engendering a closely interconnected service network. These interconnected layers are further consolidated through the utilization of public communication corridors, which facilitate seamless connections between each concentric circle. The Stanford Research Park, in particular, shares a close association with the city, benefitting from the presence of expressways and main roads that traverse the park, ensuring convenient accessibility and fostering interconnectedness with neighbouring cities.

（4） Friendly environment

Silicon Valley's favourable ecological environment has exerted a magnetic pull on a growing influx of talent, invigorating their creative prowess. Across numerous cities within Silicon Valley, a noteworthy emphasis is placed on preserving ecological green spaces, with over 40% of such areas being safeguarded. Stringent regulations govern non-construction land, ensuring its effective conservation. Moreover, ample provisions are made for outdoor sports grounds and leisure facilities, facilitating recreational pursuits for residents and visitors alike.

（5） Diversed public spaces

Silicon Valley has proactively developed a plethora of public spaces, encompassing establishments like cafes, convenience stores, retail outlets, and third places. Furthermore, the office areas within this region feature a diverse array of flexible space configurations, including shared offices, co-working spaces, and innovative workspaces. These initiatives are implemented with the aim of fostering effective

communication among individuals and kindling inspiration in the community.

（6） Diversed innovation spaces

Silicon Valley serves as a convergence hub for the corporate headquarters of numerous high-tech enterprises, each embodying a park-like setting characterized by multifaceted and diversified functionalities. Notably, this dynamic ecosystem encompasses a profusion of low-cost innovation spaces, with some companies having their humble beginnings in residential garages. Moreover, coffee shops have assumed a pivotal role as essential hubs for entrepreneurial exchanges and information sharing, offering a conducive environment for individuals to engage in vibrant startup-related interactions.

（7） Flexible land use

The United States employs a hybrid approach of employing both rigid planning spaces and flexible mixed and superimposed areas to effectively regulate land zoning. The peripheral region surrounding University Street in Palo Alto, as well as the Stanford Science Park, represent vibrant and thriving sectors within Silicon Valley. The introduction of mixed superimposition areas plays a pivotal role in bolstering the vitality of the city. Local governments, while ensuring adherence to fundamental frameworks and regional planning controls, have established innovative and adaptable zones, thereby relaxing the functional access mechanisms associated with these areas. Consequently, this approach engenders substantial flexibility in terms of function combinations and research and development activities. Through the implementation of innovation-oriented land classifications and permits, land utilization becomes more compatible, facilitating collaborative initiatives within the industry and fostering an environment conducive to innovation[34].

3.2 Kendall Square, Boston, USA

3.2.1 Site

Kendall Square, situated within the Boston metropolitan area, Massachusetts, USA, has gained global recognition as a renowned urban innovation district. Positioned across the Charles River from the heart of Boston, it has earned the distinction of being hailed

as "the most innovative square mile in the world." This vibrant locale is in close proximity to esteemed academic institutions such as the Massachusetts Institute of Technology, Harvard University, and Boston University. Kendall Square is esteemed for its dense concentration of innovative enterprises, fostering an environment conducive to groundbreaking advancements. Additionally, it is distinguished by its pleasant neighbourhood ambience and serves as a thriving hub for the biotechnology and information technology industries[53].

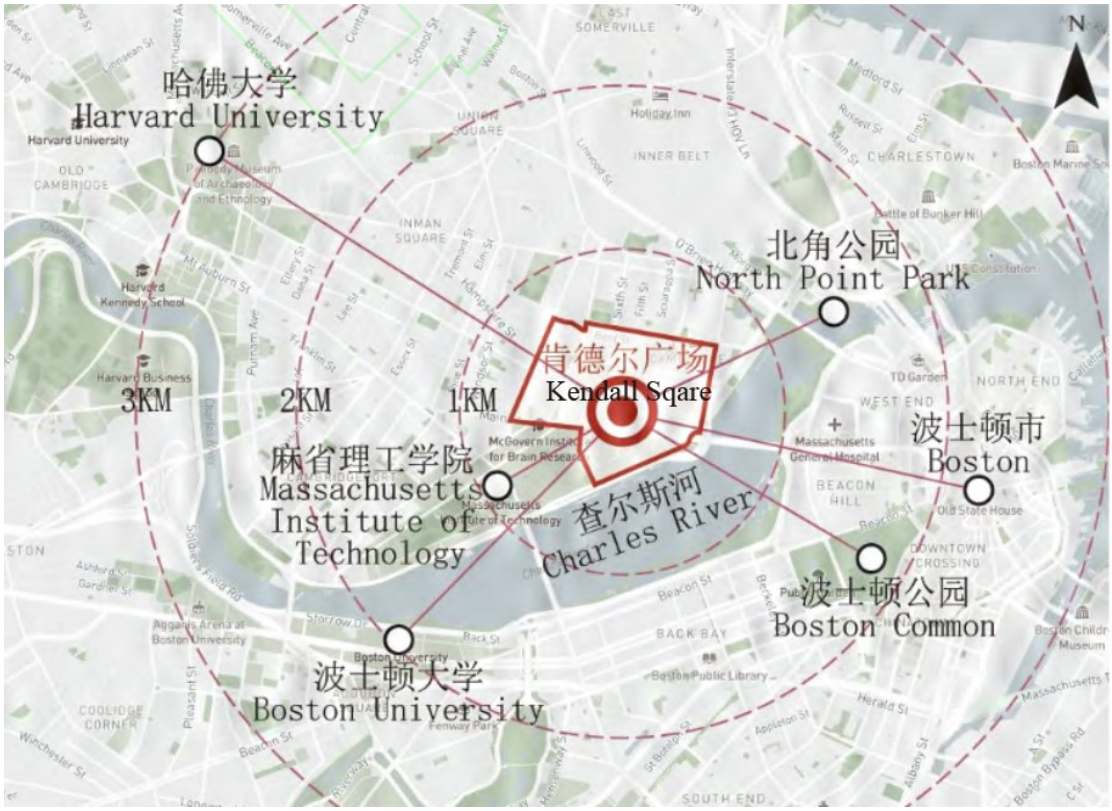


Figure 3-4 Kendall Square: The most innovative square mile in the world. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

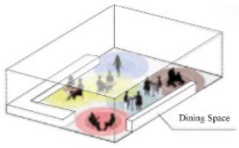
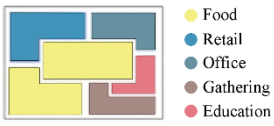
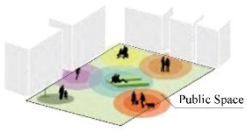
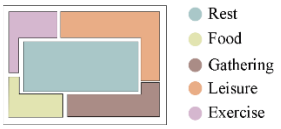
3.2.2 Design Features

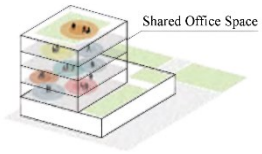
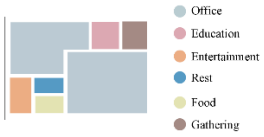
(1) Diversified third place function combination

Kendall Square places significant emphasis on the integrated functions of the third place, catering to the diverse functional requirements of innovative talents through a variety of spatial function combinations such as "catering + office," "rest + party," and

"office + entertainment." Specifically, by employing horizontal and vertical integration at the architectural level and comprehensively blending pedestrian scales, different types of third places amalgamate multiple functions including catering, retail, office work, social gatherings, education, relaxation, and entertainment within a singular spatial framework. This integration fosters mutual permeation and gradually establishes a functional layout structure that integrates "life-work-study-entertainment" development. However, in terms of the spatial configuration of functional combinations, Kendall Square predominantly leans towards horizontal integration, while vertical functional blending is comparatively less pronounced. Furthermore, in addition to the mixed-function layout, Kendall Square places considerable emphasis on guiding different functions within the same spatial framework to assume leading roles during distinct time periods, thereby ensuring the innovation district maintains a continuous vitality for innovation. For instance, Catalyst Restaurant exemplifies this by serving as both a dining and office space for innovative talents at different times, while also hosting various themed events such as cocktail parties and holiday gatherings, thereby manifesting multi-dimensional feature integration.

Table 3-1 Kendall Square Third place Mixed Mode. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

Category	Typical Case	Function	Pattern Diagram	
Dining space	Catalyst Restaurant	catering, retail, office, party, educate		
Public space	Marriott Plaza	rest, dining parties, entertainment, exercise		

Shared office space	Cambridge Innovation Center	office, education entertainment, rest Catering, party		

The third place within Kendall Square employs diverse spatial carriers and activities to achieve internal functional blending. On one hand, it fosters informal communication among individuals from different fields and age groups, while on the other hand, it facilitates the sharing and exchange of innovation and entrepreneurial resources. In the context of domestic urban innovation districts, there exists a low degree of functional blending among different types of third places, and the role of third places, particularly catering spaces, in promoting innovation remains largely unexplored[42]. To enhance the degree of functional blending within the third place, it is necessary to introduce diverse facilities, services, and activities. Simultaneously, it is crucial to promote vertical functional integration and the mixing of land use between the third place and other spaces, thus providing a range of informal communication venues for innovative talents and facilitating the sharing and exchange of innovation resources. This multifaceted approach ensures the sustained innovation vitality of urban innovation districts.

(2) Implementation of phased third place construction and renewal

During the evolution of Kendall Square from an industrial zone to a business office area and subsequently, to an innovation hub, the municipal government of Boston has implemented phased and gradual construction and renewal plans to enhance the quality of the third place, aligning with the spatial requirements of innovative talents and enterprises across different developmental stages (Table 2-3). Analyzing the changes in Kendall Square's land use structure during different periods (Figure 3-5), several observations can be made. During the transition period from an industrial area to a commercial office area (1980-2000), a portion of the industrial land was repurposed for commercial facilities and residential use, resulting in increased plot density, albeit predominantly serving single-office functions. The newly added third place primarily consisted of public areas such as parks and squares, catering to the daily relaxation

needs of office workers. In the subsequent transition from the district to the innovation district (2001-2012), the construction density of Kendall Square further intensified, incorporating numerous commercial facilities, residential areas, and green spaces. The development of the third place during this stage primarily focused on shared office spaces and catering spaces, with the latter exhibiting a trend towards multifunctional integration, reflecting the demand for flexible workspaces and diverse communication among enterprises and talents within the innovation-driven economy[54]. In the current phase of innovation district development (2013-present), Kendall Square increasingly prioritizes the creation of a conducive environment for the innovation district. The newly added land is predominantly allocated for commercial facilities, while shared office spaces remain a prominent feature. However, no specific plan targeting the third place has been issued, and the existing plan has limited intervention in the development of private third places. Nevertheless, guided by a series of plans, the functions and activities within Kendall Square's catering spaces have continuously expanded, public spaces have witnessed enrichment in terms of facilities and landscapes, and shared office spaces have improved in terms of variety and services. Consequently, a relatively stable system of third places has gradually emerged.

Table 3-2 Kendall Square's attention to the construction and renewal of the third place in different periods of planning. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston [55]

Development Stages	Promulgated Plan	Years	Details
1980-2000 (starting stage)	East Cambridge Riverfront Plan and Implementation	1978	1. Add a number of dining spaces facing the street; 2. Create a wide canal pedestrian plaza
	Kendall Square PUD	1999	1. Create a public space along the Charles River; 2. Introduce a number of street-facing dining spaces in Cambridge Research Park, and establish a zoning incentive mechanism for living space and dining space
2001-2012 (accelerated	Eastern Cambridge Planning Study	2001	Establish a zoning incentive mechanism for living space and dining space

development stage)	303 Third Street PUD	2003	Establish a zoning incentive mechanism for living space and dining space
	Alexandria Rezoning	2009	1. Increase the construction density of catering space; 2. Build new public spaces
From 2013 to now (perfect stage)	Kendall Square Final Report	2013	1. Increase building density to develop more third places; 2. Introduce characteristic and regional small-scale catering institutions to create active and convenient catering spaces
	Kendall Square Initiative	2015	Provide functional, diverse street furniture and widen streets to facilitate pedestrian interaction
	Implementation Plan Kendall Square Urban Renewal Area 2016-2020	2015	Renovation and reconstruction of Galaxy Park etc. will be achieved by introducing relevant facilities and improving the surrounding landscape
	Kendal1 Square Urban Renewal Proiect (KSURP) Amendment No.10)	2016	1. Create a roof garden; 2. Improve the landscape of the main street in the planning area
	MXD Infiil Development Concept Plan	2017	1. Expand Broadway Park and Binney Park and introduce various tables, chairs, and plants to enhance the diversity and ornamental value of the park; 2. Attract pedestrians to enter the street by adding new seats, improving lighting systems, and enriching extreme wood species; 3. Turn Broadway Street into a restaurant corridor to ensure that potential food and beverage formats are complementary to existing food and beverage formats

Figure 3-5 Kendall Square Site Structural Evolution. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

By implementing phased construction and renewal strategies, Kendall Square has successfully enhanced the quality of its third place, effectively catering to the evolving demands of the region and its inhabitants across different time periods. While the development of urban innovation districts in China has been relatively recent, it has exhibited robust growth momentum. In recent years, there has been an increasing trend of local governments directly promoting urban innovation districts. However, many urban innovation districts in China primarily rely on high-tech zones, science and technology parks, and university campuses for development, with some being entirely newly constructed science and technology cities or science cities[56]. Consequently, the foundation for third place development in these areas remains relatively weak. Drawing inspiration from the experience of Kendall Square, domestic urban innovation districts should not only prioritize the construction of third places but also progressively promote their development through systematic planning and a focus on creating a favourablemarket environment. In this process, urban innovation districts should

carefully balance the relationship between third place construction, urban renewal, and new district development, gradually establishing a functional adaptable third place system that aligns with the development stage of the innovation district and the specific needs of enterprises and talents.

(3) Building a networked third place system with high internal and external connectivity

Guided by a comprehensive set of plans, Kendall Square has successfully established a highly interconnected and networked third place system, both internally and externally, through the creation of a network of public space connections, pedestrian networks, and transportation networks. This has significantly enhanced the frequency of communication and interaction among innovative and entrepreneurial groups. Internally, Kendall Square exhibits strong connectivity among its various types of third places. Firstly, the dining space extends its reach to the public space by incorporating outdoor seating areas and hosting themed activities, thereby fostering a connection between the dining space and the public space. Secondly, the implementation of continuous pedestrian streets facilitates the networked connection among dining spaces, public spaces, and shared office spaces, thereby promoting bi-directional pedestrian flow. Externally, the third place in Kendall Square places emphasis on its connection with transportation hubs such as subway and bus stations, ensuring excellent transportation accessibility. The distribution of Kendall Square's third place is concentrated along Main Street, Third Street, Broadway Street, and Ames Street within a 500-meter radius of Kendall Square Station. These main thoroughfares are situated in close proximity to bus and subway stations, facilitating convenient communication with the outside world.

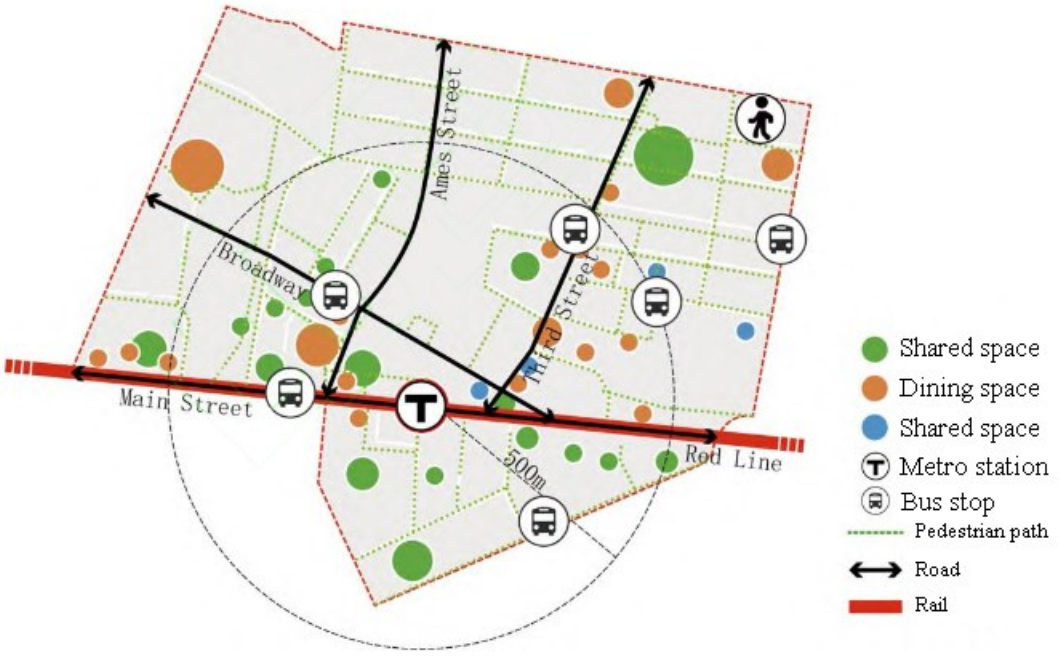


Figure 3-6 Kendall Square Third Place Connect Network. Source: Spatial qualities of innovation districts [55]

Kendall Square focuses on building a networked third place system. On the basis of realizing a high degree of connectivity inside and outside the tangible material space, it also opens up an invisible "channel" for smooth communication between innovative subjects. For some domestic urban innovation districts with large-scale and closed block forms, the internal and external connections of the third place are often not close enough, which limits the effective dissemination of knowledge and information to a certain extent. Referring to the practice of Kendall Square, while improving the quality of the third place, this type of urban innovation district can adopt new construction and reconstruction methods to create a dense and walkable street network and promote the interior by connecting physical spaces of different sizes, shapes and types. Improve the interaction of people, improve the public transportation service system, and enhance the external connectivity of the innovation district.

3.2.3 Third Place in Kendall Square

Kendall Square exhibits a dedicated endeavour towards augmenting the regional

environment's quality, drawing in innovative talents, and fostering the diversity of innovative activities through the establishment of the third place. This strategic initiative effectively invigorates the vitality of regional innovation[14]. The inception of the third place construction in Kendall Square can be traced back to the 1980s, culminating in the establishment of a relatively stable spatial configuration by the early 21st century. Primarily encompassing retail spaces, public areas, and shared office spaces, the third place construct plays a pivotal role in promoting collaborative engagement and stimulating a culture of innovation within the region.

Figure 3-7 Kendall Square Third place Status. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

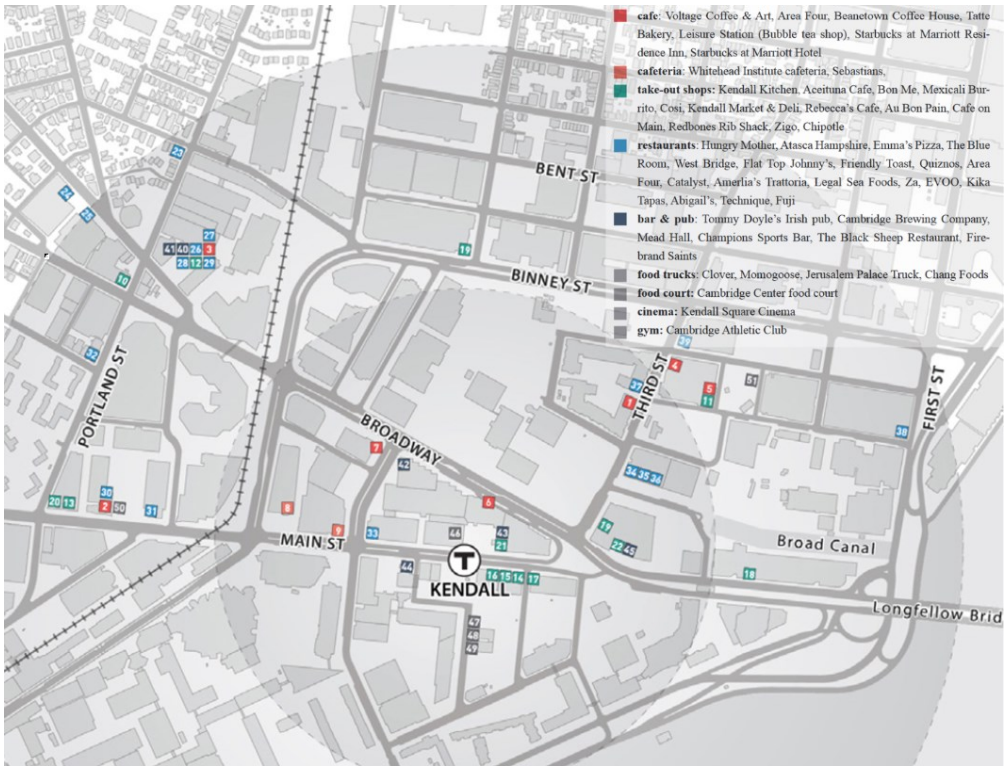


Figure 3-8 Retail Space in Kendall Square. Source: Spatial qualities of innovation districts [4]

Figure 3-9 Public Space in Kendall Square. Source: Spatial qualities of innovation districts [4]

(1) Dining spaces: blending of commercial and non-commercial functions

Since the 1980s, Kendall Square has witnessed the gradual integration of dining spaces as an integral component of its urban fabric. Initially, the dining spaces primarily catered to the material needs of office workers and were concentrated within the Riverfront Office Park and Technology Square areas, serving as the main epicentres for dining activities. However, as the development progressed, the spatial layout and functions of the dining spaces underwent notable transformations. Presently, dining spaces are predominantly dispersed along Broadway and Third Street, occupying the ground floor spaces of various types of buildings across the land. Notably, One Kendall Square and Marriott Hotel exhibit a distinct concentration of dining establishments, exhibiting concentrated distribution characteristics (Figure n).

Figure 3-10 Distribution of main dining spaces in Kendall Square. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

At the functional level, the catering space in Kendall Square has undergone a transformative evolution to cater to the specific needs of innovative talents and enterprises. It has evolved into a multifunctional space that integrates various non-commercial functions such as office work, social interactions, learning, leisure, and entertainment. In contrast to traditional catering spaces that primarily serve commercial

purposes, the catering space in Kendall Square offers diverse spaces and facilities that facilitate multiple activities. Moreover, it frequently hosts various communication events, fostering a comfortable environment and an open atmosphere that effectively encourages interactions among individuals (Table 3-3). Specifically, the catering space in Kendall Plaza has gradually transformed into an "extended office space" and a significant hub for face-to-face exchanges among individuals from different industries. This transformation is attributed to the provision of free high-speed WiFi, flexible and open functional spaces, and well-spaced seating arrangements, among other facilities. Furthermore, the vibrancy of Kendall Square's dining space is evident through the frequent organization of various exchange activities, such as knowledge-sharing sessions and coffee gatherings. For many entrepreneurs, these communication activities offered within the dining space serve as a vital and convenient avenue to enter Kendall Square's innovation ecosystem and expand their professional networks.

Table 3-3 Facilities configuration and communication activities of typical dining space in Kendall Square. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston [55]

Type	Name	Space and Facilities	Activities
Bar	Cambridge Brewing Company	Open dining space	Autumn Carnival, Bike Festival, Music Festival
Restaurant	Catalyst Restaurant	1 Space: Gathering space, seasonal terrace, flexible function space; 2. Facilities: Seats in various styles, soundproof walls, advanced audio-visual equipment public lounge, event venue	Corporate internal meetings, product launches, cocktail parties, holiday parties
Café	Venture Café		Thursday coffee meeting, knowledge sharing session

(2) Public space: a city living room that is both open and inclusive

Prior to the 1980s, Kendall Square's third place primarily comprised block-shaped public areas, including parks and squares[57]. However, it was not until the planning and development of Kendall Square in the 1980s that the significance of pedestrian-friendly environments gained emphasis. During this period, public spaces were predominantly

located around the Massachusetts Institute of Technology (MIT) campus on the southern side of Kendall Square. Over time, the number of public spaces along the western side of Kendall Square and along the Charles River gradually increased. Subsequently, in the early 21st century, public space facilities on the eastern and northern sides of Kendall Square saw gradual improvements. By 2012, the pattern of public spaces in Kendall Square had essentially stabilized, with subsequent planning efforts focusing on renovating existing spaces. Currently, the pedestrian streets within Kendall Square connect diverse public spaces, such as parks and squares, forming a well-connected and easily accessible public space system. With the continual enhancement of spatial quality, Kendall Square's public spaces have transformed into an open and inclusive urban living room within the Innovation District, fostering the exchange and collaboration among innovative talents.

Figure 3-11 Distribution of main public spaces in Kendall Square.Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

The inclusiveness and openness of Kendall Square's public spaces are evident in multiple aspects, encompassing facility arrangement, event organization, and spatial scale. Practical amenities like tables and chairs, ornamental features such as fountains,

and entertainment facilities like ice rinks are commonly found in these public spaces, creating venues for diverse activities including seasonal events and music festivals. The scale of Kendall Square's public spaces is typically moderate, ranging from a few hundred square meters to several thousand square meters. Overall, the planning and design of these spaces take into account the varied needs of individuals across different occupations and age groups. By fostering extended visits and encouraging people to engage within the public spaces, communication among individuals from diverse social backgrounds is promoted, leading to an increased likelihood of novel ideas and the collision of fresh perspectives.

Table 3-4 Basic situation of the main public space of Kendall Square. Source: https://www.cambridgeredevelopment.org/pops

Category	Name	Facilities and Activities	Area（㎡）
Park	Galaxy Park	Ring Bench, Sculpture	825
	Timothy J. Toomey 、Jr. Park	1. Facilities: chairs, dog park; 2. Activities: Water games	9955
	Binney Park	Seats, Interactive Lounges, Sculptures, Playgrounds	726
	Broadway Park	1. Facilities: Seats, dining tables; 2. Events: Summer open-air movies, concerts	1298
Roof Garden	Kendall Center Rooftop Garden	1. Facilities: seating, dining tables; 2. Activities: fitness classes, gardening workshops, cooking activities	2354
Plaza	Henri A.Termeer Square	Seats, dining tables, ponds, sculptures, ice rinks	3345
Street	Marriott Plaza	1. Facilities: Seating; 2. Events: Temporary art exhibitions, music festivals, seasonal farmers markets, social events	1335
	Pioneer Way Easement	Dining table, Chair	1173

(3) Shared office space: diversified space forms and service subjects

In comparison to dining spaces and public spaces, the development of co-working spaces in Kendall Square has received relatively less planning intervention and commenced at a later stage. From the late 20th century to the early 21st century, as Kendall Square transformed from an office park into an urban innovation hub, the limitations of traditional office spaces, such as inflexibility and high costs, became

apparent and no longer met the needs of innovative and entrepreneurial groups. In response, the establishment of the Cambridge Innovation Center in 1999 provided a dedicated hub for innovation-driven individuals and entrepreneurial teams. As Kendall Square's global influence expanded and attracted an increasing number of multinational companies, the resulting competition for space necessitated the provision of flexible and cost-effective innovation spaces for startups and small and medium-sized enterprises (SMEs). In 2012, the "Kendall Square Central Square Planning" proposed allocating 5% of newly added office space for shared office purposes. Subsequently, the number of shared office spaces in Kendall Square has progressively grown.

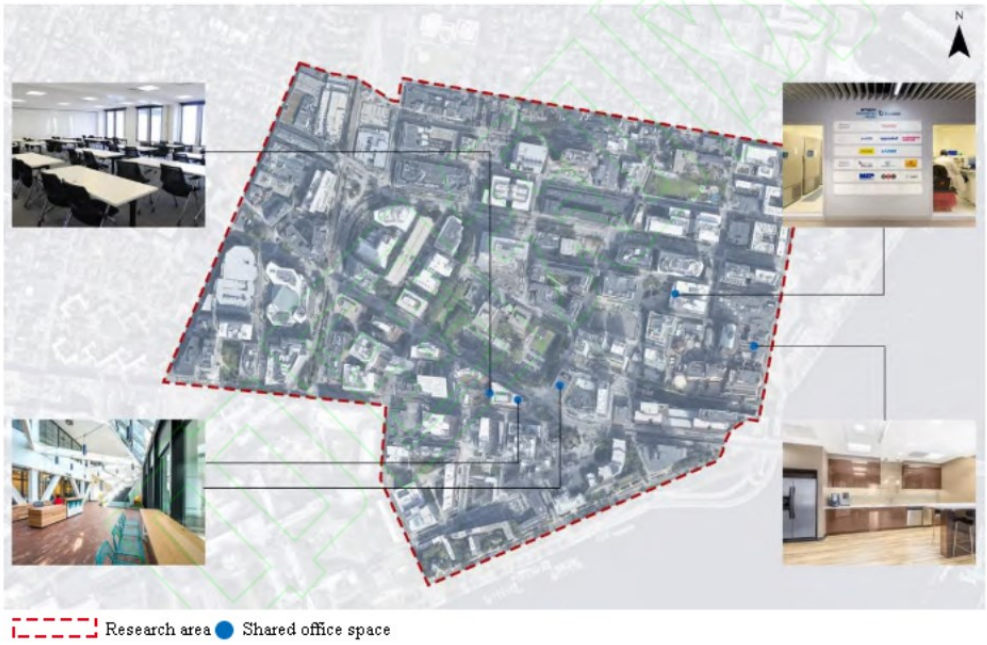


Figure 3-12 Main co-working space in Kendall Square. Source: Development Characteristics and Construction Strategies of Third Places in Urban Innovation District: A Case Study of Kendall Square in Boston

The shared office spaces in Kendall Square exhibit diverse spatial configurations and cater to a wide range of service recipients. By facilitating the sharing and utilization of innovative resources, these spaces have significantly lowered the entry barriers for startups and small and medium-sized enterprises (SMEs), thereby fostering the growth of enterprises from diverse social backgrounds and professional fields. Within these spaces, members engage in knowledge sharing and exchange of experiences. As depicted, co-working spaces encompass various types of areas, including collaborative office spaces, meeting rooms, and event spaces. The office facilities provided

encompass high-speed Wi-Fi, printing facilities, and video conferencing equipment. The services primarily target entrepreneurs, investors, startups, and nonprofit organizations. The presence of shared office spaces, such as the renowned Cambridge Innovation Center, has attracted numerous startups and nonprofits to establish themselves in Kendall Square, playing a pivotal role in cultivating a vibrant innovation ecosystem within the Innovation District[55].

3.3 Zhongguancun Street, Beijing, China

3.3.1 Site

Zhongguancun Street stretches over a distance of 7.2 kilometres. Historically known as Baiyi Road prior to the establishment of the People's Republic of China, it served as a suburban thoroughfare connecting the urban core of Beijing with the imperial gardens. In the late 1980s, the emergence of Zhongguancun Electronics Street sparked the revitalization of the surrounding areas, leading to the official designation of Zhongguancun Street. Presently, this locale has evolved into a renowned innovation avenue, attracting a multitude of innovative enterprises and scientific research institutions, consequently fostering a vibrant ecosystem that draws innovative individuals to the area.

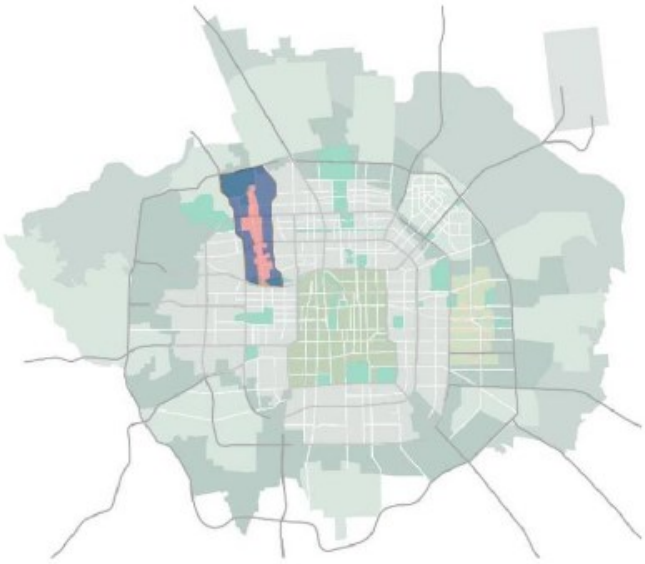


Figure 3-13 The location of Zhongguancun Street in Beijing, Source: Study on Urban

Design of Important Streets Connected to Implementation

3.3.2 Design Features

(1) Function remodeling

Zhongguancun Street facilitates the comprehensive advancement of the four zones through the delineation of their core functions and the establishment of three key systems, encompassing the following:

a) Reinforcing local culture

Through meticulous evaluation and optimization of the prevailing land resources within Zhongguancun Street, along with the augmentation of its functionalities, a novel landmark that showcases distinct regional characteristics can be realized. A progressive approach involves the gradual transformation of the enclosed courtyards flanking Zhongguancun Street into accessible open spaces, thereby enriching the market's functions through the addition of supplementary facilities.

b) Upgrading low-end businesses

Through the implementation of innovative service functions, the low-end business forms present on both sides of Zhongguancun Street can be elevated, culminating in the transformation and upgrading of the entire area. This progression can be achieved by introducing high-end business forms, thereby fostering a shift towards more sophisticated and advanced commercial activities.

c) Innovative renewal model of old communities

Drawing upon the requirements of innovative individuals, a thorough exploration of diverse residential renewal models is essential to effectively activate the functionalities of Zhongguancun Street. By considering the unique demands and preferences of this demographic, strategic approaches can be developed to revitalize residential spaces, thereby unlocking their full potential and contributing to the dynamic activation of Zhongguancun Street's multifaceted functions.

(2) Traffic remodeling

Zhongguancun Street advocates for the prioritization of public transportation and the alleviation of transit congestion through the strategic reshaping of rights-of-way. A

comprehensive assessment of the spatial interplay between roads and buildings is crucial. The implementation of the small streets and dense roads concept is recommended, accompanied by the enhancement of living roads and internal road networks. Additionally, the establishment of three-dimensional corridors can effectively bolster connectivity between buildings. Leveraging smart traffic control measures enables the maximization of both traffic comfort and utilization efficiency, ultimately optimizing the overall transportation experience.

Figure 3-14 Zhongguancun Street Traffic Remodeling, Source: Study on Urban Design of Important Streets Connected to Implementation

(3) Construction of a shared vitality ring

Zhongguancun Street catalyzes the development of urban vitality spaces through the establishment of a shared vitality ring within the block. This Vitality Ring comprises various components, such as leisure jogging paths, Vitality Chronic Lines, strip parks, and a multitude of diverse public service facilities. Its construction is intricately linked with the walking life circle, intertwining and harmonizing with the surrounding environment to foster a vibrant and dynamic urban atmosphere.

(4) Improve functional compounding

To enhance the impetus of urban innovation and achieve the multi-dimensional

integration of complex urban functions and spaces, a comprehensive approach is adopted, encompassing both horizontal and vertical dimensions. At the horizontal level, a mixed-use approach is employed to amalgamate diverse functions within each designated area. Simultaneously, at the vertical level, the ground floor of buildings is strategically integrated with functional spaces dedicated to innovation, such as meeting rooms, screening halls, and cafes. These embedded spaces provide increased opportunities for interpersonal communication, facilitating knowledge exchange and collaboration. The inclusive coverage of innovative functions in multiple directions and scales ensures convenient accessibility for individuals engaged in innovation-driven activities. Moreover, emphasis is placed on the creation of open spaces, which facilitate communication at the ground level and expand the availability of urban space to a wider audience, thereby optimizing space utilization efficiency. Attention is also given to the interactive utilization of aerial corridors, roof gardens, sunken squares, and other spatial elements, further enhancing the overall functionality and aesthetic appeal of the urban environment.

(5) Flexible spatial patterns

The spatial arrangement of Zhongguancun adheres to a "sixteen gardens in one district" concept, where each park exhibits relative autonomy while simultaneously enabling integration to form a self-contained cohesive unit. Several smaller parks are strategically managed and guided, employing classification and categorization principles through road systems, public amenities, and residential zones. Through the synthesis of multiple small parks, a large circular framework is established, enveloping the layout of public service facilities. This model fosters a dynamic and expandable park system that seamlessly integrates the realms of industry and urban living.

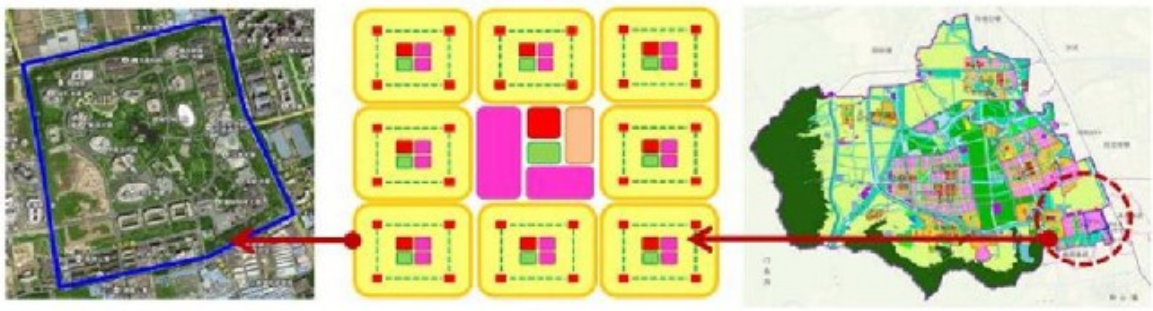


Figure 3-15 Schematic diagram of small gardens and large gardens in the mountain area of Zhongguancun, Source: China Academy of Urban Planning and Design 2014

3.4 One-North, Singapore

3.4.1 Site

"One-North Technology City, situated in Queenstown, an area southwest of Singapore, was originally known as the Buona Vista Science Hub. This nomenclature stems from its geographical proximity to the 1° north latitude marker, as illustrated in Figure 1. Recognizing its symbolic significance as an apt homophone for 'unique', it was subsequently renamed as One-North Technology City. The comprehensive blueprint for this innovative endeavour was officially unveiled by the Singapore government in 2000, followed by the initiation of construction activities in 2001. Spanning approximately 200 hectares, the ambitious project commanded a substantial investment amounting to approximately 15 billion Singapore dollars. Initially envisioned as a 20-year development plan, the realization of One-North extended beyond expectations, extending the actual development timeline to nearly 40 years. Conveniently located a mere 20-minute drive away from the city center and 45 minutes from Changi International Airport, One-North enjoys close proximity to esteemed educational institutions including the National University of Singapore, Singapore Polytechnic University, Singapore Science Park, and INSEAD Singapore. Its primary mission revolves around the attraction and nurturing of burgeoning industry clusters specializing in scientific and technological research and development, biomedicine, information communication, and new media."[58]

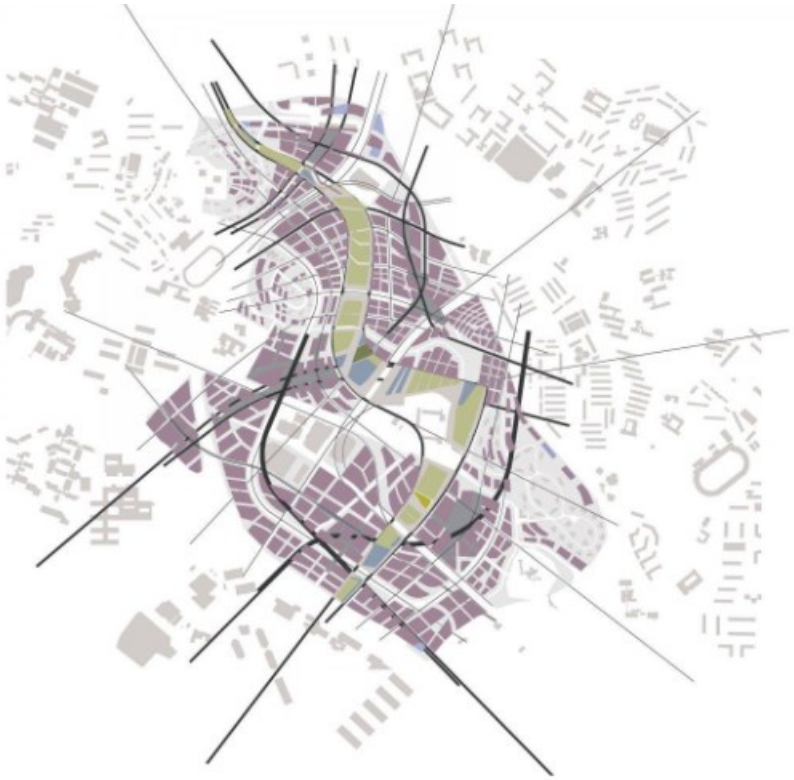


Figure 3-16 Concept plan by Zaha Hadid Architects. Source: http://www.zaha-hadid.com/masterplans/one-north-masterplan/

3.4.2 Design Strategies

To cultivate a vibrant community of technology entrepreneurs, Jurong Group undertook international consulting activities for one-north Sci-tech City. They selected master planning communication and transportation consultants for the Science City and travelled to Europe and the United States to study planning practices adopted by technologically mature parks like Silicon Valley. They also sought suggestions from renowned architectural and planning companies regarding the master plan of the Science and Technology City. After three rounds of evaluations, Zaha Hadid Co., Ltd. was appointed as the master planning consultant in June 2001.

One-North Technology City adopted a radical "dynamic planning" approach, breaking away from established thinking of existing industrial parks. It foresaw the concept of fully satisfying organic growth and creating a vibrant public space to develop an "inspirational place" that would attract, cultivate, and sustain a dynamic and distinctive technology entrepreneurial community. The goal was to become a catalytic community

in the field of innovation and knowledge creation.

The overall plan completed by the Zaha Hadid team introduced a planning and design guideline (PDG) for urban and architectural design. This design guideline takes a relatively qualitative approach to ensure the feasibility of the development. It comprises primary and secondary criteria, with the primary criteria being mandatory for planning and design. Together, these criteria shape the tangible architectural form and environment of the park.

The planning and design guidelines are divided into five parts: the vision of One-North, which aims to create a vibrant global hub for knowledge-driven industries; an innovative and dynamic working community; four key planning and design strategies—'dynamic fine-grained mixed use', 'seamless connection', 'continuous revival', and 'unique identity' (Table 3-5); general guidelines and development control exemptions. The vision of One-North seeks to redefine the spatial and social relationship between research, business (work), and urban life (community). It promotes long-term sustainable development by tailoring the industrial ecology of commercial, residential, leisure, educational, and institutional components to create the most favourable environment for innovation. The guide provides corresponding mandatory control and flexible construction guidance for the planning and design of One-North, encompassing the strategies and general guidelines mentioned above, as well as development control exemptions. Strict control over the development, construction, and approval of One-North is ensured through effective supervision and review agencies.

Table 3-5 Four Strategies of One-North Master Planning and Design Guidelines (PDG). Source: Arranged according to the official website of Jurong.

Number	Strategy	Definition
1	Dynamic fine-grained mixed-use	One-North integrates work, life, entertainment and learning in the horizontal and vertical dimensions, providing park diversity and intensity for the innovation community, thereby creating a balanced mix and distribution of activities.

2	Seamless connection	Software (IT, social and business networks) and physical connections (traffic and pedestrian network) are the focus of the planning of one-north. The campus interior is fully connected with wireless and ultra-high-speed fibre optic broadband while providing a complete and well-connected road network, as well as public transport nodes closely integrated with the development to utilize human traffic.
3	Continued revival	Continuous revitalization and renewal of parks through flexible zoning, non-continuous cultivation, and integration of public space networks is an important way to maintain the development vitality of One-North.
4	Unique identity	In order to create a unique place for one-north and fully protect the current topography, the unique temperament and atmosphere of one-north Science and Technology City will be shaped from multiple aspects such as the use of curved grids, roof landscape, ground landscape creation, greening integration, and artistic environment guidance.

The planning and construction of One-North Science and Technology City commenced in 1998, with a total investment of approximately SGD 15 billion. The initial planned development period was 20 years, but the actual park development extended to nearly 40 years. As of 2018, the development process of One-North Science and Technology City has reached about 60%. The construction process of the park can be roughly divided into three development stages based on the evolving focus of its construction and development: the "planning design and preparation stage," the "regional construction and cultivation stage," and the "function improvement and promotion stage.

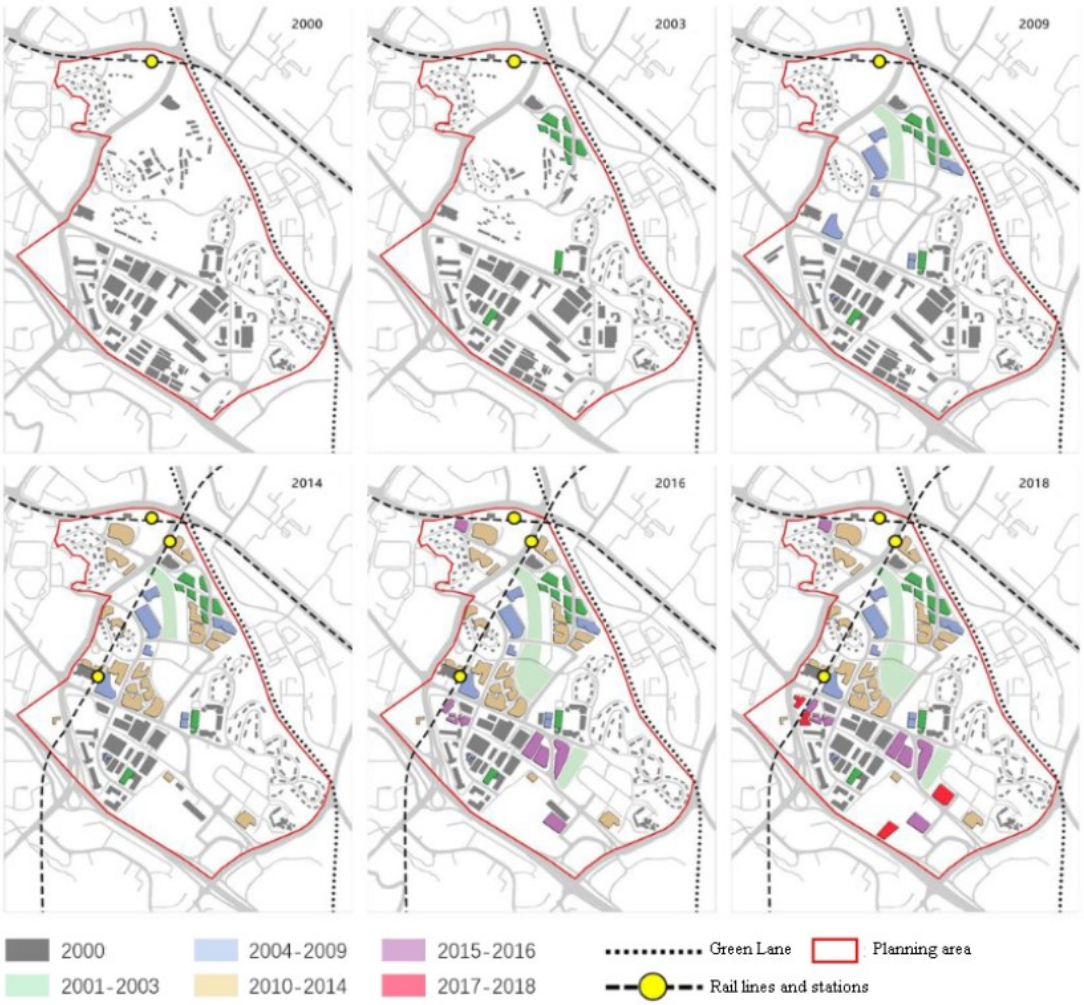


Figure 3-17 The Evolution of the Construction Space of One-North Singapore.

Source: Innovation-oriented research on the planning regulations of high-tech parks.

In Singapore's One-North Technology City, the functional areas are strategically distributed to accommodate various urban functions. The Core Business District occupies approximately 18 hectares in the northern region of One-North Technology City, accounting for 8.5% of the total area. This district, located near the Bonavis subway station, houses business offices, fashion outlets, cultural shopping centres, and transportation links.

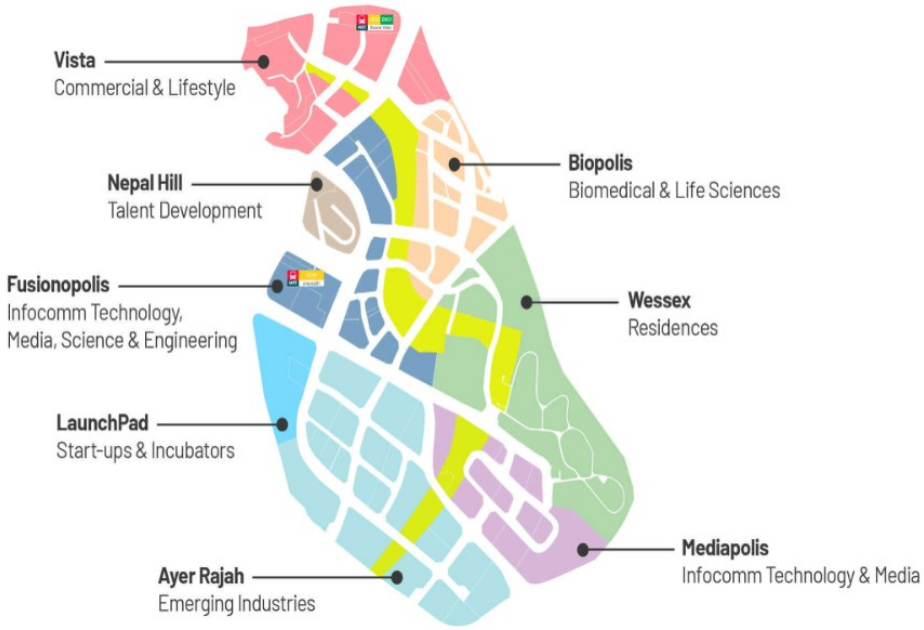


Figure 3-18 Distribution of developed projects in One-North Singapore. Source: https://www.jtc.gov.sg/find-land/land-for-long-term-development/one-north

The Life Technology Zone covers an area of about 20 hectares in the northeast, comprising 10% of the total area. It serves as the location for biomedical public research institutions and laboratories, with plans for more than 10 commercial office buildings. The goal is to actively attract biomedical research institutions, private companies, and achievement transformation centres.

The Information and Communication Area, located in the western part of One-North Science and Technology City, spans approximately 30 hectares, constituting 15% of the total area. Comprising more than 10 commercial office buildings, this zone hosts industry-related public facilities, service facilities, and technological centres. It is designed to become a hub for information and communication research and development, media research, and physical engineering research.

The Living and Residential Area is situated in the southeastern strip of One-North Science and Technology City, covering an area of about 28 hectares, making up 14% of the total area. Recognized as one of the cultural heritage sites in One-North Technology City, this area is designated for residential purposes.

One-North Park (One-North Park) spans an area of approximately 16 hectares,

accounting for 8% of the total area of the Science and Technology City. As a linear public leisure space, it connects the core business area, life science area, information communication area, living and residential area, Temasek media area, and future reserved development land.

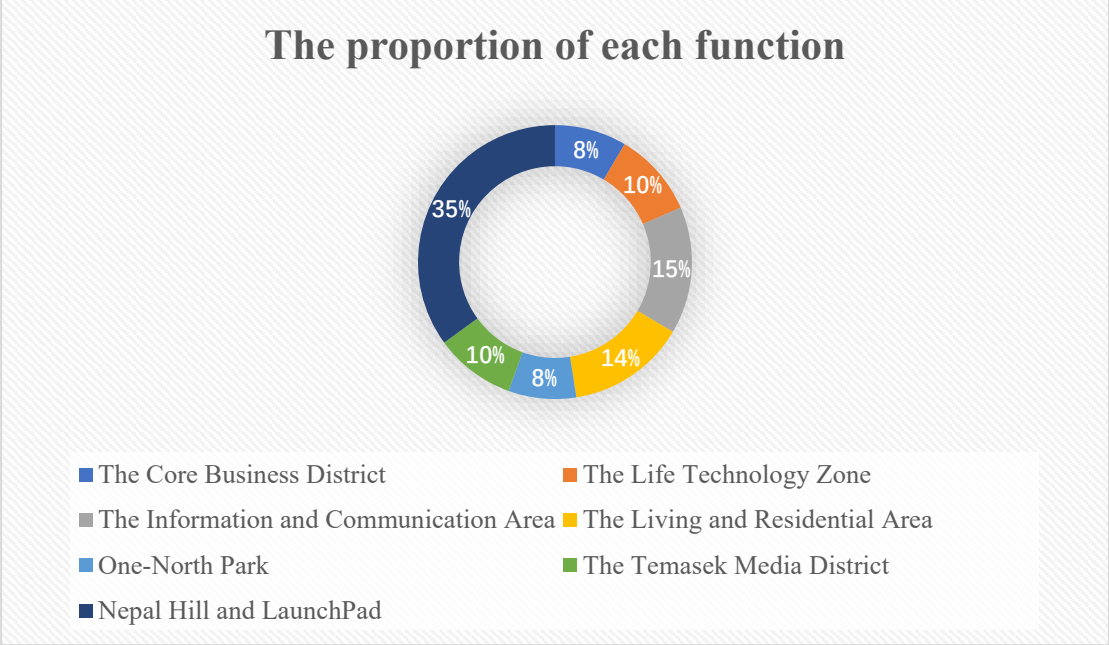
The Temasek Media District, known as Mediapolis, covers approximately 19 hectares, accounting for 9.5% of the technology city area. It is focused on bolstering the infrastructure of the local media industry and establishing a self-contained and vibrant digital media cluster. Mediapolis will serve as a significant platform for the new round of media technology industry development in Singapore.

Nepal Hill is a global centre for leadership training and serves as a corporate social venue for senior executives within the park. Additionally, it functions as an education centre for international students, forming an international education and training hub.

LaunchPad, situated on reserved land and covering an area of 6.5 hectares, is dedicated to incubator parks for creative companies, such as information communication and media. It provides incubation spaces and services of various sizes, offering entrepreneurial talents a more informal setting to foster ideas, creativity, and entrepreneurship[59].

Figure 3-19 The proportion of each function in One-North Singapore.

Source: made by the author.



4. EMPIRICAL STUDY

4.1 Basic information about the Site

4.1.1 Project Background

Amidst the backdrop of a nation prioritizing innovation-driven strategies, Guangdong Province has consistently demonstrated remarkable regional innovation capabilities year after year. In an effort to expedite the establishment of a high-calibre hub for scientific and technological innovation and talent cultivation, Guangdong Province has introduced the concept of an innovation source area encompassing five prominent mountains. The objective is to attain "high-level innovation," foster the growth of "high-growth industries," and facilitate the realization of a "high-quality life." Demonstrating its continued leadership in regional innovation capabilities, Guangdong Province currently endeavours to advance the construction of a comprehensive innovation ecosystem characterized by an integrated chain of activities spanning "basic research, technological breakthroughs, industrialization of achievements, technology finance, and talent support." Moreover, Guangzhou has placed great strategic importance on cultivating a regional innovation ecosystem and proposes the establishment of an innovation source area centred around the Wushan Mountains. Additionally, efforts will be directed towards the establishment of bases for the transformation of scientific and technological achievements in proximity to Zhongshan University and University Towns[2].

In line with the pursuit of establishing an international hub for science and technology innovation, Guangzhou is strategically focused on attracting, retaining, and nurturing innovative enterprises and individuals, which has emerged as a pivotal factor driving urban development through innovation. The vigorous development of science and technology parks has significantly enhanced Guangzhou's economic competitiveness. However, as the economic driving forces undergo transformation, traditional science

and technology parks have gradually revealed shortcomings in terms of innovation capabilities, limited advantages in fostering innovation growth, declining market competitiveness of enterprises, and the absence of a supportive environment fostering periodic issues, such as an innovative regional culture (Xu, 2005; Tian, 2007).

The five-mountain innovation source area stands out as a region abundant in innovation resources within Guangdong Province. It not only serves as a hub for numerous academic institutions and research organizations but also boasts substantial academic expertise and a vibrant scientific and technological innovation atmosphere, offering the potential for building a robust innovation ecosystem. Nevertheless, certain development bottlenecks persist, including imperfect linkages, insufficient infrastructure, inadequate support facilities, and a dearth of international talent. These factors need to be addressed to fully leverage the unique advantages and potential of the region[2].

To realize its ambition of becoming an international hub for science and technology innovation, Guangzhou must adopt a transformative mindset, proactively adapt to evolving circumstances, and transcend the path dependency associated with its current stage of development. This strategic shift is crucial for attaining high-quality social and economic development objectives. Against this backdrop of developmental imperatives, the revitalization and advancement of urban innovation districts have emerged as a pivotal means to unlock the untapped potential of traditional science and technology parks.

In the past, the emphasis on rapid technological innovation resulted in the establishment of science and technology parks predominantly located in suburban areas characterized by favourable ecological conditions. However, in the era of the knowledge-based economy, the principles advocated by New Urbanism, which promote urban environments that are diverse, multifunctional, and pedestrian-friendly[65], align closely with the requirements of innovative individuals. As a result, these urban environments are increasingly preferred by knowledge workers and innovative entrepreneurial enterprises. The transition to a knowledge economy and innovation-driven economy has eroded the boundaries between innovation and production, laboratories and

factories, thereby reconfiguring the entire production ecosystem. This paradigm shift in knowledge-based economic development activities is accompanied by a corresponding shift in people's lifestyles and consumption patterns from suburbs to urban areas. The rise of the experience economy, the prominence of the innovation economy and innovative individuals, changes in family structures, and the blurring of boundaries between work and leisure have all contributed to the reconfiguration of urban experiences and the spatial dynamics of urban innovation. Scholars in the Western hemisphere have recognized this phenomenon and have conducted extensive research from the perspectives of innovative industry clusters and venture capital, providing empirical evidence for the emergence of urban innovation districts (Thomas Hutton, 2004; George Bugliarello, 2004; Richard Florida, 2014). In 2014, the Brookings Institution formally introduced the concept of "Innovation Districts" and conducted research on the origins, growth dynamics, development mechanisms, and common patterns of spatial organization based on observations from the United States.

The notion of the "third place" was initially introduced by Ray Oldenburg in 1982, positing it as an interactive and informal gathering place existing outside the realms of residence (the first space) and the workplace (the second space). In recent years, an increasing number of scholars have come to recognize that the third place not only facilitates community-building and social interaction but also serves as a conduit for the dissemination of tacit knowledge, thereby acting as a catalyst for innovative activities[10,43]. Studies have indicated that the creative class, a pivotal driving force in the advancement of the globalized knowledge economy, tends to gravitate toward locales boasting abundant cultural and recreational amenities, such as cafes and parks[60]. Given that urban innovation districts represent compact urban spaces characterized by high concentrations of the creative class, innovative enterprises, and associated innovation and entrepreneurship service organizations[14], the relationship between these districts and the third place has garnered attention among scholars. Consequently, the third place can fulfil the spatial requirements of innovative and entrepreneurial groups seeking diverse lifestyles, signifying its crucial significance in fostering the sustainable development of urban innovation districts.

4.1.2 Site Background

The period spanning from 1988 to 2005 marked the nascent phase of science and technology park development following increased recognition in my country. Drawing insights from the establishment of science and technology parks in the United States, Europe, and other regions, my country embarked on exploring the advancement of science and technology industries. In 1988, the Tianhe High-tech Industrial Development Zone was established in Guangzhou, signifying the official initiation of high-tech park construction in the city. Subsequently, in 1991, Guangzhou incorporated the concept of "science and technology" into the national economic ten-year plan and the "Eighth Five-Year Plan," leading to progressive enhancements in the technological innovation policy framework. This developmental trajectory firmly positioned the Tianhe Science and Technology Park as China's second-largest hub for the software industry. Transitioning from 2005 to 2012, the Guangzhou Science and Technology Park underwent a period of innovation. Notable measures, such as the "Three-year Action Plan for the Construction of Guangzhou Value Innovation Park (2018-2020)" and the "Five-Year Action Plan for Accelerating the Development of IAB Industry in Guangzhou (2018-2022)," were introduced as crucial catalysts in advancing the city's construction as an innovative hub. Consequently, Guangzhou embarked on an accelerated trajectory in its journey towards an innovative city. From 2012 to the present, Guangzhou has entered a phase focused on promoting the Guangzhou Urban Innovation District. During this period, Guangzhou's innovation capacity and business environment have consistently ranked among the top three in the nation on multiple occasions. As stated in the Innovation and Entrepreneurship Environment Evaluation Report by the Tus-Innovation Research Institute, Guangzhou has maintained the second position for five consecutive years starting from 2011 (excluding municipalities directly under the Central Government). Following the inclusion of municipalities directly under the Central Government in the ranking in 2017 and 2018, Guangzhou has consistently maintained the fourth position, surpassed only by Beijing and Shanghai. Currently, Guangzhou finds itself in the stage of upgrading the urban innovation district,

which primarily entails the progressive refinement of science and technology parks with well-established industrial development. Moreover, there is an increasing emphasis on creating an innovative environment and enhancing spatial quality within the urban innovation district.

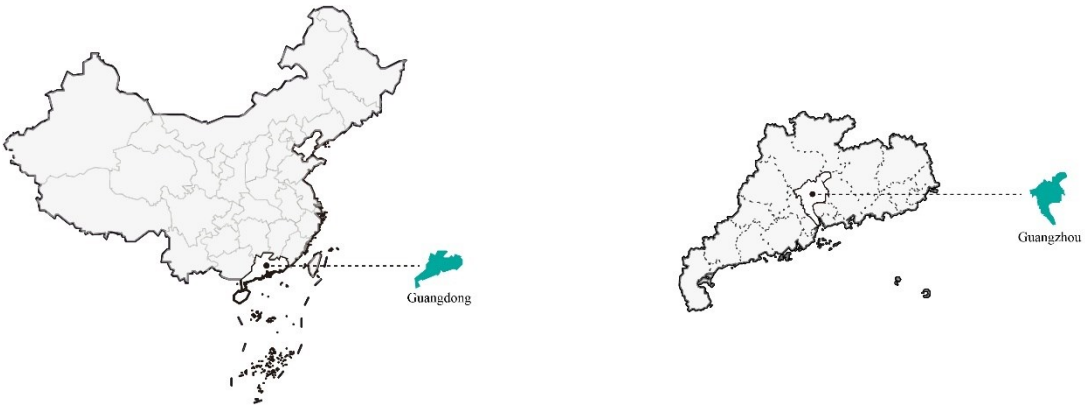


Figure 4-1 Location of Study Area. Source: made by the author.

(1) Distribution of Guangzhou Science and Technology Parks

From a spatial distribution perspective, the distribution pattern of incubators and maker spaces in Guangzhou exhibits a characteristic of central agglomeration and peripheral diffusion[61]. In terms of district-level distribution, three concentric circles can be roughly discerned. Notably, the first circle, distinct from science and technology parks, is distinguished by its composition. Tianhe District and Huangpu District emerged as the primary hubs of incubator and maker space distribution, with Tianhe District taking the lead. Tianhe District hosts 74 incubators, comprising approximately 25% of the city's total, and 89 maker spaces, accounting for over 40% of the city's total. It is worth mentioning that among these, there are 5 state-level incubators (26 citywide) and 17 maker spaces (51 citywide). Furthermore, according to the 2018 Guangdong Technology Business Incubator Maker Space Operation Evaluation Results published by the Provincial Department of Science and Technology in 2019, Tianhe District boasts 9 incubators with an A-level evaluation, constituting a quarter of the city's total (32), and 10 maker spaces with an A-level evaluation, representing approximately one-third of the city's total (29).

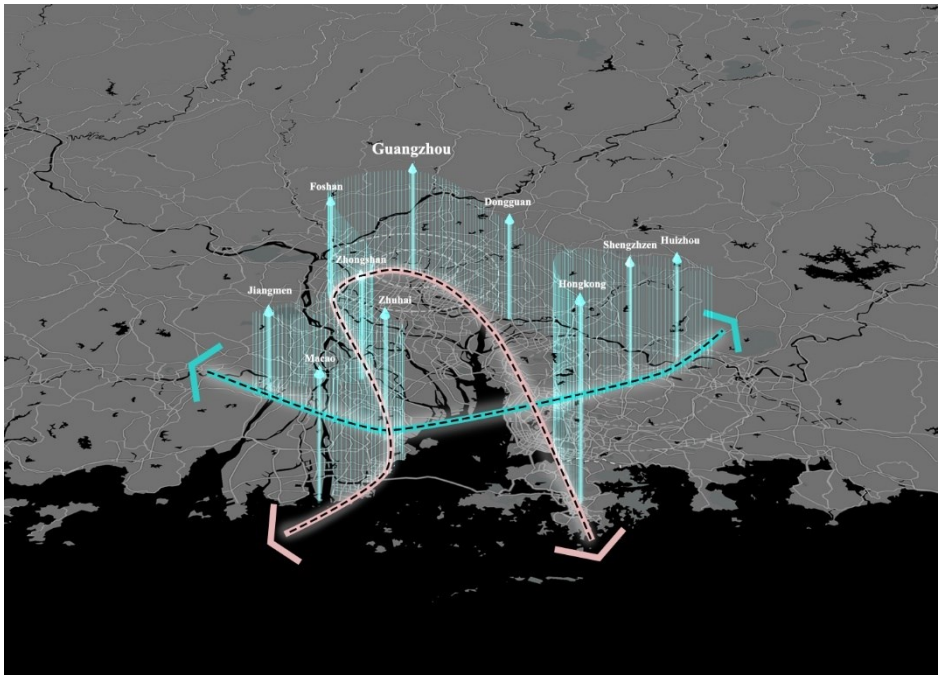


Figure 4-2 The development of science and technology enterprises in the Greater Bay Area. Source: made by the author according to Notice of Guangzhou Science and Technology Innovation "14th Five-Year Plan".

Table 4-1 The Great Bay Sub-indicator development index driven by industrial economic innovation from 2013-2018.

Source: https://www.gz.gov.cn/zwgk/ghjh/fzgh/ssw/content/post_8085235.html

Province	2013	2014	2015	2016	2017	2018	Ave.
Guangzhou	37.25	38.4	44.16	50.2	58.74	59.7	48.08
Shenzhen	59.43	59.17	65.53	74.54	80.76	89.55	71.50
Zhuhai	43.11	45.32	49.5	55.06	61.74	70.59	54.22
Foshan	37.91	39.89	41.12	46.15	58.99	59.78	47.31
Huizhou	32.31	34.06	37.3	42.46	48.27	48.81	40.54
Dongguan	30.81	34.17	39.56	46.49	51.49	61.35	43.98
Zhongshan	38.65	40.15	42.43	46.97	58.19	50.52	46.15
Jiangmen	28.34	28.1	29.53	32.24	41.51	41.64	33.56
Zhaoqing	21.44	21.85	23.73	27.12	31.43	31.54	26.19

Table 4-2 Guangzhou Sub-indicator Development Index driven by industrial economic innovation.

Source: https://www.gz.gov.cn/zwgk/ghjh/fzgh/ssw/content/post_8085235.html

Year	Enterprise R&D personnel	Enterprise R & D investment	Enterprise R & D output	Enterprise R & D institutions	Enterprise technological transformation	Enterprise innovation environment	Composite index
2013	5.57	7.62	7.31	5.35	3.12	8.28	37.25
2014	5.85	8.66	7.79	5.68	3.23	7.19	38.40
2015	5.80	9.13	8.63	7.39	4.00	9.21	44.16
2016	5.51	10.21	9.91	10.34	4.63	9.59	50.20
2017	6.42	11.82	11.12	14.05	4.39	10.94	58.74
2018	6.05	11.52	12.19	15.45	4.49	9.98	59.70

(2) Related Policies

In parallel with the rapid pace of national modernization and scientific and technological innovation, and in line with Guangzhou's efforts to establish itself as an innovative city and a national centre for the science and technology industry, the city's relatively mature science and technology parks are demonstrating a transition towards becoming urban innovation districts[62]. In 2015, Guangzhou City issued the "Guangzhou City Trial Measures for Improving the Efficiency of Industrial Land Utilization" as part of its drive to expedite industrial transformation and upgrading. This measure encompassed a total of 95 industrial blocks, including planned industrial parks, industrial land in villages and towns, high-tech industrial parks, and logistics parks. Furthermore, the "Guidelines for Industrial Land Use in Guangzhou (2018 Edition)" classified and provided guidance for 107 industrial zones in Guangzhou. These zones covered various sectors, including the city's traditional advantageous industries (such as automobile manufacturing, electronic products, and petrochemicals), information technology, biomedicine, marine industries, logistics parks primarily focused on warehousing and transportation, and producer service industries (e.g., headquarters economy, finance, exhibitions, technological innovation). These guidelines highlight

Guangzhou's intent to concentrate producer service parks in the central urban area. To further reinforce the city's position as an international science and technology industry innovation centre, the three-year action plan (2018-2020) introduced initiatives to encourage and guide the integration of technological innovation enterprises and projects through the revitalization of old factories and buildings. Additionally, efforts were made to secure land for innovation and development within the central urban area. The 13th Five-Year Plan for Science and Technology Innovation in Guangzhou (2016-2020) emphasized the construction of 14 science and technology parks, aiming to establish the Guangzhou Science and Technology Innovation Corridor. This initiative also sought to establish four core innovation platforms and thirteen additional nodes. In line with these plans, the land and space master plan for Guangzhou until 2035 outlines the establishment of four core innovation platforms.

Table 4-3 Relevant planning and policies of innovation-driven development in Guangzhou. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou[15].

Policy	Year	Content
The Thirteenth Five-Year Plan for Science and Technology Innovation in Guangzhou	2017	It is proposed to focus on the construction of 14 science and technology parks to build the Guangzhou Science and Technology Innovation Corridor.
Guangzhou Industrial Land Guide (2018 Edition)	2018	Classified and guided 107 industrial zones in Guangzhou, covering industrial parks, logistics parks and productive service areas
Three-year action plan for Guangzhou to build an international science and technology industry innovation centre (2018-2020)	2018	It is proposed to encourage and guide the transformation of old factories to introduce scientific and technological innovation enterprises and projects through the transformation of the three old buildings, so as to ensure the land for innovation and development in the central city.
"Guangshen Science and Technology Innovation Eagle Plan" Guangzhou plan	2017	Propose the construction of four innovative schools and thirteen nodes.
Guangzhou Land and Space Master Plan 2035	2018	Establish four core innovation platforms, innovation four core thirteen points.
Opinions of the People's Government of Guangdong Province on Fostering and Developing Strategic Pillar Industrial Clusters and Strategic Emerging Industrial Clusters	2020	Propose to focus on the development of ten strategic pillar industry clusters and ten strategic emerging industry clusters

Guangzhou Science and Technology Innovation Regulations	2021	Clarified the development orientation of Guangzhou's science and technology innovation axis, "one district and three cities" and other space-bearing areas
Guangzhou Science and Technology Innovation "14th Five-Year Plan"	2022	Around the whole chain of scientific and technological innovation of "scientific discovery, technological invention, industrial development, talent support, ecological optimization"

(3) Keyun innovation district general context

The establishment and growth of the Keyun Sub-Park, located within the Tianhe Software Park, have been closely intertwined with the development of the Guangzhou High-tech Zone. Initially constructed in the late 1980s and early 1990s under the name "Eastern Suburb Industrial Park," it attracted a cluster of electronic information and industrial manufacturing companies. Over time, the park underwent various transformations and acquired designations such as Tangxia Industrial Zone and Industrial Park. With the approval and establishment of the first group of national high-tech industrial development zones and the implementation of the "one zone with multiple parks" management system in the Guangzhou High-tech Zone, the Tianhe Software Park was founded in 1999, gradually solidifying its position as a leading hub for the software industry. By 1999, the software output value of Tianhe Software Park had reached 3 billion yuan, positioning it as the second-largest software industry base in the country. Simultaneously, as the city centre of Guangzhou shifted eastward, labour and production costs within the park escalated, prompting manufacturing enterprises to relocate. Consequently, the government proactively guided the industrial development of Tianhe Software Park, attracting information technology enterprises. As Tianhe Software Park continued to flourish and expand, the Keyun Sub-Park incubated the initial batch of technology software companies.

Since its inception, the Keyun Branch Park has been consistently attracting a cluster of pioneering enterprises. Notably, in 2006, the Guangzhou Information Port commenced operations, housing prominent entities such as NetEase, Lenovo, and the China International E-Commerce Center of the Ministry of Commerce. Subsequently, in 2016, the Keyun branch earned distinction as a paramount core area for "Internet +" towns in Guangdong Province. Presently, the park has fostered an innovative enterprise cluster

with a primary focus on next-generation information technology firms, encompassing domains such as mobile Internet, geographic information, digital content, e-commerce, cloud computing, and big data. The cumulative number of enterprises operating within the area exceeds 600, with more than 140 of them classified as high-tech enterprises. Additionally, the park accommodates four incubators of varying sizes, which have successfully nurtured over 500 small and medium-sized enterprises.

Figure 4-3 Site surrounding functions. Source: made by the author.

(4) Location Background

Tianhe District, the location of the Keyun Area, serves as a vibrant hub attracting a multitude of talents in Guangzhou. It is characterized as a prominent gathering place for over 300,000 college students and innovative individuals across various fields. Moreover, the district houses more than 150 incubators and maker spaces. The Keyun Area establishes connectivity from Huaguan Road to Tianhe Smart City in the north, extending towards Guangzhou International Biological Island and Guangzhou University City in the south. Additionally, its proximity to the Wushan Higher Education and Research Area situated in the northwest corner is notable. This strategic positioning aligns it closely with key academic and research institutions, including

South China Agricultural University, South China University of Technology, South China Normal University, Jinan University, and scientific research institutes such as the Guangdong Agricultural Research Institute. These institutions are concentrated within the development corridor, coinciding with the eastward movement of Guangzhou's urban centre.

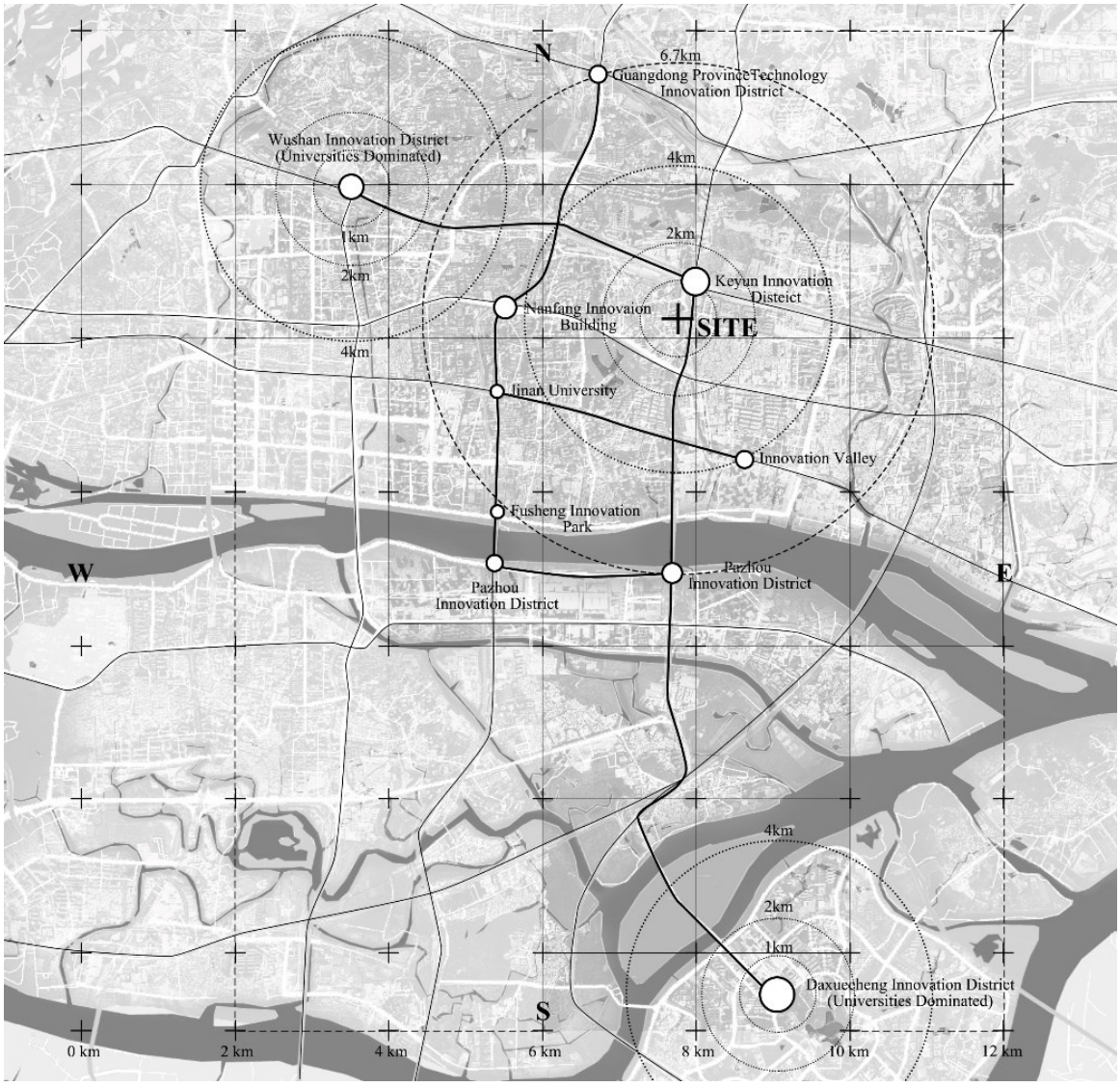


Figure 4-4 Location Relationship of Guangzhou Innovation District.

Source: made by the author.

4.2 Status analysis of Keyun Innovation District

4.2.1 Status of Land Use

The Keyun area originated from an industrial park built in the 1990s, and in 2005

basically formed the current block pattern characterized by a dense road network. There are two parts of high-density urban villages on the site. The game companies in the Keyun Innovation District are mainly located in the middle and north of the site. Part of the buildings in Tangxia Community have been transformed into Tangxia Yuanchuang Community, which has the characteristics of an open and innovative community. Some public spaces are provided. For the convenience of management, there is a fence separating the Keyun branch garden from the residential community, which reduces the accessibility within the area, but the mixed land use promotes the interaction between the various functional areas. The road traffic on the site is chaotic and not connected to each other, which brings inconvenience to the daily life of knowledge workers working in this innovation district.

Figure 4-5 Function analysis diagram of buildings in the site. Source: made by the author.

4.2.2 Traffic and Elements Layout

（1） Traffic layout

The site is located in Shangshe Village. The site is adjacent to Keyun Middle Road in the east and Zhongshan Avenue in the south. The main road on the site is Heguang Road and its branch roads. Part of the road network of the innovation park on Heguang 2nd Road is relatively regular and has a high degree of openness. The internal branch roads of the commercial and residential communities on the west and south sides of the area mainly serve the connection between buildings, so the degree of openness is low and pedestrians and vehicles are mixed. In terms of public transportation, it mainly relies on the Keyun Road Station of Metro Line 5 on the south side of the site and buses. The subway lines 13 and 15 under construction will have Tianhe Park Station intersecting on the south side of the site, which will enhance the accessibility of the area.

（2） Elements layout

The buildings in the Keyun area are mixed with old and new. Among them, the Guangzhou Information Port was built late and has a good architectural style. It is a relatively tall office building group in the area, while the north and south areas of the Software Park are mainly old industrial buildings, with 6-8 floors as a whole. Transformation into low-cost office space; the commercial and residential communities are mainly high-density slab-type residential quarters, and the adoption of the model of commercial residences on the ground floor improves the vitality of the streets in the area. The square of Jiangyun Hotel and Shengda Innovation Park is the main public communication space in this area, located on the west side of Keyun Middle Road. Shengda Innovation Park is an innovation park renovated in 2015. The road traffic is in good condition, but because the surrounding community is a closed park formed by walls, it is not connected to the surrounding roads. In addition, there are two urban village areas in the middle and south of the site. The built-in roads are relatively narrow and the road conditions are complicated. People, non-motorized vehicles, and motorized vehicles are mixed.

Table 4-4 Road interfaces, boundary walls and major public spaces.

Source: made by the author.

Road interfaces			
Boundary walls			
Major public spaces			

4.2.3 Business Format and Network Distribution

From the perspective of core density and commercial service network density, the commercial vitality of this area is slightly lower than the surrounding 500m range. Tianhe Park is the main reason why the density of commercial service outlets in the Keyun area is lower than that within the surrounding 500m range. The density of commercial service outlets in the Keyun area is similar to that in the surrounding area after deducting the area of Tianhe Park. Looking at the nuclear density analysis map alone, three hotspots are formed in Shangshe, Yuancun and Tangxia in the three directions of north, south and east respectively. Among them, Yuancun and Keyun areas in the south are most closely connected, and Tangshi Road passes through the pedestrian crossing across Huangpu Avenue. The overpass connects Yuan Village on the south side of Huangpu Avenue. Tangshi Road in the area has become a commercial hotspot, bringing together commercial service facilities such as newspaper kiosks, convenience stores, small supermarkets, markets, affordable restaurants, hairdressing and beauty, etc.

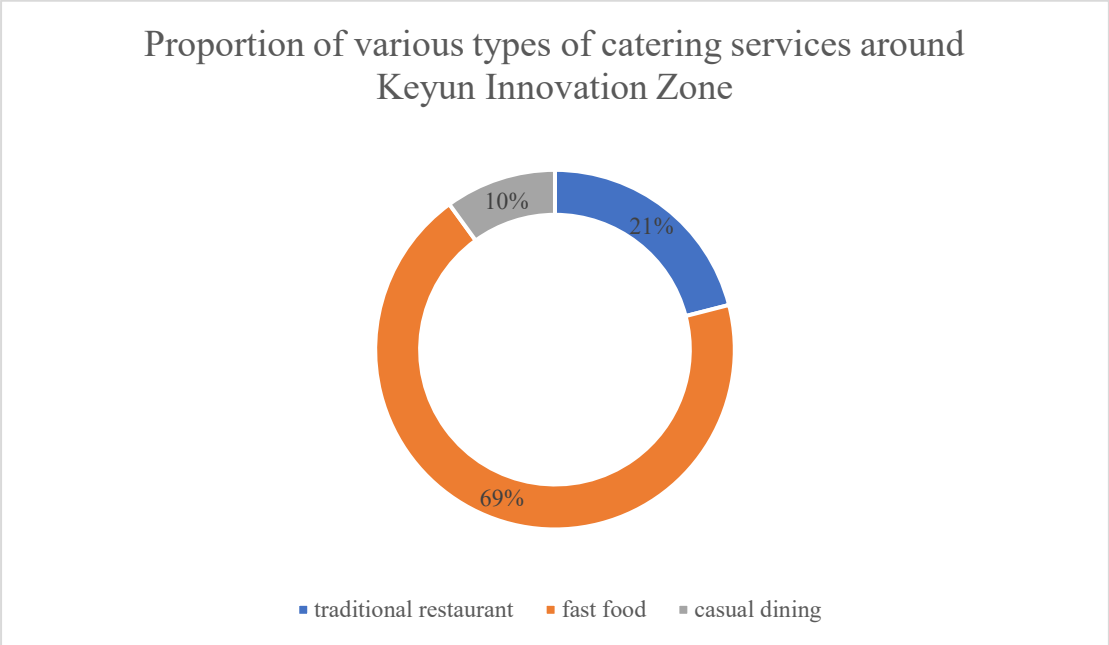
The highest degree of concentration is near Jingjing Market. Facility outlets are scattered on both sides of Shangshe Road in the Keyun Innovation district, and there is no obvious gathering.

The clustering of retail outlets is basically consistent with the kernel density analysis of the overall commercial service outlets. In terms of the specific types of retail, there are many types of retail in this area, and there is no obvious preference for a certain type. In terms of catering, in addition to Shangshe Road, which mainly serves fast food and snacks, there are also a small number of restaurants in the Innovation Industrial Park. The north end of Tangshi Road connects with Jianye Road and enters the Software Park. Nearly 7 types of catering in the Software Park have become fast food and snacks, which are concentrated on the west side of the site, with little or no public communication space and weak communication with the Innovation Park. To meet the daily dining needs of employees in the innovation park, the fast food and snacks of the first-floor shops in the surrounding communities complement it to a certain extent; casual dining accounts for about 9%, including bars, coffee shops and leisure tea shops.

Table 4-5 Table Catering Status in Keyun District. Source: made by the author.

Catering Status			
	The snack bars around the site are mainly taken away, providing convenient food for surrounding knowledge workers and residents, but no leisure space.	The coffee shop and tea shop in the venue provide a space for negotiation and leisure communication	The fast food restaurants around the site meet the basic dining needs of knowledge workers and provide short-term informal communication space.

Table 4-6 Proportion of various types of catering services around Keyun Innovation district. Source: made by the author.



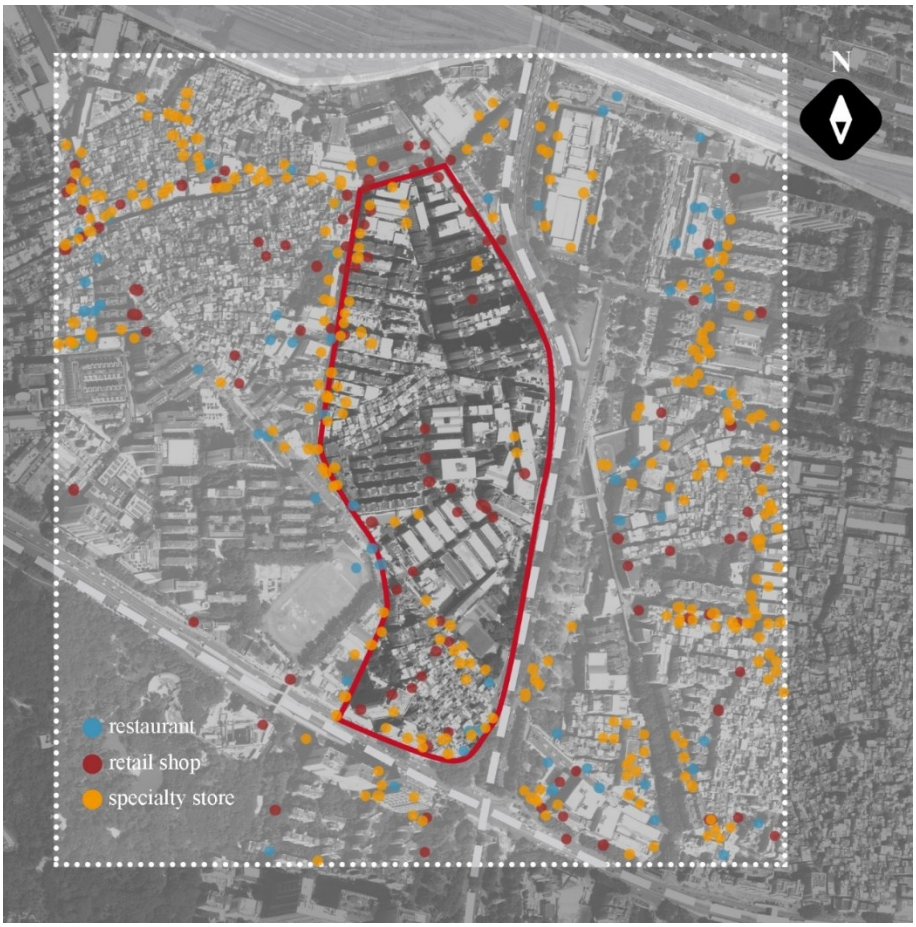


Figure 4-6 Distribution of retail outlets around the site. Source: made by the author.

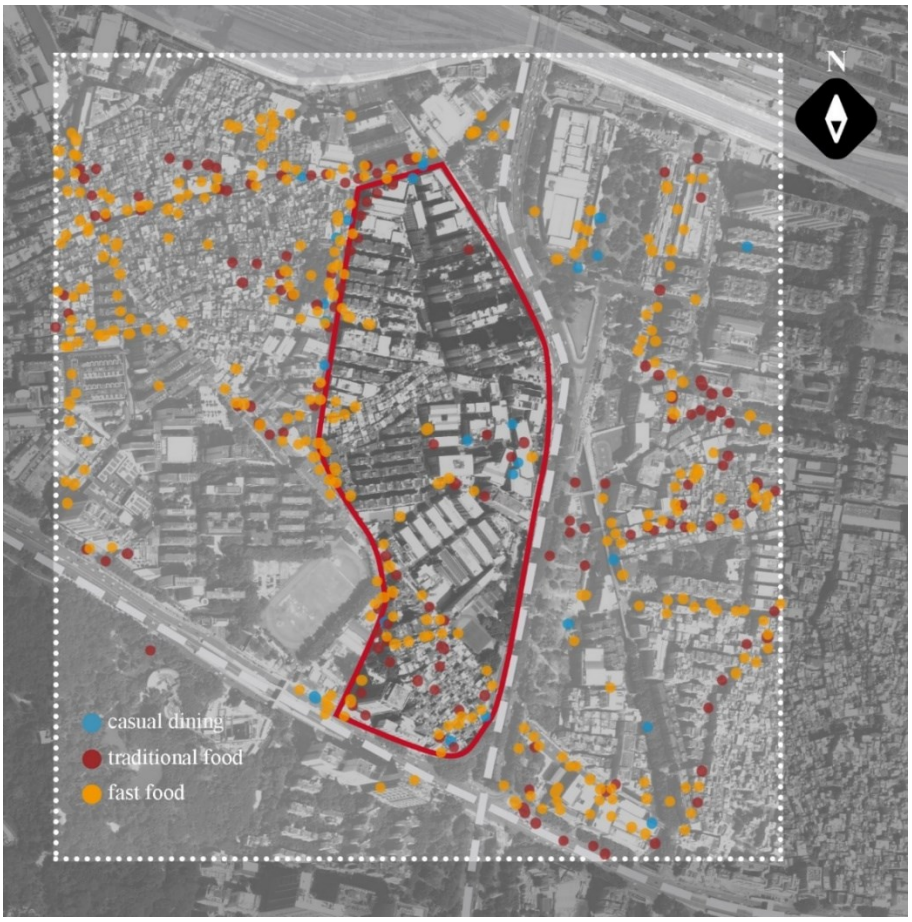


Figure 4-7 Distribution of catering outlets around the site. Source: made by the author.

4.2.4 Greening and Landscape Facilities

The internal building density of the Keyun Innovation Park site is relatively high, and the main greening is the greening of the residential area. Therefore, the internal greening of the site is concentrated around the residential area without obvious landscape elements. In addition, there is a lack of parking lots inside the site. The main parking lots are supporting facilities for public service buildings such as hotels, and most of the cars in other areas are parked on the side roads, which may easily cause road traffic congestion. There is a lack of unified logo expression in the area, and only the layout guideboards are set up at the entrances and exits of the Innovation Park.

Table 4-7 Keyun area greening and landscape facilities. Source: made by the author.

Greening and landscape facilities			
	Landscape in front of the site entrance	Greenery around the building	Green plants and street trees around public squares

4.2.5 Public Spaces

The Keyun Innovation district currently exhibits a deficiency in terms of an integrated urban public space system. An examination of various facilities, including overpasses, urban furniture, urban sculptures, and significant landscape paths, reveals a lack of essential nodes and destinations that can be utilized for leisure, recreation, visitation, and parking. In order to establish a superior living environment and ensure a secure and comfortable urban space, the planning process consistently prioritizes the development of high-quality public spaces and public facilities. These endeavours aim to create an environment that fosters a high quality of life while promoting safety and comfort for residents and visitors alike.

Figure 4-8 Space Maintenance and Slow-Walking Environment.

Source: made by the author.

The interior of the area is dominated by motor vehicles, which squeezes some street space; due to the serious lack of parking spaces, some public spaces are also designated for parking functions. The public space of the Innovation Park is squeezed by motor vehicles, which also affects the vitality of the public space of the Software Park to a certain extent. Vehicles are parked in an orderly manner on some sections of the road. Although people and vehicles walk together, it does not cause confusion and safety problems. A large number of shared bicycles are randomly placed at the entrance and exit of the software park, and there is no effective management, which not only affects the perception of the street but also occupies the sidewalk space, causing traffic chaos.

Table 4-8 Street slow traffic environment. Source: made by the author.

Street slow traffic			
	Non-motorized vehicles parked on sidewalks	Vehicles parked in public spaces	Mixed traffic of people, bicycles and motor vehicles

4.2.6 Creative Staff

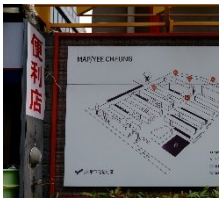
The shared service facility within the Keyun area serves as a hub for various innovative exchange activities. Presently, the area hosts seven maker spaces, including one at the state level (Weigu Community) and four provincial-level pilot spaces. Additionally, there are three incubators, with one being a nationally recognized cultivation unit (PCI Future Community). The PCI Future Community, established by Jiadu Group, represents an innovative platform catering to entrepreneurs of the new generation. Formerly an office building, it has undergone transformation to accommodate this purpose. Notably, the area features the "Venture Capital Meeting Room," an open exhibition hall serving as a platform for joint investment institutions affiliated with the Guangdong Venture Capital Association, facilitating interactions between start-ups and capital resources.

Moreover, several third-space coffee and tea houses, such as Ruixing Coffee near the Software Park Community Park, are situated in the Keyun area. In addition to providing beverage services, these establishments foster communication by creating a casual and relaxed environment. The successful hosting of the 2018 "Tianyinghui｜PCI·Future Technology Cup" at PCI Future Community demonstrates the area's commitment to supporting start-ups. The software park frequently organizes policy presentations to cater to the needs of these budding enterprises. For instance, the venture capital meeting room regularly hosts seminars, specialized forums, maker salons, and investment and

financing events, establishing an effective communication platform for entrepreneurs, experts, institutions, and capital providers. This platform fosters the establishment of interpersonal networks among innovative entities. Beta Space, a versatile venue blending leisure, office, and negotiation functionalities, facilitates learning, communication, and offline activities related to the Internet.

In addition to promoting innovation and entrepreneurship, the Keyun Branch Park has organized sports games since 2009, enriching the lives of employees and fostering communication between enterprises. Over nearly three decades of development, the area has embraced the "Keyun Road Spirit," embodying pragmatism and courage, which has become an intangible symbol of Guangzhou. The Keyun Sub-Park not only offers new high-rise office buildings, such as the Guangzhou Information Port, for larger companies but also preserves multi-story factory buildings from the old industrial area to cater to the needs of start-up companies. This diversity of office spaces enhances interactions among employees. Furthermore, the presence of free and open shopping malls in the surrounding communities contributes to the creation of a dynamic environment that seamlessly integrates work and life.

Table 4-9 Incubation facilities and innovation exchange activities in the Keyun area.

Incubators and Activities			
	Incubation building	Game creative activity	Small Creative Park

4.2.7 Summary

The development of the Keyun area benefits from the convenient access to Keyun Road, the abundant university resources around it, and the originally cheap industrial transformation office space. It has gradually grown from an industrial park in the suburbs of the city to an important node on the "artery of the game circle". With the

development of the software park, the increase in the daily needs of employees promotes the economic benefits of the software park to spread from the single park itself to the whole Keyun area, and then forms an urban functional area integrated with the surrounding areas; while the development of the area brings about rent increases and motor vehicles occupying space And other problems have restricted its further development. Based on the strategy of innovation sources around Wushan, in order to promote the sustainable development of the innovation district, starting from the characteristics of the innovation district, through road planning and functional reconstruction, it provides more third places for knowledge workers and stimulates the innovation vitality of the site. Improve the overall space quality of the innovation district.

4.3 Insufficiency of the Third place Construction Elements in Keyun Innovation district

4.3.1 The Openness of Innovation Districts to Public Space Needs to be Improved

As pointed out by Nicole Fichera, the general director of District Hall, innovation districts often have incubation facilities that are either located within enterprises or on upper floors of buildings, making them inaccessible or unknown to the public. This lack of public accessibility and awareness hinders active public participation in innovation district activities and weakens the overall recognition of the innovation district.

In Guangzhou, incubators primarily exist in the form of office parks, exhibiting a limited degree of openness. Innovation activities are confined to office buildings, failing to capture the interest of community residents. However, a few exceptions, such as the National University Science and Technology Park of Polytechnic University and the National University Science and Technology Park of Sun Yat-sen University, have combined maker spaces with public retail spaces like coffee shops. Examples include Weigu Makerspace, Beta Coffee, and Bole Coffee. Similarly, the Sun Yat-sen

University International Innovation Valley encompasses both office-style incubators like the Sun Yat-sen University National University Science and Technology Park and collaborative spaces with public retail areas on the ground floor, such as the Xingang 82 Designer Creative Valley.

Enhancing the integration of communication and interaction spaces with public areas is vital for promoting the flow and exchange of knowledge. This integration facilitates greater engagement and participation from the public, fostering a dynamic and collaborative environment within the innovation district.

4.3.2 The Richness of Commercial Service Outlets Does not Match the Degree of Industrial Space Development

Owing to the progression of urban development, the immediate urban surroundings of the urban innovation district located within the main city core exhibit a dense and diverse landscape, characterized by comprehensive public service elements and a relatively abundant mix of commercial formats. For instance, Yuexiu District boasts a flourishing service industry, offering a wide range of choices for individuals engaged in innovation activities. However, due to limited land availability, the expansion of industrial spaces is constrained, necessitating alternative approaches such as revitalization and renovation.

In the core area of Guangzhou Science City, there has been an excessive emphasis on industrial functions, resulting in a neglect of the construction of commercial service facilities. As a consequence, the variety of public retail outlets within this area is limited, primarily comprising large commercial plazas. Moreover, other public retail spaces are predominantly situated within the premises of individual enterprise parks, failing to foster effective social interaction spaces. In an ideal urban innovation district, the coexistence and mutual reinforcement of commercial service spaces and industrial development spaces should be prioritized, rather than one overshadowing the other.

4.3.3 The Threshold of Innovation Activities is High and the Driving Effect is Insufficient

The vibrancy of public spaces within urban innovation districts relies on the active engagement of community residents in public activities, encompassing a diverse array of open and innovative cultural endeavours. While the presence of prominent incubation facilities fosters a strong enthusiasm for organizing various public innovation activities across all districts, the overall impact of these activities remains limited. This can be attributed to the predominance of knowledge-intensive and skill-demanding innovation competitions, such as the PCI Future Science and Technology Cup, Innovation and Entrepreneurship Competitions, and Double Entrepreneurship Week, within the Guangzhou Innovation district. Consequently, there are few opportunities for entry-level innovations that are accessible to the general public. Moreover, the absence of educational and popular science exhibition activities hampers the establishment of fruitful interactive relationships and community awareness among individuals in the urban innovation district. As a result, cross-disciplinary and cross-industry communication is hindered, impeding the development of weak ties within the community.

5. OVERALL KEYUN INNOVATION DISTRICT URBAN DESIGN STRATEGIES

5.1 Development Strategies for Innovation District

5.1.1 Create an Environment Conducive to Innovation

First and foremost, it is imperative to undertake spatial environment renovation within urban areas characterized by aged infrastructure, former industrial zones, and storage areas. Particular emphasis should be placed on enhancing the organization models of low-density and loosely structured blocks, thereby augmenting their density and compactness.

Secondly, it is crucial to establish an open space system by strategically sorting and integrating the existing open areas by the spatial characteristics of the blocks. The introduction of intelligent, digital, and networked infrastructure is recommended to enable comprehensive Wi-Fi coverage throughout the open space system. This will facilitate the provision of diverse and intelligent services, fostering a communicative environment and enriching exchange experiences, thereby promoting the dissemination and exchange of knowledge.

Thirdly, attention must be directed towards rectifying the current block road network system. This entails the removal of adjacent and unauthorized buildings along the streets, as well as optimizing and improving the spatial quality of the streets and public transportation network. By doing so, the accessibility of the neighbourhood can be enhanced, generating a pedestrian-friendly environment that promotes face-to-face communication opportunities and frequencies.

Lastly, the preservation of the block's spatial texture, historical significance, and cultural heritage necessitates careful consideration. Leveraging the distinctive qualities and advantages offered by the historical and cultural elements within the block is paramount. By enhancing the cultural ambience and accentuating the block's

uniqueness and identity, a heightened sense of belonging and regional pride can be fostered among the residents.

5.1.2 Construct a Multi-level Functional Hybrid Guidance System

In China, the promotion of mixed land use and the implementation of "industrial reform M0" has been predominantly utilized to foster diverse functionalities within urban areas. This approach involves transforming industrial land (including M1, M2, and M3) into pollution-free new industrial land (M0) that integrates research and development, creativity, design, pilot testing, production, and associated support services, thereby enhancing the level of mixed land use. However, these methods are susceptible to the influence of profit-driven capital, often resulting in the construction of office and apartment buildings with high vacancy rates. Consequently, they fail to adequately meet the spatial needs of innovative enterprises and talent in the context of open innovation, where the integration of multiple functions is crucial[54].

Drawing insights from the experience of Nanhai Port, we can explore the establishment of a hierarchical mixed-function guidance system during the implementation of urban renewal and innovation districts in China. At the overarching level, urban planning should articulate guiding principles and requirements for land use compatibility and the integration of diverse functions. At the group level, the integration of "life-work-study-entertainment" functions should be pursued within the group, considering the group's development orientation. This entails determining the proportions and construction requirements of the four major functional areas to achieve the integrated development of living, working, learning, and entertainment functions within the group. At the plot level, specific requirements for the types and proportions of primary and ancillary functions should be established, accompanied by guidelines for supporting facilities. Additionally, to safeguard plot benefits from the adverse impacts of inappropriate land mix, a "negative list" management approach can be implemented, outlining unsuitable land types and facilities for the plot[63]. Lastly, the proposal for diversified and intricate architectural spatial combinations in different scenarios offers horizontal and vertical functional mixed scenarios for type buildings, enhancing the complexity and variety of

architectural spaces.

5.1.3 Pay Attention to the Innovative Catalyst Effect of the "Anchor" Mechanism

Broadly speaking, the "anchor" institutions within innovation districts can be categorized into "innovation anchors" and "vitality anchors". In the case of "innovation anchors," it is typically advisable to select small-scale innovation spaces such as incubators and accelerators that possess strong capabilities in delivering innovation services. The presence of these micro-technology innovation enterprises can effectively cultivate an atmosphere of innovation within the region. In areas with the necessary conditions, collaboration with nearby universities and research institutes to establish new research and development (R&D) institutions aligned with the regional industrial characteristics can also be considered.

The selection of "vitality anchors" should adhere to principles that prioritize people-oriented approaches and embrace diversity and tolerance, aiming to avoid issues of gentrification during renewal and transformation processes. Specifically, the choice of "vitality anchors" should account for the needs of not only highly educated and high-income innovative groups but also those of low- and middle-income segments. Moreover, it should address the needs of both new innovative enterprises and talents, as well as the relocation requirements of original residents and the surrounding community. Consequently, the selection of "vitality anchors" necessitates extensive social surveys and comprehensive consideration of the service needs of various stakeholders. For instance, in areas characterized by a weak innovation foundation and a strong inclination to relocate indigenous populations, the inclusion of general commercial centres, cultural activity centres, and well-designed parks and squares may be worth considering. Conversely, areas with a robust innovation foundation and a predominant focus on service-oriented innovative enterprises may benefit from the inclusion of landmark buildings such as museums and exhibition halls, which serve as focal points for attracting talents.

5.1.4 Establish a Sustainable Planning and Management Mechanism

During the development of urban renewal innovation districts in China, it is essential to enhance the efficiency and sustainability of planning through the refinement of planning compilation, management, evaluation, and adjustment mechanisms. Firstly, the establishment of a dedicated planning and implementation management agency is crucial. Given the multifaceted nature of constructing urban renewal innovation districts, encompassing public space, infrastructure, and affordable housing, substantial public investment is required, involving multiple authorities. Consequently, the establishment of a unified planning management agency is necessary.

Secondly, an effective communication and feedback mechanism should be put in place. The management agency should promptly disclose planning outcomes to the public and take responsibility for facilitating repeated communication and exchanges among various stakeholders, social organizations, and individuals regarding the planning outcomes.

Thirdly, an evaluation and adjustment mechanism should be established to ensure plan updates. Regular evaluations should be conducted to assess the plan's implementation, and address residents' concerns and regional issues. These evaluations serve as a basis for dynamically adjusting the plan or developing new plans in response to evolving circumstances[54].

Furthermore, it may be advantageous to establish a dedicated innovation district management agency responsible for site management, operations, and fostering an innovative atmosphere upon the completion of the innovation district[64]. For instance, organizing community cultural festivals and innovation and creativity exhibitions can strengthen interactions between community residents and creative individuals, thereby enhancing the cultural and innovative ambience of the innovation district.

5.2 Urban Design Principles Under the Concept of Innovative Space

5.2.1 Openness: Public Space Makes Innovation Visible and Open

In the realm of urban innovation districts, the management of public space assumes a pivotal role in fostering an environment conducive to the diffusion of innovative activities and creative ideas. Guided by the principle of openness, the effective management of public space becomes paramount. Urban innovation districts underscore the significance of spatial proximity and the agglomeration of economic endeavours. Given the fluid boundaries characterizing these districts and the blurring of work-life demarcations, the proximity of public and private spaces within economic activities becomes apparent. However, the fluid nature of information circulation, characterized by its "liquid state," poses challenges to openness. Without the traits of openness, information spillover becomes unattainable, leading to the potential loss of valuable ideas that fail to circulate and diffuse. According to the Brookings Institution's Twelve Principles guiding innovation districts, public space assumes a crucial role in rendering innovation visible and accessible to the public. Open innovation activities serve as catalysts for piquing the curiosity of prospective innovators, sparking dialogue among community members, and facilitating the dissemination of innovative ideas. Consequently, in urban innovation districts, public spaces assume the role of outdoor testing grounds, allowing for the initial assessment of innovation outcomes. Notably, District Hall in the Boston area exemplifies a product of innovation itself, as it creates a novel public space known as the Innovation Hall, specifically designed to foster an innovation-driven culture. By opening District Hall to BSID as a testing case, diverse innovative activities find accommodation within its premises.

5.2.2 Network: Relying on Public Space to Build a Network

The social dimensions inherent in urban innovation districts place significant emphasis on the value of social interaction. This extends beyond fostering strong connections and

interactions within similar fields and departments but also entails the establishment of new connections between diverse fields and departments, often referred to as weak ties[65]. Public spaces play a crucial role as vital arenas for cultivating these weak ties, providing opportunities for serendipitous encounters, networking, and knowledge exchange. Creating an innovative atmosphere represents a novel public interest embodied by public spaces within urban innovation districts, particularly in the context of the sharing economy and technological advancements. The planning and design of the network infrastructure hold paramount importance for public spaces, serving as platforms for a myriad of activities aimed at learning, skill development, and social interaction. The high-frequency social interactions among innovative individuals tend to concentrate in specific "hotspots" that may occur organically, such as Poblenou Central Park in 22@ Barcelona or the renowned bar in Silicon Valley known as Walker's Wagon Wheel. Alternatively, intentional event planners, exemplified by initiatives like BSID and MPID's Venture Café, meticulously curate such hotspots. Moreover, innovation districts require a range of catalyst activities to reactivate neglected public spaces, such as the 22@ series of events in 22@ Barcelona, the Boston Hackathon and Cocktail Party, and MPID's Thursday Innovation Exchange. Consequently, public spaces act as vital linkers between these innovation hotspots, not only forming a visible public network but also establishing internal interactive networks characterized by elements of competition, collaboration, and learning.

5.2.3 Accessibility: The Connection of Public Space and Functional Areas

A well-designed layout has the potential to enhance the utilization of local accessibility within the public space of an innovation district. Conventional industrial parks often adopt a closed approach, utilizing physical barriers like walls to isolate the park from the surrounding residential communities. However, such an approach hinders the integration of the park with its neighbouring communities.

Enhancing the local accessibility of public spaces within urban innovation districts

contributes to preserving their openness and fluidity. MPID (example) has implemented various walking and cycling options from the track site to Lane Cove National Park, while concurrently strengthening the road network density in conjunction with the public space layout to improve public space accessibility. The Huaqiang North Area in Shenzhen, originating from the Shangbu Industrial Zone, upholds the openness characteristic of the industrial block[66]. It has transformed into a highly accessible public space that is pedestrian-friendly and welcoming. In recent years, Guangzhou's urban design and planning optimization in the Pazhou West District has emphasized the development concept of "compact, intensive, efficient, and complex". On the ground level, an arcade street exceeding 2 kilometres in length has been implemented, complemented by a three-dimensional park platform above ground, and interconnections among public spaces have been realized through vertical traffic modules underground, effectively integrating ground, air, and underground public spaces.

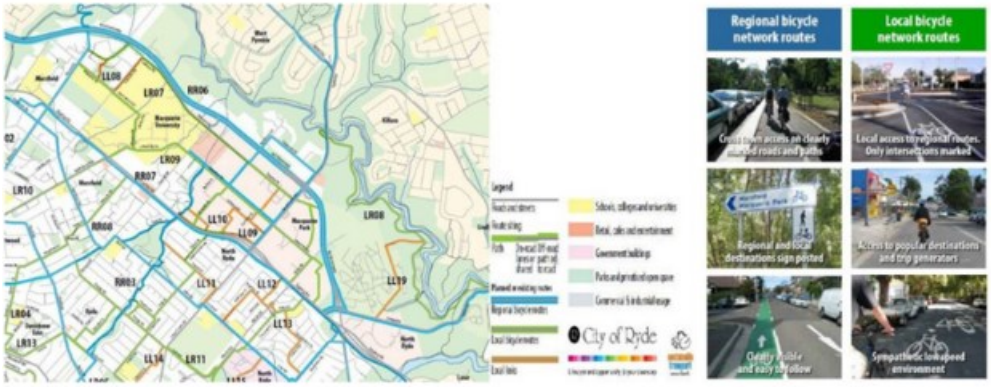


Figure 5-1 Macquarie Park Urban Innovation District Walking, Strange Walking Route Planning Map, source: Development Control Plan 2014, City of Ryde

Figure 5-2 Public space in Pazhou Street East Square. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou

5.2.4 Vibrant and Relaxing Slow-Moving Environment

Creating a pedestrian-friendly environment within public spaces is a crucial prerequisite for attracting crowds. In the context of high-density science and technology parks, it is imperative to mitigate rapid and large-scale mixed traffic and pedestrian flows. Additionally, the planning of new science and technology parks should refrain from neglecting considerations of space scale and from pursuing landscape ecology exclusively. Blindly constructing extensive green belts and large-scale square nodes without careful assessment can lead to adverse outcomes.

Figure 5-3 Schematic diagram of the renovation of Yantai Phoenix Industrial Park. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou

Moreover, incorporating pocket parks and urban furniture into the design can enhance the appeal of the walking environment and foster serendipitous encounters. A notable example is the revitalization of Kendall Square Avenue, where a distinctive leisure facility was introduced. This addition not only embellishes the urban landscape but also provides an inviting space for pedestrians to linger and engage in conversations.

Figure 5-4 Urban Furniture on Main Street in Kendall Square, source: https://mooool.com/kendall-square-main-street-by-kmdg.html

5.2.5 Knowledge Flow Atmosphere Creation

(1) A functional composite shared communication space

Shared communication spaces play a significant role in differentiating urban innovation districts from other urban areas. Similar to community service centres found in various neighbourhoods, these shared communication spaces serve as unique public venues intentionally constructed within the urban innovation district to stimulate innovation vitality. They provide an open setting for knowledge exchange and idea sharing, enabling broader engagement with ongoing innovative activities. By facilitating interaction and awareness, these spaces contribute to the enhancement of the innovation ecosystem.

The primary objective of establishing shared communication spaces is to foster knowledge sharing and facilitate information exchange. From an economic perspective, the creation of diverse and accessible shared communication spaces promotes the exchange and cross-pollination of ideas. Internationally, regions that actively cultivate urban innovation districts prioritize the development of shared communication spaces as crucial hubs for knowledge flow. Notably, innovation districts in Barcelona and Stockholm have successfully implemented workshops and informal meeting spaces to encourage such exchanges. Conversely, the Research Triangle Park in North Carolina, despite its overall success as a cluster, encountered limitations due to a dearth of venues for idea exchange. Consequently, they sought to revitalize their physical spaces to promote vibrant interactions.

Currently, Guangzhou boasts a thriving incubator ecosystem comprising over 250 facilities, including 26 nationally recognized incubators. Primarily catering to tenants, these incubators provide shared office spaces, essential office equipment, conference rooms, and roadshow halls. Some even offer specialized public laboratories, as depicted in Figures 5-5. Beyond the physical infrastructure, the incubators also provide vital software support, including venture capital, legal consulting, accounting services, and technical mentoring. While the primary focus of incubation facilities lies in offering shared office spaces and accommodating resident startups, public innovation centres serve as vibrant hubs for idea generation and exchange. These centres regularly organize interactive events and provide skill development training for the public.

Figure 5-5 The architectural form of the innovation district. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou

(2) Introduction of derivative functions of incubation facilities

The Cambridge Innovation Center (CIC), as illustrated in Figure 5-11, stands as the original startup incubator in Kendall Square. Originally a 1970s office building with an MIT Beastie style, the CIC was transformed with the aim of addressing the need for a physical space that could enhance idea exchange and networking within Kendall Square's thriving innovation economy. Recognizing the importance of creating a neutral and open meeting place, founder Tim Rowe envisioned a movement rather than a purely commercial venture, emphasizing the value of fostering conversations and interactions over a traditional dining establishment. Thus, the CIC was established to fulfil this purpose, and the model was subsequently expanded to other regions, including District Hall in Boston's Seaport Innovation District. District Hall encompasses a diverse range of functions, such as a public restaurant, a versatile multipurpose room accommodating up to 250 individuals, communal spaces featuring lounges and workstations, and flexible "pods" that can be adaptively repurposed for vending, meetings, classes, and exhibitions. By integrating public innovation spaces with open public areas, the layout allows for the extension of innovation activities beyond incubation facilities into the realm of public open space, effectively transforming such spaces into testing grounds for new products. By incorporating a broader array of public activities and programs, public innovation centres avoid being solely facilitated by tenant spaces and foster a more inclusive environment.

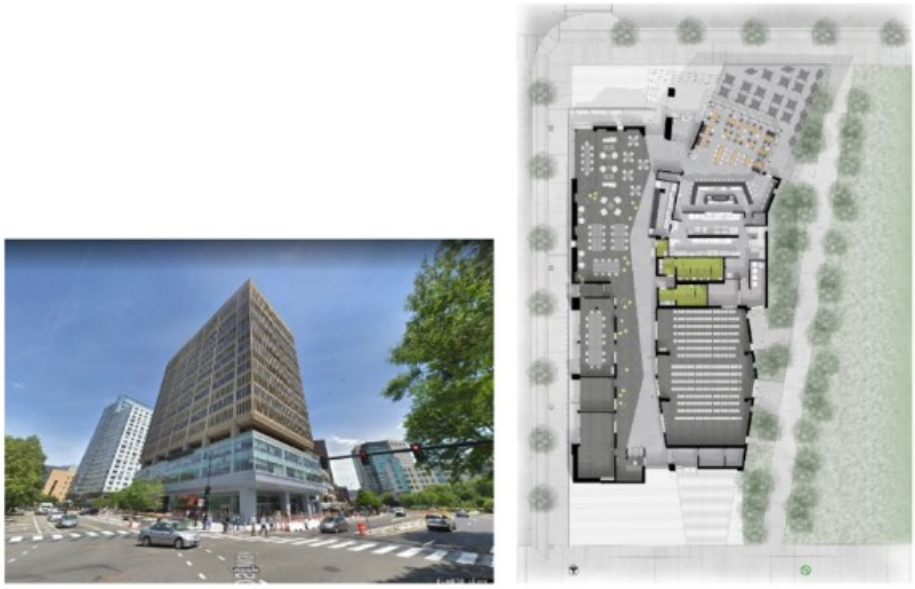


Figure 5-6 Ground Floor Space of Innovation District. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou

(3) Public retail space with various options

If we consider open spaces as the physical foundation for people to stay and unwind, the inclusion of diverse retail spaces for entertainment purposes can greatly contribute to the creation of a harmonious communication environment and enhance the sustainability of the innovative community (Figure 5-18). As highlighted by Jacobs (1961), when urban streets are filled with social gatherings, entertainment options, and commercial activities, a network of relationships and daily interactions emerges among users that cannot be easily replicated elsewhere. While policymakers may not possess the ability to directly foster a culture of innovation, public retail spaces can play a crucial role in amplifying knowledge spillovers[67]. Examples such as MPID's University Atrium, Kendall Square's Innovation Promenade, and Barcelona22@'s Poblenou Street showcase the provision of spaces where innovative individuals can reside. These spaces often open up the first floor of buildings or utilize more transparent materials at the interface, enabling pedestrians to connect with the innovative activities taking place inside. This approach significantly contributes to the dissemination of innovative practices within the public realm.

In his examination of city centre "new economy" clusters, including innovation-

oriented clusters, Thomas Hutton observed that restaurants, coffee shops, and bars not only reflect contemporary urban consumption patterns but also contribute to the unique geography of these clusters, with public retail spaces playing a complementary role in facilitating intensive social interactions within the innovation economy. An example of this approach can be seen in Singapore's One-North Science City, where a business core area near Bonavis MRT Station has been strategically designed. This area brings together various supporting services for leisure and entertainment, such as the Star Commercial and Cultural Complex, Rochester Park, and Rochester Complex. Importantly, ample space has been allocated for activity squares and pedestrian-friendly walkways, fostering an environment conducive to interaction. The adjacent retail spaces cater to the basic needs of nearby employees, offering opportunities for gathering and socializing.

Figure 5-7 Well-scaled sunken plaza and retail space, source: https://www chicagoarchitecture org wp-content uploads 2014 03/John-Hancock-CenterChicagoIllinois-March.2010-003a1.jpg

The 181 Fremont Building, located in the South District of the San Francisco Bay Market, has incorporated public retail spaces on its 5th floor, ground floor, and rooftop garden platform, providing open access to the public. This strategic implementation effectively activates the street space and enhances the engagement of surrounding communities. Prior to the renovation of Kendall Square, a survey was conducted to assess the needs of the population. The findings revealed that 77% of the respondents visited the area solely for work purposes, leading to a high daytime population and

relatively quiet evenings. In a study by Minjee Kim on the remodelled Kendall Square, it was discovered that 85% of the respondents visited public spaces, such as cafes, at least once a week during lunchtime, while 56% and 48% visited these places at least once a week during working hours and after work, respectively. As the innovation economy continues to flourish, the boundaries between traditional office spaces and daily life and leisure spaces are becoming increasingly blurred. Therefore, the inclusion of catering and retail spaces, such as bars, cafes, and trendy tea shops, alongside innovative activation facilities has become essential in urban innovation areas. District Hall and the Citizens Green in the BSID have been equipped with the necessary dining spaces to accommodate this trend. A survey conducted by Sasaki Associates in 2010 revealed that employees in Kendall Square frequently utilize social public spaces, particularly catering and retail spaces, for purposes beyond mere food and beverage consumption. These spaces serve as venues for business discussions, leisure activities, and social interactions. Research also indicates that preserving local, non-chain commercial retail spaces is beneficial for fostering diversity within public retail spaces.

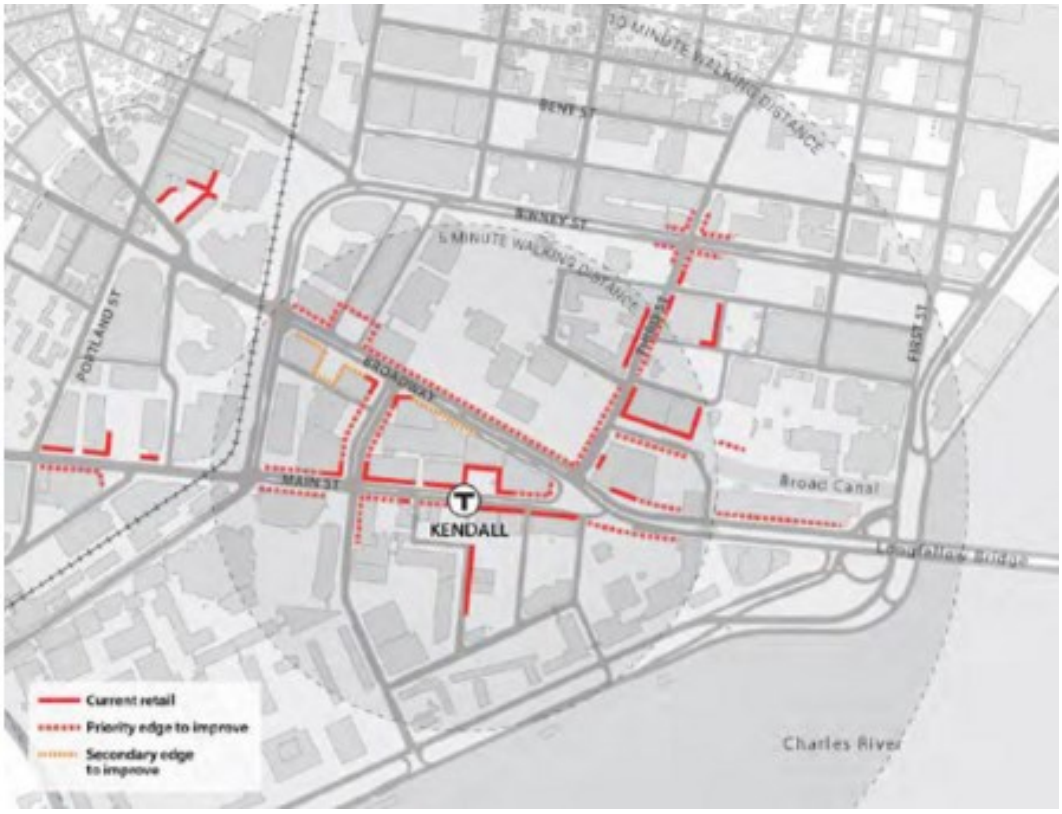


Figure 5-8 Retail space along Kendall Square. Source: Spatial qualities of innovation

districts.

Source: Spatial qualities of innovation districts

Figure 5-9 The application of transparent materials in the ground floor space helps to enhance the openness. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou

(4) Collaborative and innovative cultural activities

Innovation, as a manifestation of bottom-up creativity, thrives within networks. The establishment of urban innovation districts cannot be achieved through a single directive, but requires the careful planning and construction of diverse activities that foster collaboration across industries and departments, cultivating innovative networks and a culture of exchange and sharing. Creating public spaces that facilitate communication and interaction serves as a foundation for nurturing weak interpersonal ties while fostering an innovative atmosphere acts as a catalyst for forming a network of such ties. This atmosphere is closely intertwined with various elements, including vibrant innovation activities, street art, and lively nightlife, all of which contribute to enhancing social vitality and business interaction. By creating an environment that attracts, retains, and nurtures innovative individuals and enterprises, these districts can

thrive.

In the review of One-North Science City's development in Singapore, certain requirements were set to ensure compliance with the floor area ratio and the provision of affordable spaces for entrepreneurship, research, and public retail. Additionally, the development company was mandated to organize a minimum of two public activities annually related to the park industry. Barcelona's 22@ innovation district strategically cultivated a community culture by implementing a series of 22@ activities, fostering a strong sense of community among residents and employees. Notably, Keyun Park in Tianhe Software Park hosted an exhibition titled "I Call for the Spirit of Keyun Road" (Figure 5-10), which played a pivotal role in building a shared community identity and initiating discussions about the essence of Keyun Road. The formation of a social network, rooted in a sense of community identity, serves as a foundation for the development of weak-tie networks. Within these networks, tacit knowledge, intricately woven into the local cultural environment, is disseminated and exchanged.

Figure 5-10 Innovation activities in Keyun Innovation District. Source: Innovation District Oriented Research on the Optimization Strategy of the Public Space of Traditional High-tech Parks in Guangzhou

5.3 Third Place in Innovation District Design Principles

5.3.1 Design Principles Contribute to Building a Vibrant and Successful Innovation District.

1. Building design should be diverse.

One of the most obvious lessons from the Cambridge Center development was the

negative comments about the homogeneous brick buildings of the development. Although it may be not an easy task to artificially create diversity, it is important to keep this in mind. Utilizing old building structures and balancing the old and the new is an effective way of creating diversity.

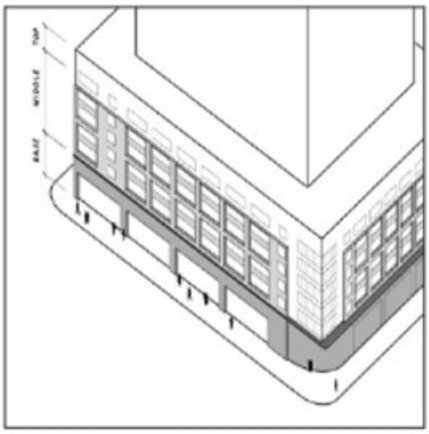


Figure 5-11 Building design should be diverse.

Source: Spatial qualities of innovation districts.

2. Plazas that are defined by buildings should be proportionate to the height and scale of adjacent buildings

Plazas that are too small or too big compared to the scale of adjacent buildings tend to be hard to activate. The appropriate proportion of the plaza is that it should be at least as wide as the height of surrounding buildings. Given the current density and built form of Kendall Square, buildings that are five to six stories are most commonplace for the buildings that abut public plazas.

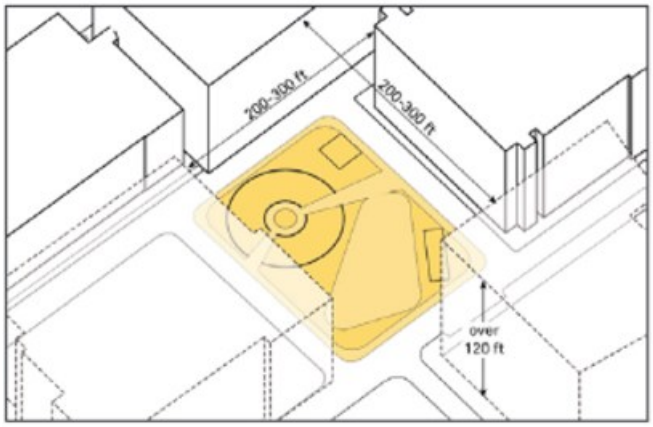


Figure 5-12 Proportionate to the height and scale.

Source: Spatial qualities of innovation districts.

3. Streets should not be overly wide

Overly wide streets create a sense that the neighbourhood is not populated enough. Kendall Square has been struggling to recover from its mistake of making the streets too wide at the time of urban renewal. The road with should be within 30 to 45 feet and sidewalk should be 10 to 20 feet if outdoor dining activities are to be accommodated. Where sidewalk spillover is not anticipated, a sidewalk width of approximately 10 ft is appropriate.

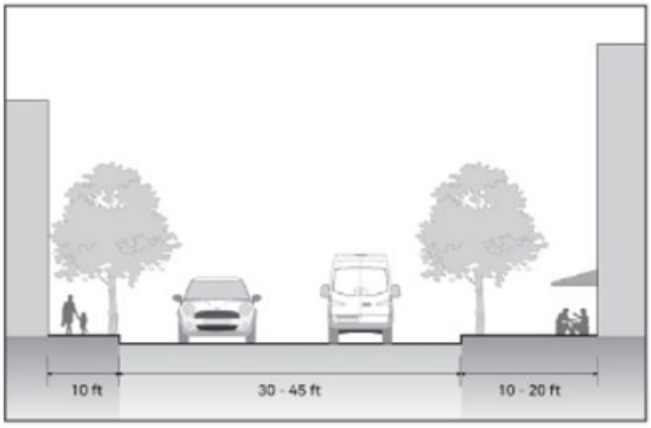


Figure 5-13 Streets should not be overly wide.

Source: Spatial qualities of innovation districts.

5.3.2 The Third Place Architectural Space Strategy

Most importantly, I argue that the physical environment that is outside buildings, the urban space that is connecting individual buildings, is the most important element in the success of innovation districts. And that well-designed Third Places, retail and public, are a catalyst for innovation. Here, I offer some specific design principles about how to create good urban spaces that will stimulate social interaction, chance encounters, and interfirm collaboration by improving the public realm of innovation districts.

One, innovation districts should be connected public realm. Comparing different public spaces in Kendall Square, I find that open spaces and plazas that are interconnected with each other and connected with public streets within a visible distance are the most thriving type of public space design.

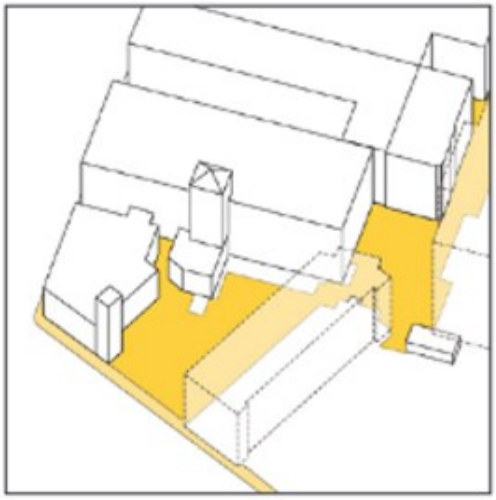


Figure 5-14 Connected public realm.

Source: Spatial qualities of innovation districts.

Two, retail spaces should be concentrated to create a critical mass. Retail spaces that are adjacent to each other or within a short distance offer eating and drinking options to the workers in the area and therefore create a focal point for concentrated pedestrian activity.

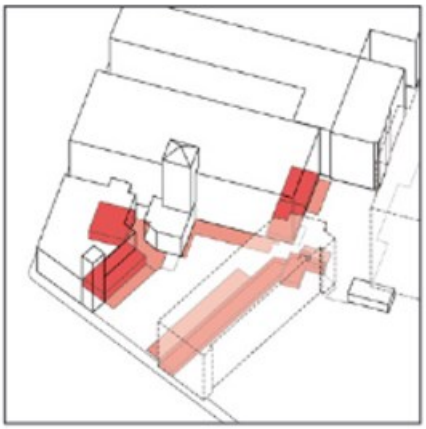


Figure 5-15 Create a critical mass.

Source: Spatial qualities of innovation districts.

Three, retail space should define the public realm. The renovation of the Tech Square in Kendall Square demonstrated the power of retail space that defines and invigorates the public realm. Public spaces that are either undefined or defined by undesirable uses such as the back of buildings become underutilized by not being able to attract people to those places.

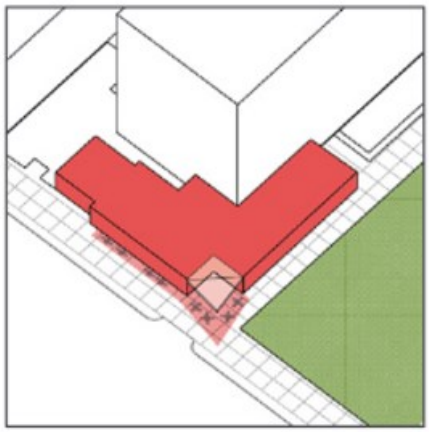


Figure 5-16 Retail space should define the public realm.

Source: Spatial qualities of innovation districts.

Fourth, ground floor of buildings should spill over to the public realm. Ground floor uses that interact with the sidewalk space, e.g. outdoor dining areas, and operable windows, have been found to be very successful in improving the image of a district compared to the uses that do not interacting with the sidewalk space[4].

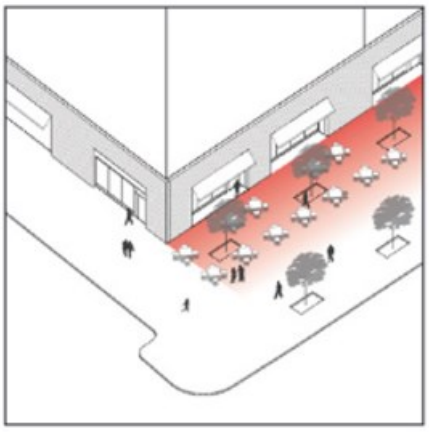


Figure 5-17 Spillover to the public realm.

Source: Spatial qualities of innovation districts.

Five, urban "nooks" are appealing to the knowledge workers. My interviews and onsite observations revealed that urban nooks become spaces where the workers like to hang around. These secluded yet public spaces are important assets in making the district look interesting and generating foot traffic.

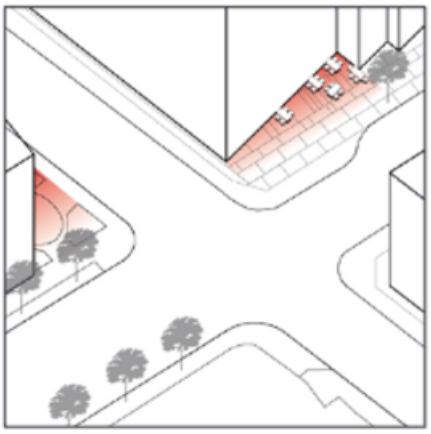


Figure 5-18 Urban “nooks”.

Source: Spatial qualities of innovation districts.

5.3.3 Third Place Public Space Strategy

1. Hyper-porch

The shared porch can transform zombie residential fabrics that lack demographic and economic regeneration into vibrant communal arrangements. In lieu of individual porches marking house fronts, a hyper-porch in mid-block threads individual homes on both sides of the block to create communal living strategies or at least a shared public realm for greater conviviality. The shared infrastructure can be managed through a Village network sponsoring a sharing economy where cars, food, tools, labour, and caregiving are exchanged peer to peer as collective resources. As infill hardware, the porch seeds a neighbourhood ecosystem welcoming additional supplementary units and plug-in components (patios, screened rooms, grill pits, terraces, gazebos, exercise pools, etc.) as desired by the pocket neighbourhood. Much like the deck of a cruise ship, the hyper-porch sponsors a chain of events where there is something for everybody.

2. Patio Mat

Cul-de-sacs are a popular suburban street type appreciated for their quietness but undermine neighbourhood connectivity. Also called “dead ends,” these streets experience very low traffic flows. at approximately 400 dollars per linear foot, they embody a significantly underutilized asphalt investment. A third place retrofit turns the oversized right-of-way into a shared space that delivers non-traffic social and ecological

services common in great streets. Streets as territories can sponsor community gardens pavilions and porches, recreational courts, and informal workplaces in constructing new places. Urban mat retrofits servicing large-scale homes, each comfortably accommodating multiple senior households, and can readily enable superior networks for aging in the community.

3. Open Green Plaza

Thriving neighbourhoods begin with the vitality of small-scale spaces on the ground floor. Many “first-ring” suburban neighbourhoods (older pre-WWII suburbs close to urban cores and characteristically compact with mixed uses and good infrastructure) are ideal candidates for infill community development that benefits urban blocks and neighbourhoods. Shared garage facilities replace individual dilapidated garage structures with a mall of mixed-use programs— accessory dwelling units (granny flats), decks and porches, senior clubhouses, covered walking and gaming courses, and co-working and maker spaces. Existing homes can be attached to the garage gallery for extension of living space and connection with neighbouring units to optimize communal living possibilities, or at least greater sharing of resources. The gallery structure provides continuity while facilitating varying degrees of individual use and development[68].

6. IMPLEMENT OF THIRD PLACE ENHANCEMENT STRATEGY IN KEYUN INNOVATION DISTRICT

6.1 Developing Position

"Guangzhou Tianhe District Land and Space Master Plan (2021-2035)" points out that Tianhe District will establish a world-class central vitality area with a leading level of openness and bursting innovation vitality in 2035. By 2025, build a core functional hub of a national central city, a display window for advanced socialist culture, and a model demonstration of a modern international business environment, and basically build a strong innovation district with international competitiveness, a strong digital economy zone, a strong modern service industry zone and a Talent Highland. "Tianhe will build an urban spatial structure of "dual-core leadership and axis drive". It will lay out key functional areas such as the central vitality area in the south, the Tianhe Smart City-Tianhe Smart Valley-Peri Wushan Innovation area in the central part, and the future science and technology ecological development area in the north. The main purpose of the five-mountain innovation source area is to solve the problems of limited expansion of colleges and universities, insufficient scientific and technological innovation carriers, poor urban quality, etc., to sort out and reconstruct the urban style of the surrounding areas, and to form a source area that meets the development needs of the source area. Space platform and space quality. Drive regional urban renewal with scientific and technological innovation of colleges and universities, form an attractive living environment for innovation and entrepreneurship, attract high-end talents to focus, and provide corresponding urban functions and landscape environments for industries and talents, so that people, cities, and The integrated development of production and scenery will improve the quality of the region.

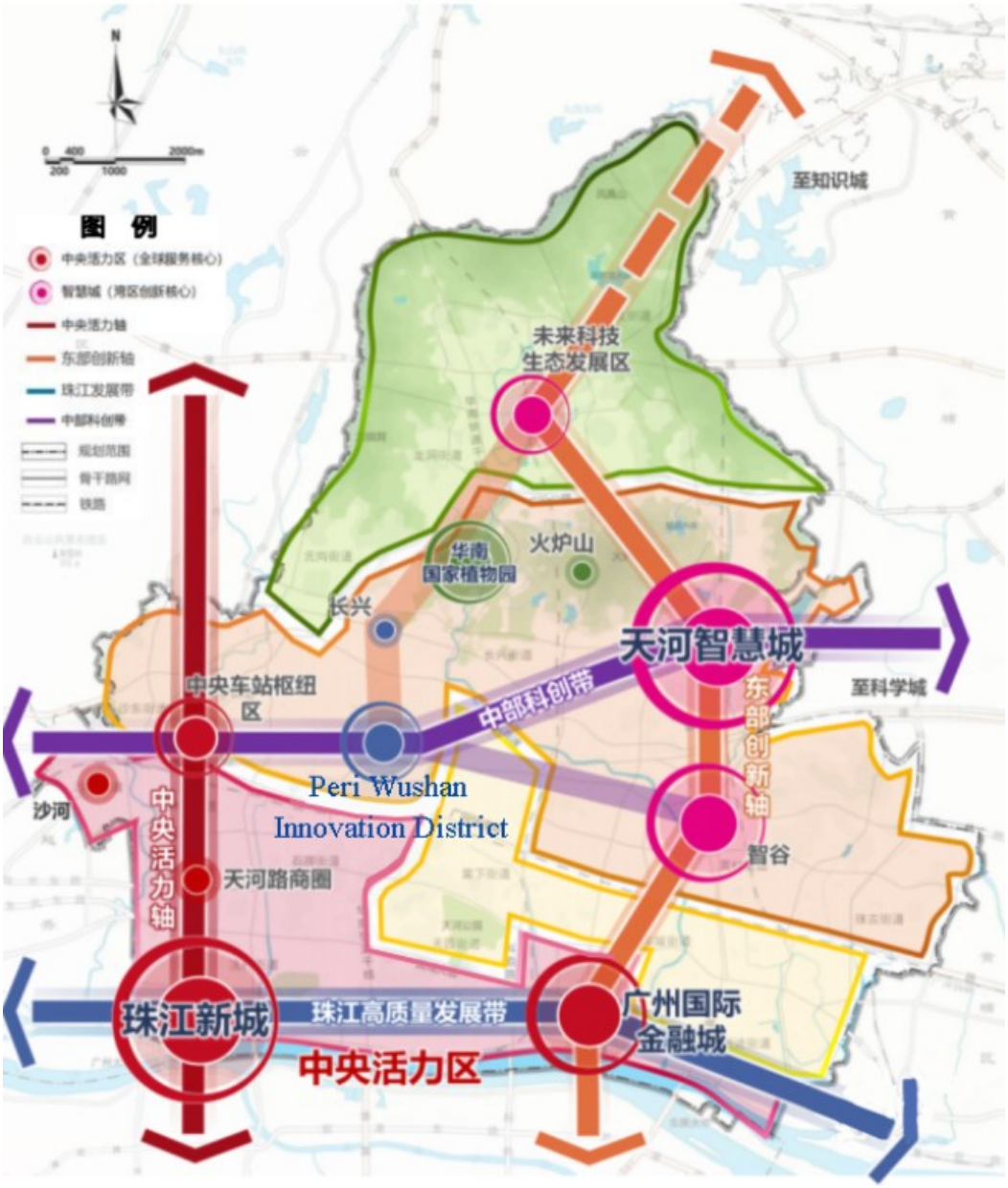


Figure 6-1 "Three Axes" of Innovation in Guangzhou. Source:

https://static.nfapp.southcn.com/content/202305/19/c7699212.html

6.2 Problem Statement

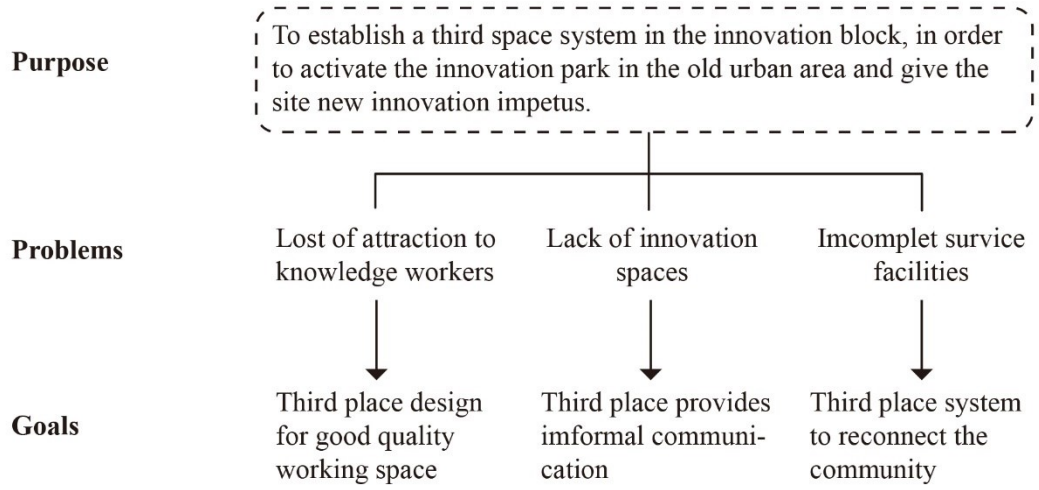


Figure 6-2 Description of Passenger Transport Innovation District Problems. Source: made by the author.

As shown in the figure, the project focuses on the problem that the development of innovation space in Keyun Innovation Industrial Zone lags behind the development of innovation types, mainly manifested in the gradual decrease in attractiveness to knowledge workers, the lack of innovation space and the lack of supporting public service facilities. Because it is located in an old urban area, the road network is chaotic, the functional division is too obvious, the traffic is inconvenient, and there is a lack of public space. As a result, the third place of the innovative industrial park is reduced, and its attractiveness to knowledge workers is reduced. At the same time, land use restrictions in old urban areas have led to the relocation of more mature enterprises, resulting in a vicious circle caused by the environment.

From the perspective of the innovation district, rebuilding the Keyun Innovation Industrial Zone and establishing a rich third-space social network connecting Keyun North Road and Zhongshan Avenue are crucial to strengthening the innovation vitality of the Keyun Innovation District. For knowledge workers, a good working environment and a third place with a good social space network are crucial to the development and transformation of Guangzhou's innovative industries.

6.3 Developing Goals

The research questions of this project are based on these questions and the third place theory. The main research question of this project is how to re-establish a new type of innovation district with sufficient attractiveness and sustainable development through the establishment of a third place network system in the city innovation district. Knowledge workers provide a better innovation environment and stimulate the innovation vitality of the site.

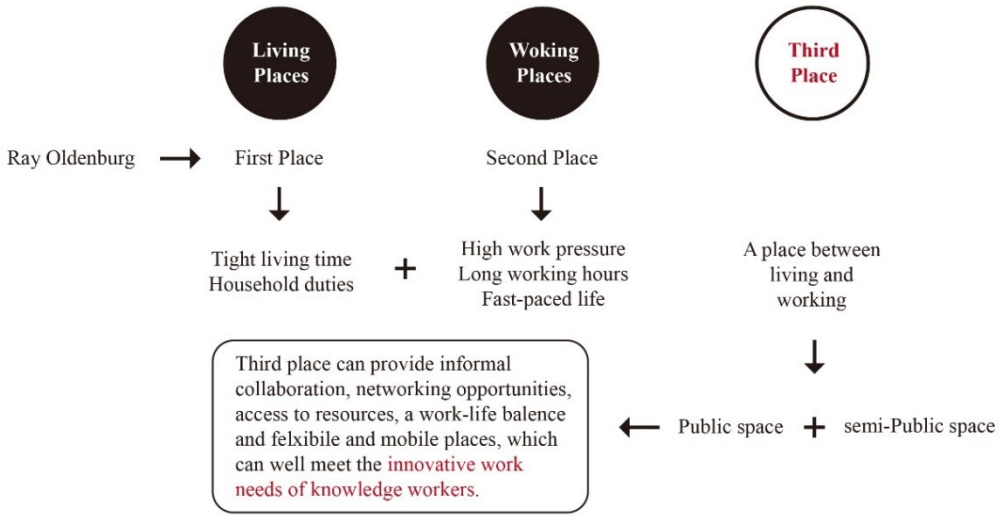


Figure 6-3 Solution from Third Place. Source: made by the author.

This paper uses the design theory of innovation districts to guide the overall spatial framework of Keyun Innovation District, and refers to the spatial texture of well-developed innovation districts at home and abroad to design the road system and functional space distribution of the site. Secondly, according to the third place theory of Ray Oldenburg and Iñigo Lorente-Riverola, the building and the grey space in the site are functionally connected, so that the third place of Keyun Innovation District can well meet the needs of knowledge-based people in the block. Workers' daily life and higher standard space requirements; classify the public space outside the building into corridors, garden groups and green public space; connect innovative functional buildings through structures and sunken squares to enhance knowledge A communication space for innovative workers in the working environment, so as to stimulate innovation vitality. In the part of commercial public space, indoor and outdoor

are connected; retail space is used to define the boundary of public space; the third place is connected to form a spatial structure from point to line; "corner" is reused to make the best use of it into A place suitable for communication.

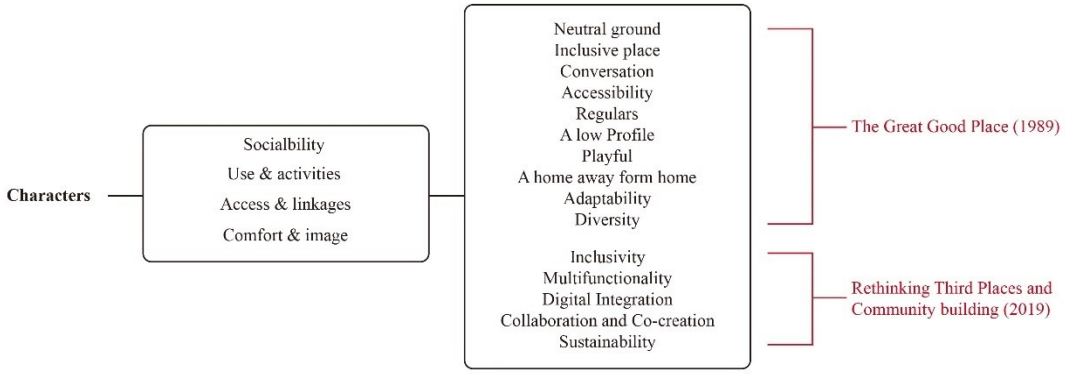


Figure 6-4 Third place characteristics. Source: made by the author.

The purpose of the third place in the Keyun Innovation District is to stimulate the innovation vitality of knowledge workers and attract innovative workers, increasing the community's innovation motivation. However, since there are other residents living on the site, the function of the site to meet the needs of daily life is also indispensable. For this project, the purpose of the third place is not to rebuild a new innovative industrial park, but to try to build a communication platform for knowledge workers through the third place, at the same time, it can also provide students who are not knowledge workers at present Or provide a platform for other social personnel to come into contact with innovative industries. Therefore, the third place in Xingmu is mostly a place to promote social communication, improve the convenience of life and reflect the characteristics of innovative industries, including retail stores, hotels, restaurants, teahouses/cafes, community centers and other indoor spaces. There are also outdoor spaces such as courtyards, streets and parks.

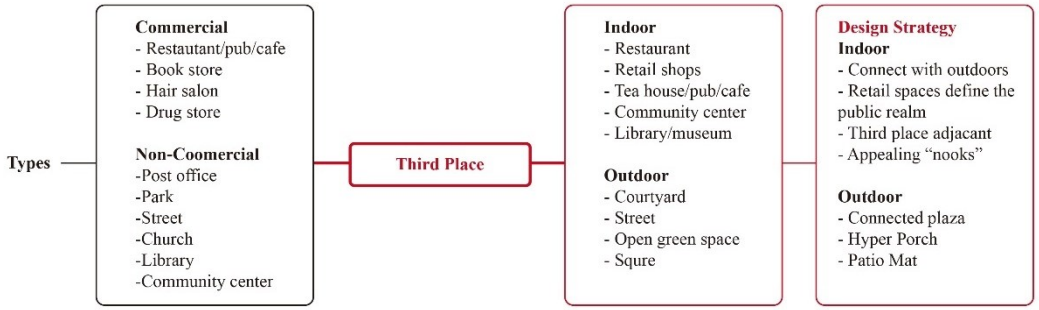


Figure 6-5 Space strategies from Third Place Theory. Source: made by the author.

6.4 Urban Design Layout

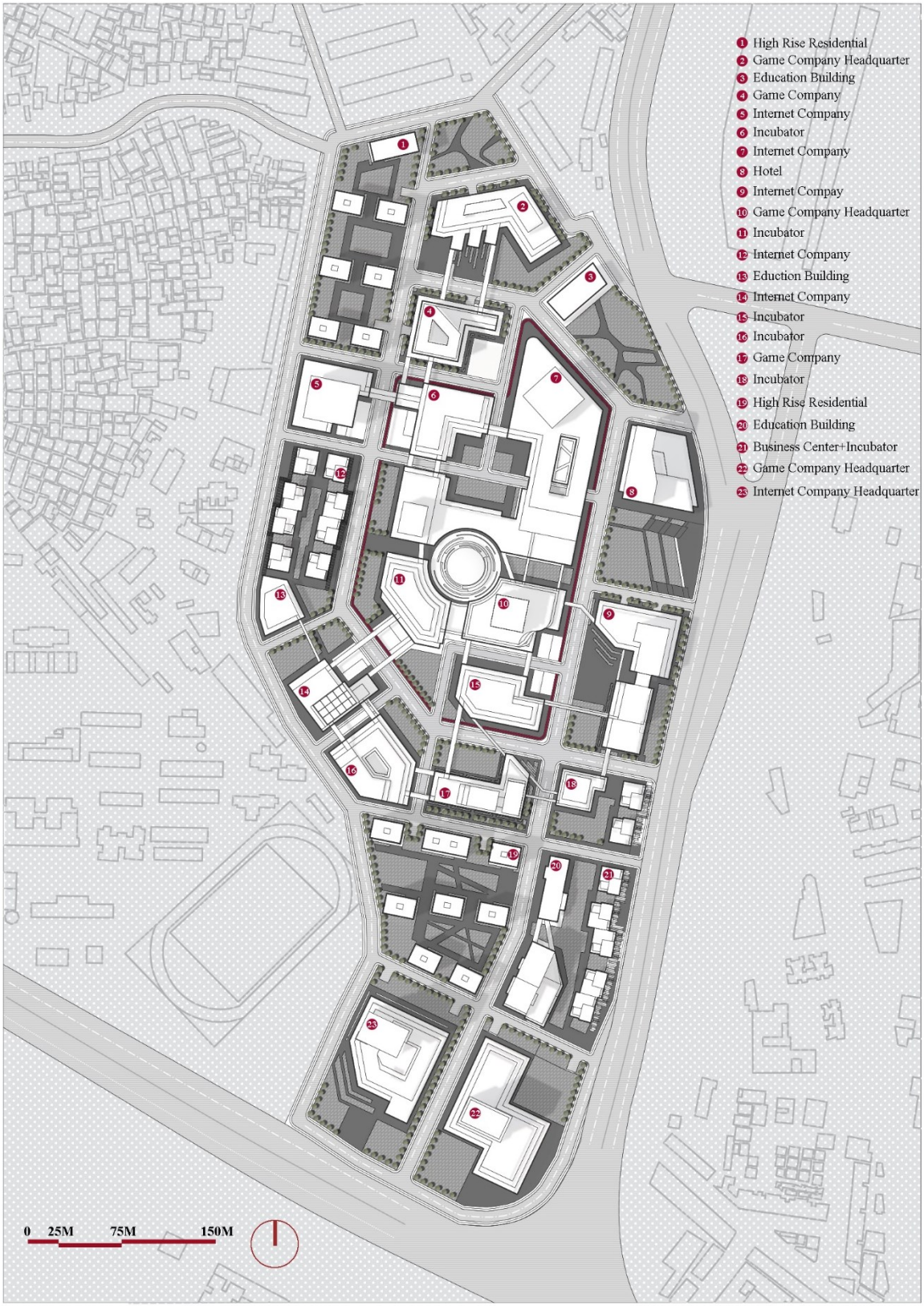


Figure 6-6 Masterplan. Source: made by the author.

6.5 Plan Strategies for Innovation District

6.5.1 Traffic Structure

Through the case analysis, try to summarize the basic scale of the well-developed innovation district. The block size of Barcelona 22@ is mainly 120m×120m, the building thickness is mostly 20m, the main road is 15m wide, and the secondary road is 10m wide. Most of the blocks in the MIND Milan Innovation District are 50m×200m, the building thickness is mostly 20m, the main road is 40m wide, and the secondary road is 10m wide. The minimum block size in Silicon Valley is 130m×230m, the common thickness of buildings is 40m, the width of main roads is 20m, and the width of secondary roads is 8m. The minimum block size of Kendall Square is 60m×170m, the average building thickness is 55m, the main road is 20m wide, and the secondary road is 10m wide. The minimum block size of Zhongguancun is 70m×150m, the average building thickness is 18m, the main road is 20m wide, and the secondary road is 10m wide.

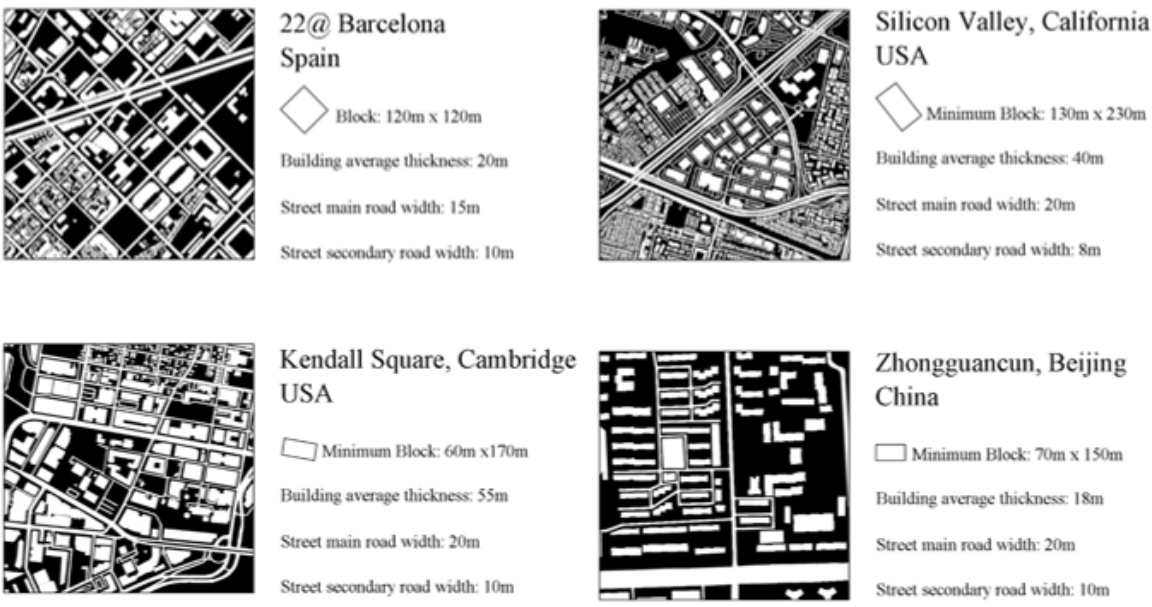


Figure 6-7 Case road network analysis. Source: made by the author.

Based on the above analysis and summary combined with the current situation of Keyun

Innovation Industrial Park, the size of the block is set at 140m×190m, the average thickness of the building is 20m, the width of the main road is 15m, and the width of the secondary road is 10m.

Figure 6-8 Functional distribution and traffic analysis map of Keyun Innovation District. Source: made by the author.

The overall planning strategy for innovative blocks proposed above needs to follow accessibility: the connection between public space and functional areas; openness: public space makes innovation visible and open; and network: the main principle of building a network relying on public space. Based on this, the road network of the site was overall redesigned[8].

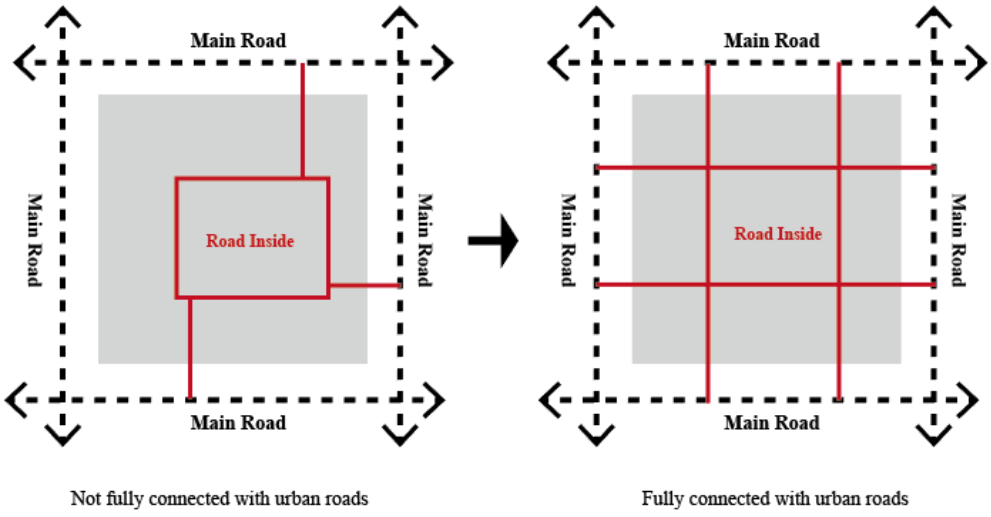


Figure 6-9 Relationship between roads in the site and main roads. Source: made by the author.

The main road forms a ring road inside the site, connecting the north and the south, and connects with the main roads adjacent to the site, Keyun Middle Road and Zhongshan Avenue, which increases the main entrances and exits of the site, connects the site with the external space and enhances the openness of the site.

Figure 6-10 Distribution of main roads inside the site. Source: made by the author.

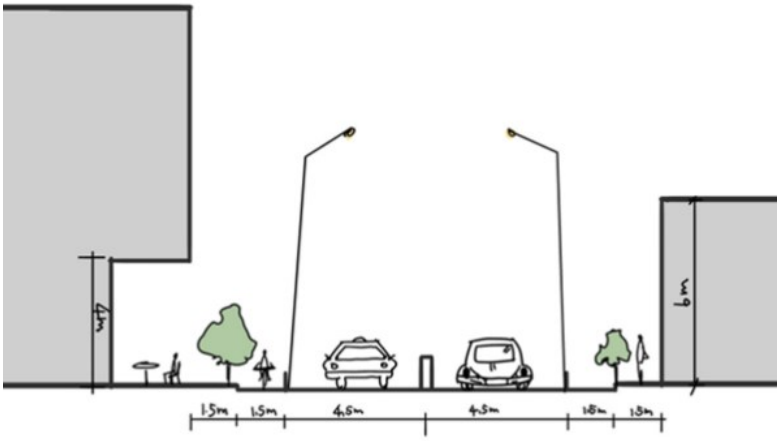


Figure 6-11 Main road section. Source: made by the author.

The secondary roads connect the interior of the site. In the initial stage, the secondary road network tends to form a complete network system to connect the site. After the function is implanted, the secondary roads of the site are optimized in combination with the functional requirements of the site and the needs of the third place.

Secondly, the road network is merged according to the function of the site, so that the

road network can be more in line with the design.

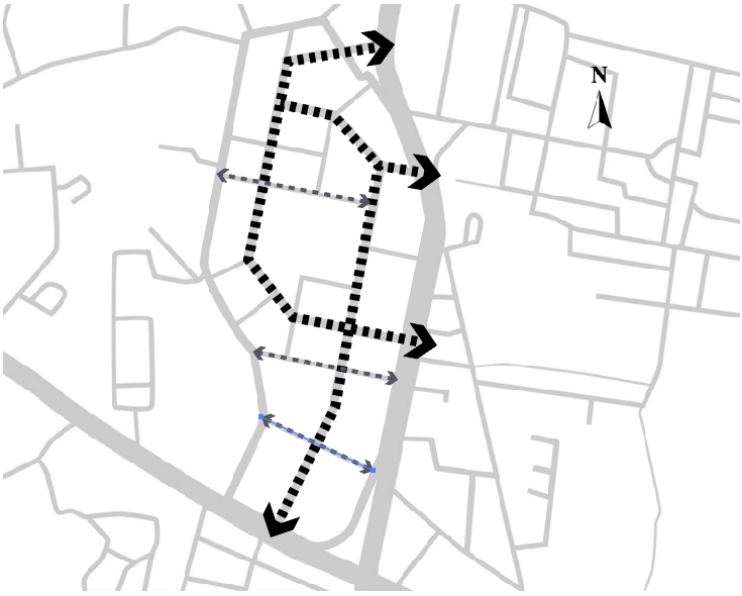


Figure 6-12 Distribution of secondary roads inside the site. Source: made by the author.

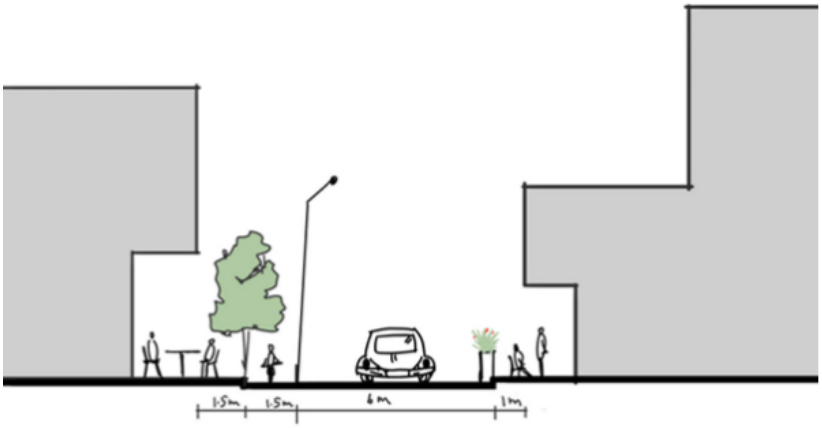


Figure 6-13 Secondary road section. Source: made by the author.

6.5.2 Function Analysis

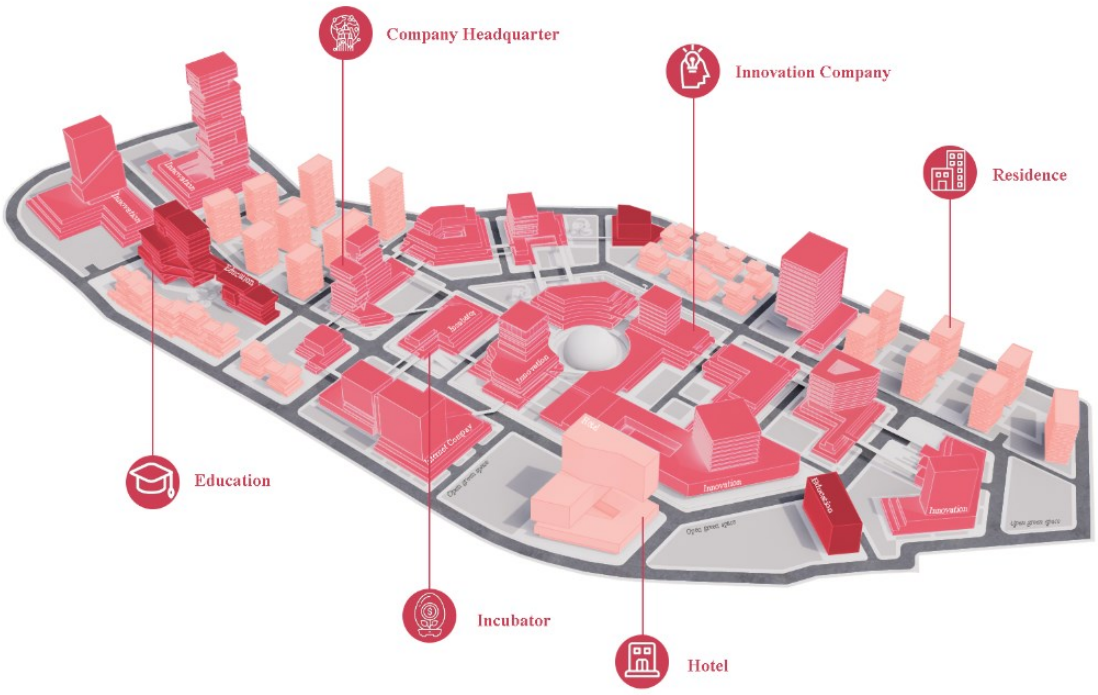


Figure 6-14 Distribution of different building functions. Source: made by the author.

Based on the 12 innovation district design principles proposed by Brooking, and following the characteristics of the Keyun Innovation District used to be, which is dominated by games and Internet companies, the functions have been re-arranged. In terms of layout, the game company and Internet company in the center of the venue are mixed, and the functions are mixed to provide maximum convenience for knowledge workers working here. The site is surrounded by buildings to form many patios, providing more possibilities for mutual communication between knowledge workers.

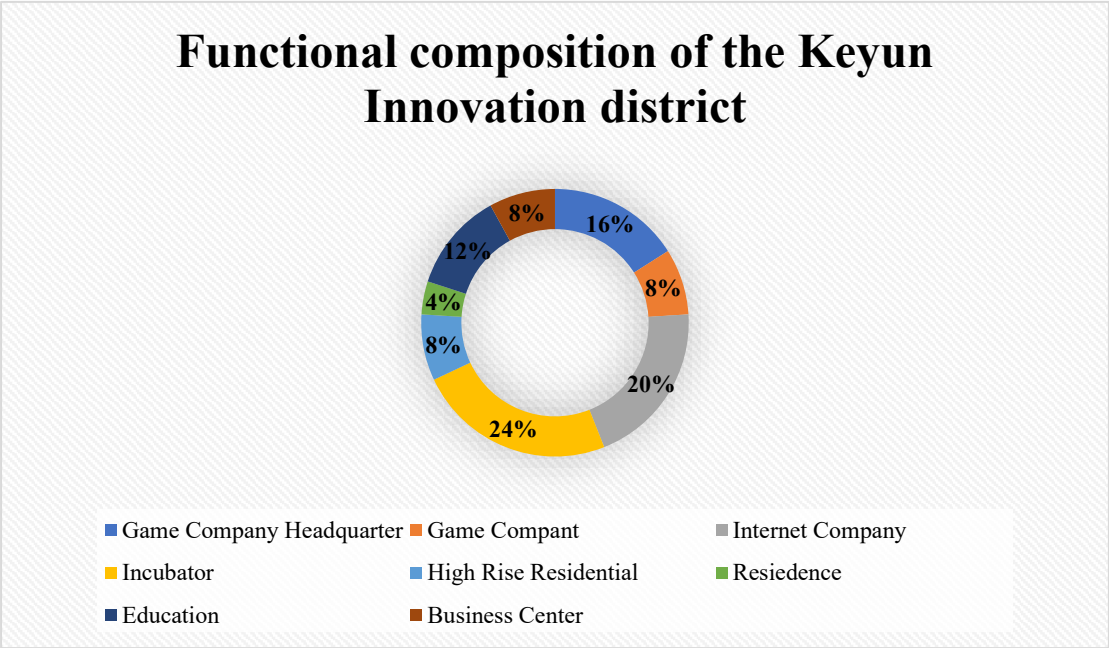
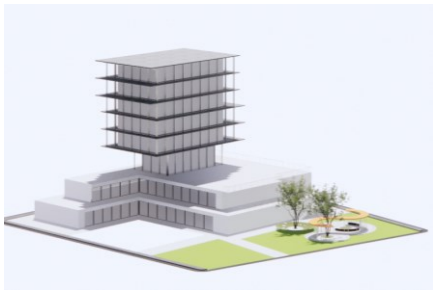
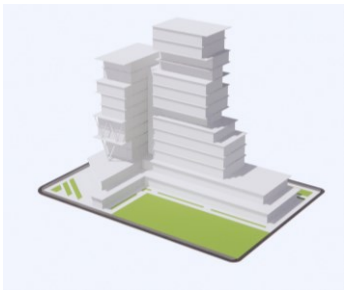
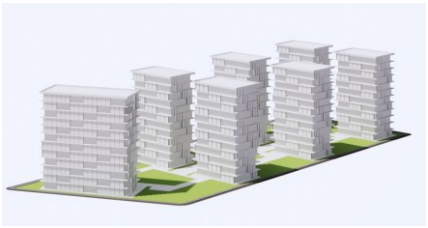
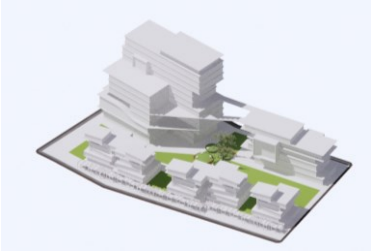
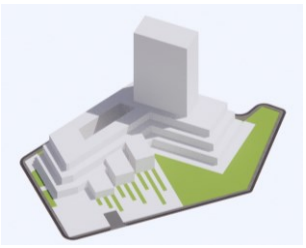


Figure 6-15 Functional composition of the Keyun Innovation district.

Source: made by the author.

As shown in Figure 6-14, in the design, the game company headquarters in Keyun Innovation district accounted for 16%, game companies accounted for 8%, Internet companies accounted for 20%, and incubators accounted for 24%. The research and development contents of these companies are interrelated, and the gathering of venues can give full play to the role of knowledge spillover in the innovation district and stimulate innovation vitality. Secondly, high-rise residences account for 8%, and ordinary residences account for 4%, which can provide certain living facilities for knowledge workers working here. Educational buildings account for 12%. By being close to innovative companies in location, learners can have close contact with specific innovation content and communicate with knowledge workers, providing a steady stream of vitality for the development of innovation districts. Commercial centers account for 8%. The goal of the innovation district is to promote economic development through innovation. The establishment of commercial centers can enable innovative companies to better display their products and open a window for commercial development.

Table 6-1 Architectural forms of different building types. Source: made by the author.

Innovation Buildings		
Residential buildings		
Education Buildings		

6.5.3 The Spatial Development Framework

Through site analysis and interviews, the classification of two types of space is mainly determined to establish a spatial framework to promote the innovative and sustainable development of Keyun Innovation District. A table describing the approach used and the space to which each selected planning method is applied and what it intends to achieve is shown below inTable 6-3.

Table 6-2 Characteristics and Types of the Third place in the Innovation District.

Source: made by the author.

Approach	Design Element	Consideration
Public	Connected Porch	**Residence**: Provide a place for residents to relax, entertain and chat. **Innovation**: Provides informal gathering opportunities and free workspace for knowledge workers.

	Creativity patio mat outside the second place	**Sunken Square**:Connect the innovative space blocked by the road with the outdoor space that provides shade. **Patio**: Provide landscape and outdoor activity space for surrounding buildings, and the enclosed form provides a certain degree of privacy.
	Relaxation green place	**Openness**: Provide activity venues for the residents around the site, so that they can get closer to the surrounding activities of the innovation district, and also provide a venue for holding corporate activities in the innovation district. **Slow walking**
Semi-public	Connected with the outdoors	**Commerce:** Commercial spaces with a third place such as retail can expand the space for commercial services by connecting with the outdoors, and can make more people pay attention to the third place itself.
	Retail spaces define the public realm	**Convenience**: The third place provided by the retail space is embedded in the innovation district, which can provide more basic service facilities and informal communication space for the innovation district.
	Third place adjacent to each other	**Network:** A spatially linear third place belt is formed through the close proximity of retail spaces.
	Appealing “nooks”	**Pocket Park:** Setting street corners as pocket parks with innovative cultural display functions are conducive to creating an atmosphere for the flow of innovative knowledge

6.6 Public Spaces Strategies Based on Third Place Theory (Outdoor)

6.6.1 Connected Porch

Figure 6-16 Connection of Porch and corridor between buildings. Source: made by the author.

Residence: Shared porches can transform activity-deprived residential structures into vibrant public spaces. The porches in the middle of the block replace the individual porches marking the fronts of the houses, linking the individual houses on either side of the block to create communal living strategies or at least a shared public realm for greater conviviality. Shared infrastructure can be managed through village networks

that support a sharing economy where cars, food, tools, labour and care are exchanged peer-to-peer as collective resources. As infill hardware, the porch provides the foundation for the neighbourhood ecosystem, meeting the needs of the pocket community. The porches support a range of activities, and there is something for everyone.

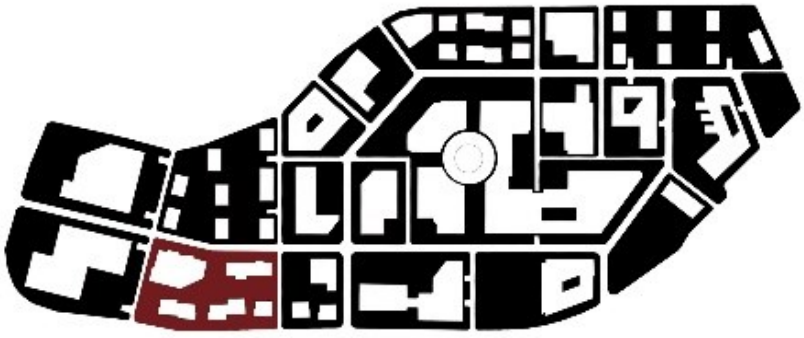


Figure 6-17 Residence block location. Source: made by the author.

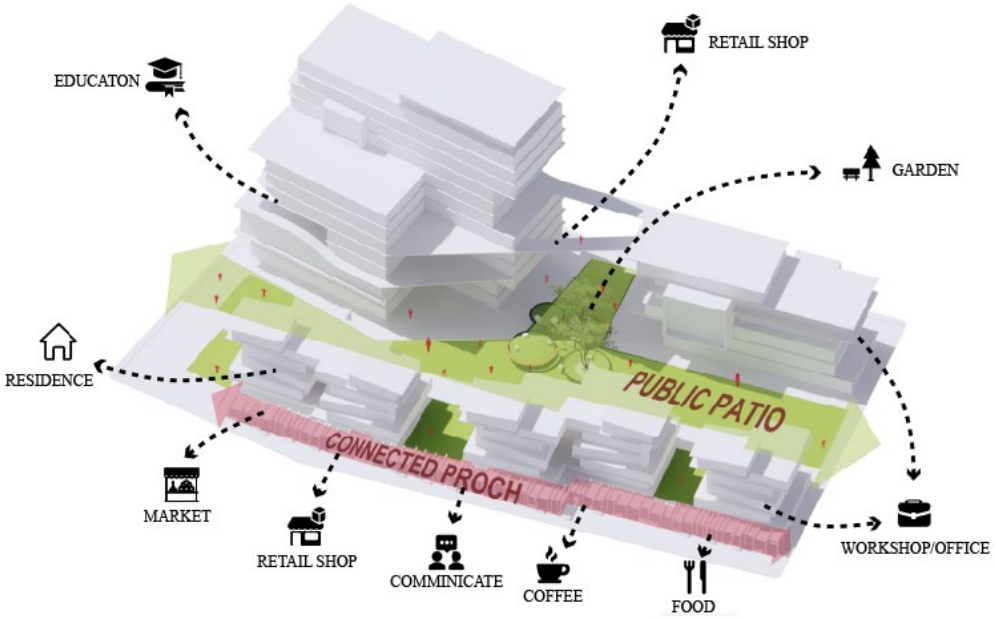


Figure 6-18 Connected Porch in Residence block space illustration. Source: made by

the author.

Innovative functional area: Based on the subtropical climate in Guangzhou, the second floor of the building in the innovative functional area is mostly cantilevered to provide such and public activity space for knowledge workers. The first floor of the innovative area is embedded with retail functions, and the third place extends from the building to the outside of the building, and it is continued by the outdoor corridor space.

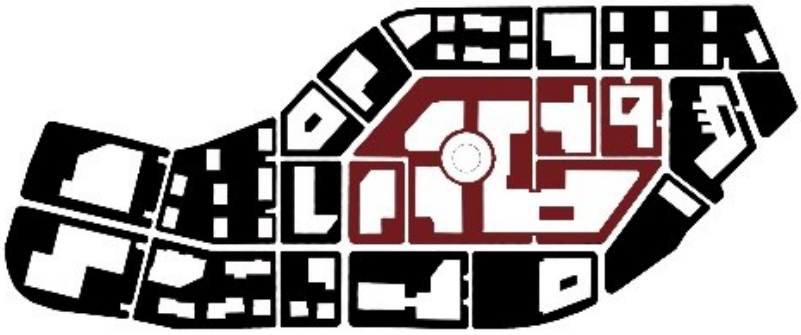


Figure 6-19 Innovation block location. Source: made by the author.

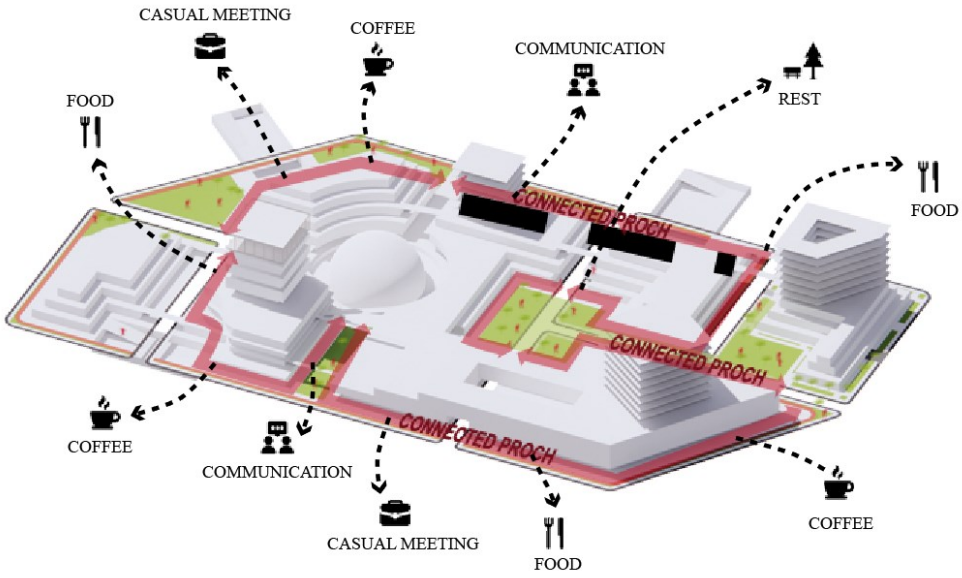


Figure 6-20 Connected Porch in Innovation space illustration. Source: made by the author.

6.6.2 Creative Patio

Figure 6-21 Continuity of squares, patios and green open spaces. Source: made by the author.

Sunken Square: Connecting components of innovative functional buildings separated by main roads, the combination of sunken space form and grand staircase naturally forms a good public space and green environment, and can provide a certain sunshade function. Although it is an open space connecting two innovative buildings, its entrance and exit are only close to the two buildings, so it has a certain degree of privacy, which is suitable for communication and activities within the team.

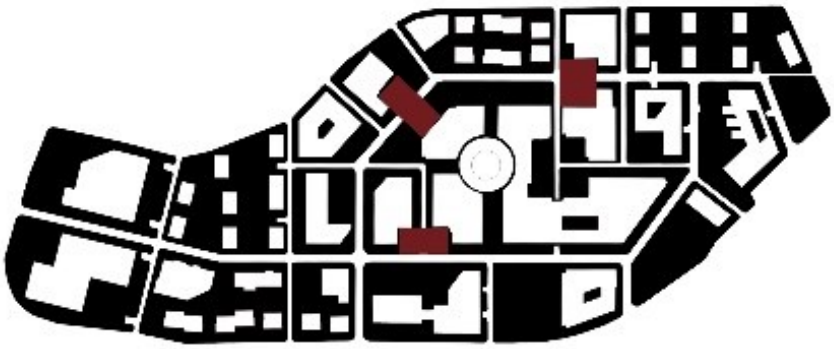


Figure 6-22 Sunken Square location. Source: made by the author.

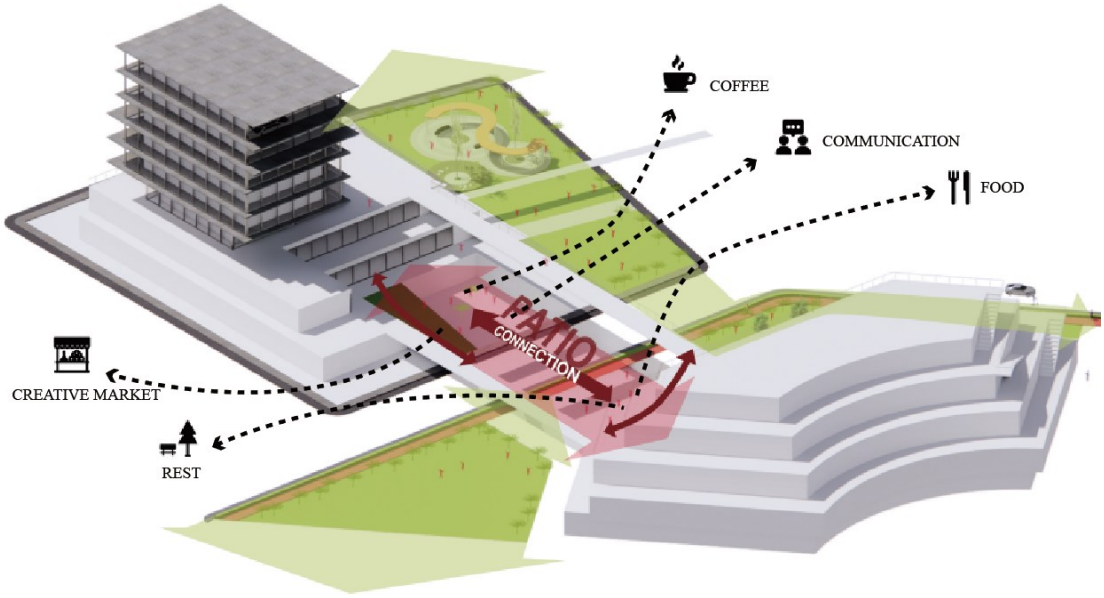


Figure 6-23 Creative porch space illustration. Source: made by the author.

Patio: Cul-de-sacs are a popular suburban street type appreciated for their quietness but disrupting neighbourhood connectivity. Also known as "dead ends," these streets have very low traffic. The third downsizing transforms oversized right-of-way into shared spaces that provide non-traffic social and ecological services commonly found on streets. Territorial streets can sponsor community gardens, gazebos and porches, playgrounds and informal workplaces to create new places.

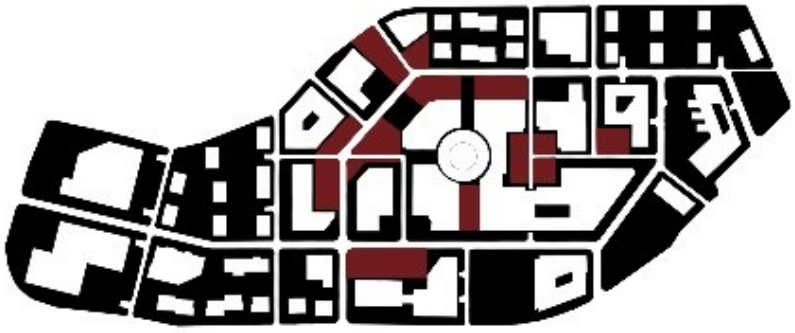


Figure 6-24 Creative Patio location. Source: made by the author.

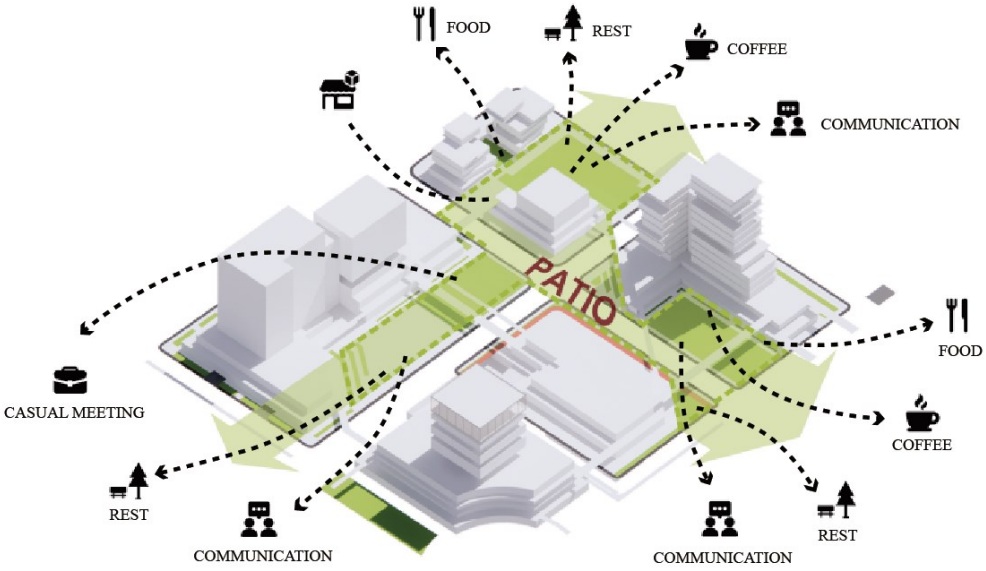


Figure 6-25 Cul-de-sacs in innovation block space illustration. Source: made by the author.

6.6.3 Relaxation Green Place

Slow Walk: The daily life of knowledge workers is often too stressful and lacks exercise. The third place of Slow Walk provides space for knowledge workers and surrounding residents to promote exercise. Movement is healing and improves balance, strength and endurance. Promote a virtuous cycle of life and work for knowledge workers.

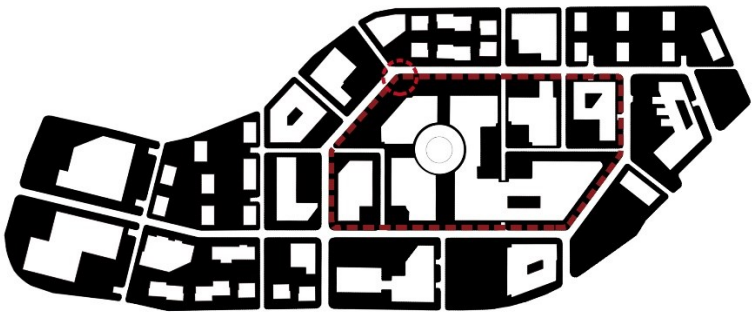


Figure 6-26 Slow Walking Road location. Source: made by the author.

Figure 6-27 Slow-walking area. Source: made by the author.

Public and open green space: It is the best third place in the city. Provide activity venues for residents around the site, so that they can get closer to the surrounding activities of the innovation district, and also provide venues for holding corporate activities in the innovation district. Creating a good landscape environment will help to increase the attractiveness of the site to knowledge workers and also help to improve the quality of urban space.

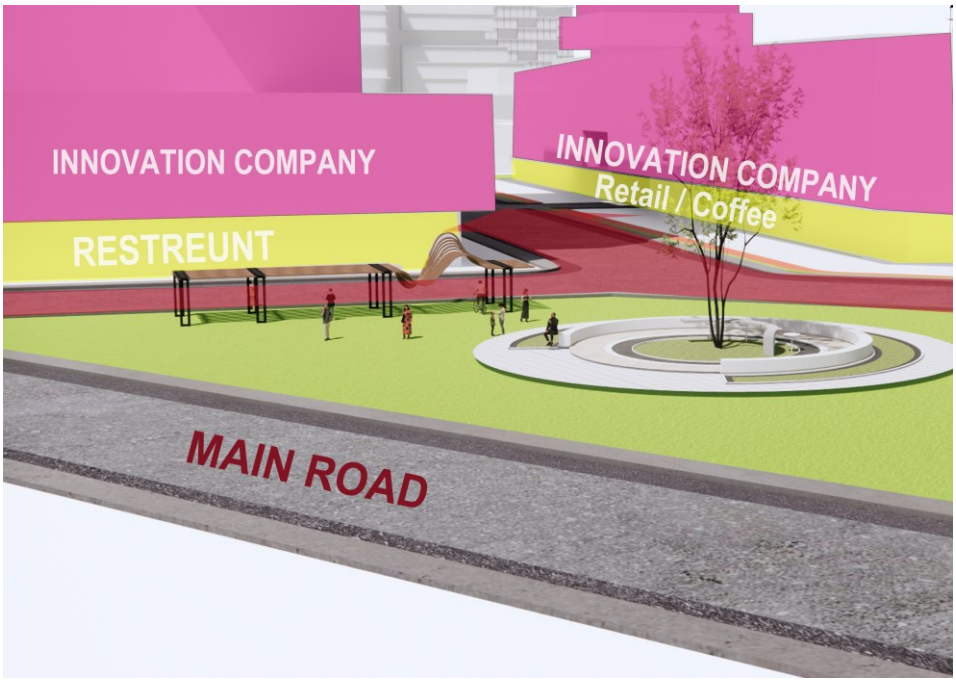


Figure 6-28 Public and open green space. Source: made by the author.

6.7 Semi-public Space Strategies Based on Third Place Theory (Indoor)

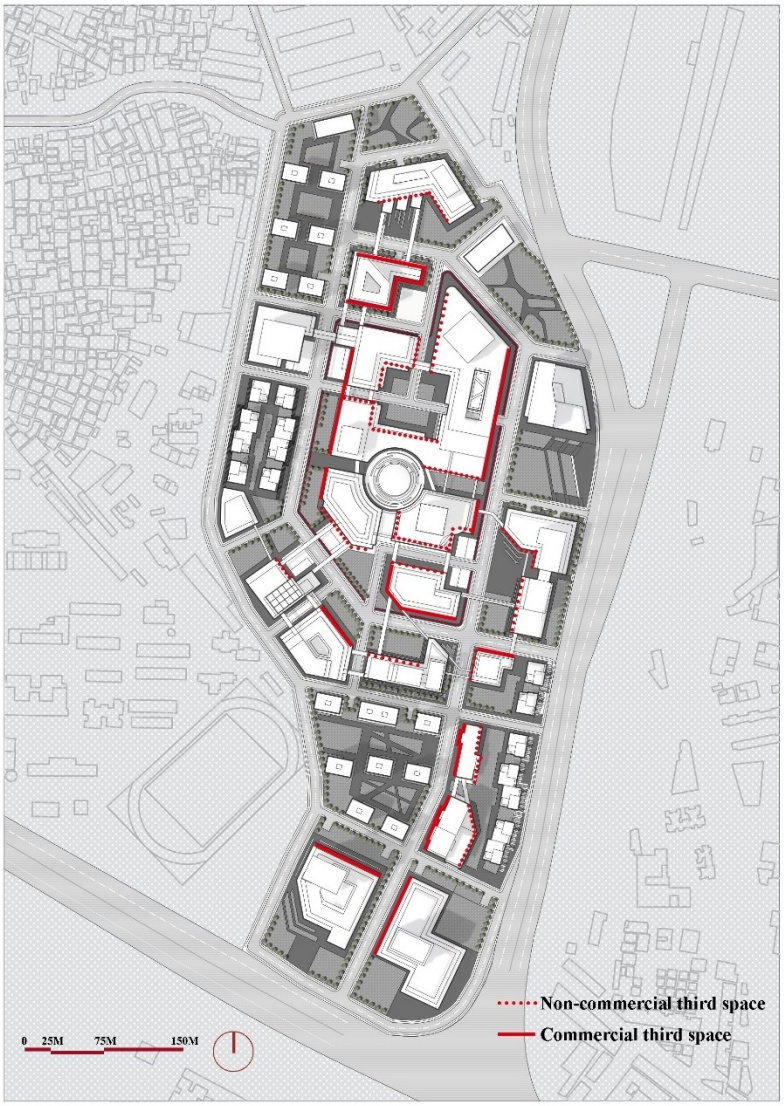


Figure 6-29 The third place that extends to the outdoor public space. Source: made by the author.

As shown in Figure 6-28, the first floor of each functional building on the site is the third place that provides the daily needs of knowledge workers and balances work and life. It is divided into commercial third place and non-commercial third place. Commercial third places such as restaurants, cafés, and retail stores provide opportunities for informal communication and leisure for knowledge workers. Non-commercial third places such as shared office spaces and lobbies provide flexible office space for knowledge workers. Through the continuous commercial third place and non-

commercial third place, knowledge workers are provided with more space for communication, cooperation and thinking besides staying at their jobs.

6.7.1 Connected with Outdoors

The ground floor of buildings should spill over to the public realm. Ground floor uses that interact with the sidewalk space, e.g. outdoor dining areas, and operable windows, have been found to be very successful in improving the image of a district compared to the uses that are not interacting with the sidewalk space.

Commerce: Commercial spaces with a third place such as retail can expand the space for commercial services by connecting with the outdoors, and can make more people pay attention to the third place itself.

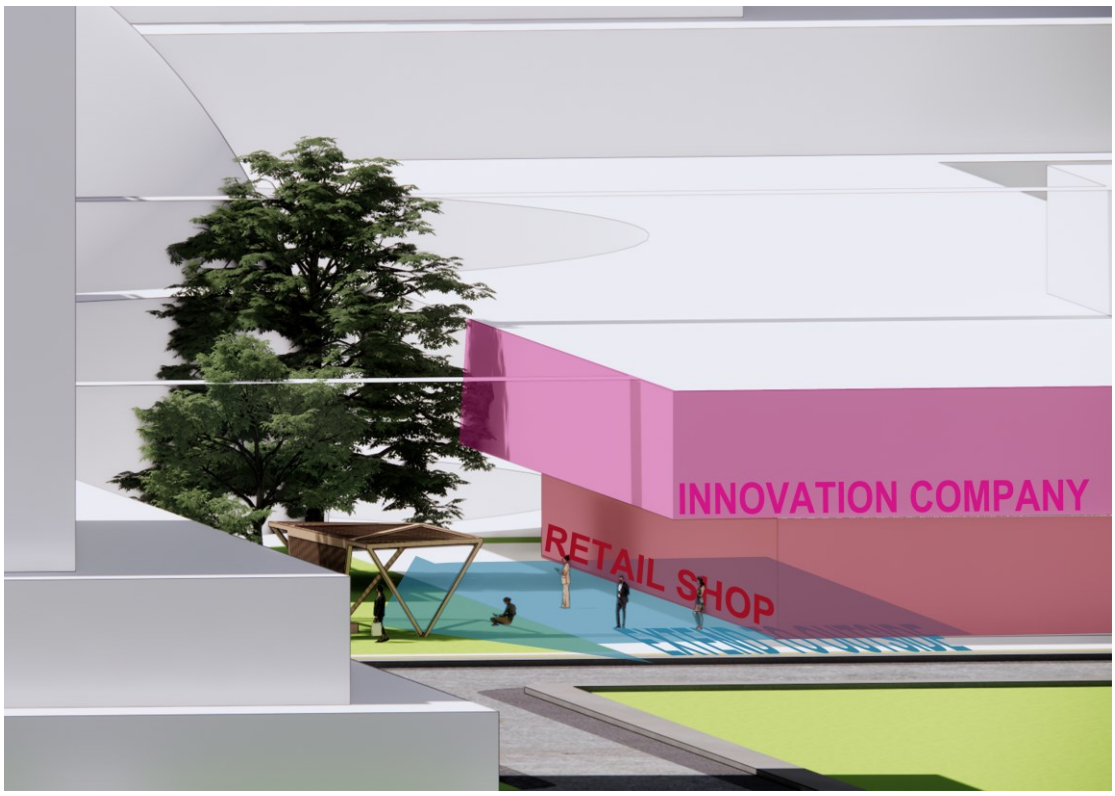


Figure 6-30 Third place connected to the outdoors. Source: made by the author.

6.7.2 Retail Spaces Define the Public Realm

Comparing different public spaces in Kendall Square, it was found that open spaces and plazas that are interconnected with each other and connected with public streets within a visible distance are the most thriving type of public space design. Retail spaces should

be concentrated to create a critical mass. Retail spaces that are adjacent to each other or within a short distance offer eating and drinking options to the workers in the area and therefore create a focal point for concentrated pedestrian activity.

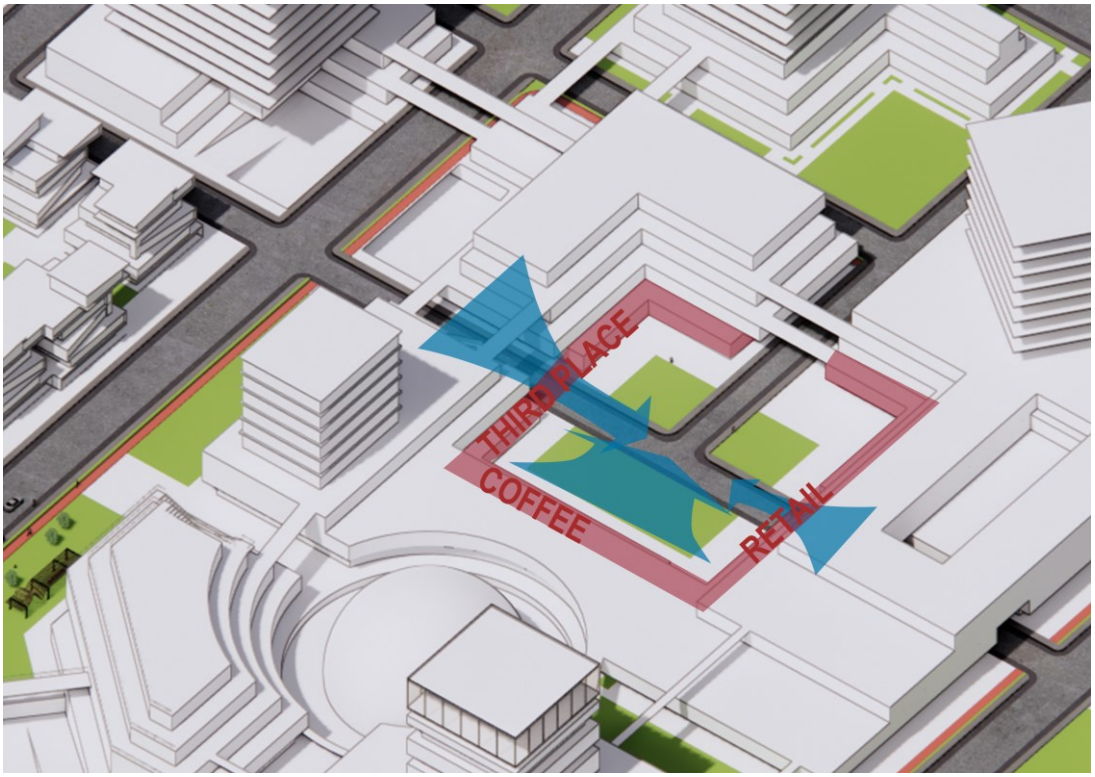


Figure 6-31 Retail spaces define the public realm. Source: made by the author.

6.7.3 Third Place Adjacent to Each Other

Most importantly, the physical environment that is outside buildings, and the urban space that is connecting individual buildings, are the most important elements in the success of innovation districts. And that well-designed Third Places, retail and public, are a catalyst for innovation. Here, I offer some specific design principles about how to create good urban spaces that will stimulate social interaction, chance encounters, and interfirm collaboration by improving the public realm of innovation districts.

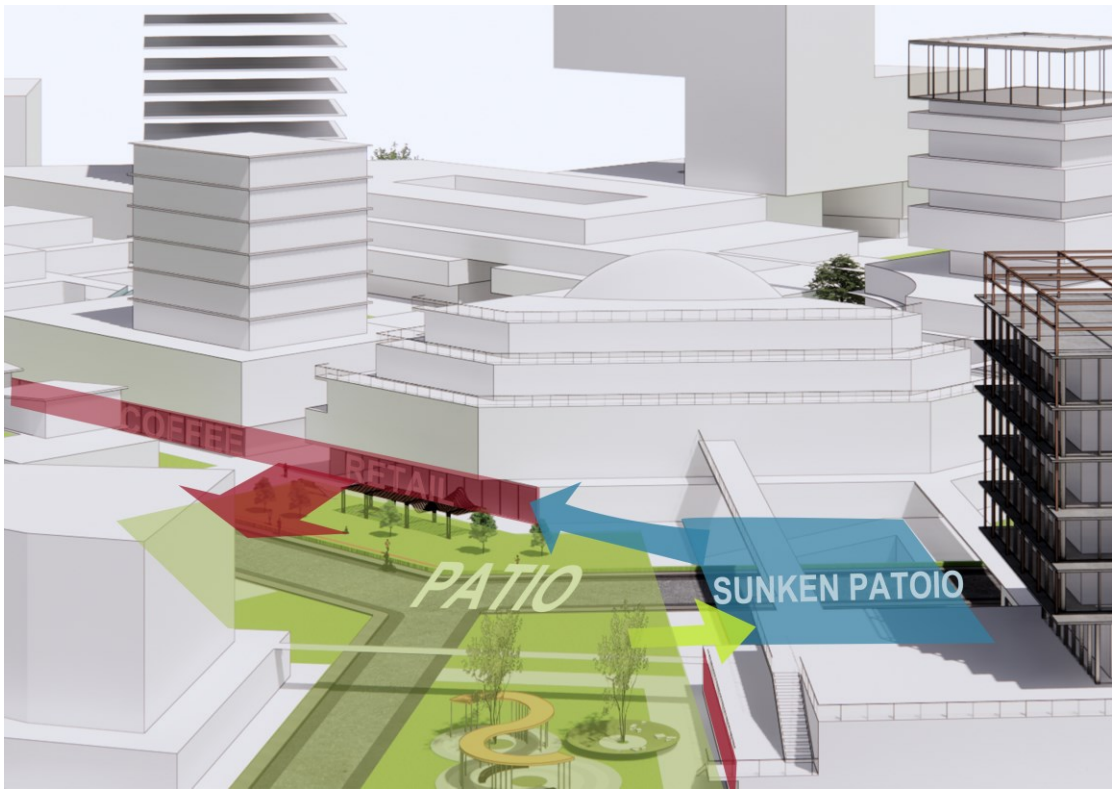


Figure 6-32 Connection of different types of third places. Source: made by the author.

Begin with the porch as a street and encourage living rooms to spill onto the street. The porch also can be winterized as an enclosed lodge linking individual living rooms(intimate), their semiprivate porches(proximate), and the collective porch(public)—maintaining the "three circles of life" living transect. Porches motivate regular visits: regulars define third places.

6.7.4 Appealing "Nooks"

Urban "nooks" are appealing to the knowledge workers. My interviews and onsite observations revealed that urban nooks become spaces where the workers like to hang around. These secluded yet public spaces are important assets in making the district look interesting and generating foot traffic.

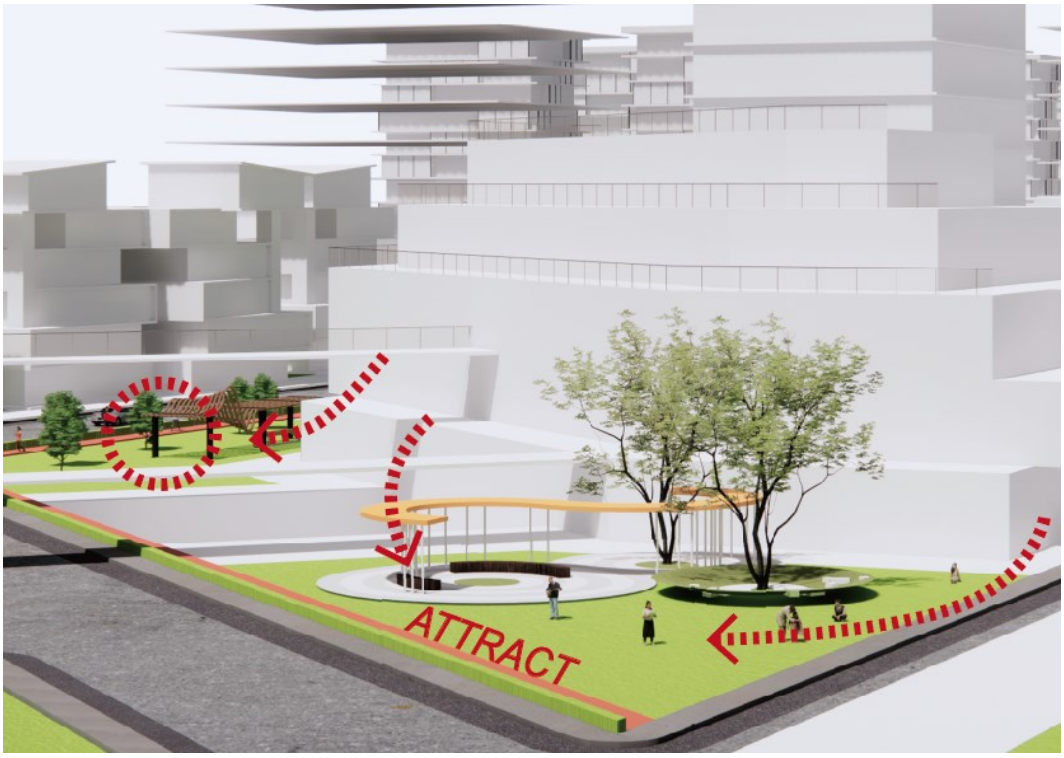


Figure 6-33 Appealing nooks provide changce to informal communication.

Source: made by the author.

7. CONCLUSION AND DISCUSSION

7.1 Conclusion

This thsies presents a comprehensive investigation into the Keyun Innovation District, probing its multifaceted influence on the advancement of innovative enterprises, appeal to knowledge workers, and the intricate spatial dynamics entwined with innovative activities, all viewed through the prism of the third place. By synthesizing exemplary theories and empirical cases from both local and international contexts, we propose an integrated design strategy encompassing critical elements such as land use function, traffic organization, third place integration, ecological network, and public service facilities. The main research conclusions are as follows:

7.1.1 Existing Problems in Keyun Innovation District

(1) The development of the Keyun Innovation Industry Park

Combining the research background, domestic and foreign research overviews, and network resources, from the classification of innovation areas and the relationship with the city, a more comprehensive understanding of innovation areas, and combined with relevant data analysis, the status quo of urban design of innovation areas from the perspective of the third place is obtained: the nature of the land use is single, the function is chaotic; the contradiction between people and vehicles is prominent, and the accessibility is poor; public service facilities are incomplete; green landscapes and public activity spaces are relatively lacking; the innovation space is single, and there is no environment for informal communication.

(2) A strategy system for third place transformation of the Keyun Innovation District

With the rapid advancement of innovative technologies and industries today, the transformation of innovative industrial parks has become an inevitable challenge. Among these parks, the Keyun Innovation Industrial Park holds particular significance, being at the forefront of early national Internet industry development. Consequently,

industrial parks in the surrounding old urban areas face common challenges. Despite a previous round of transformation in the Shengda Innovation District in this region, the current development of commercial and third places remains lacklustre. Inside the site, numerous shops stand vacant, and there is a notable dearth of public activity spaces, demanding urgent improvement in spatial quality.

Furthermore, the current architectural space in the innovation industrial park does not cater well to the needs of enterprises, leading to well-established companies gradually relocating away from the Keyun Innovation Park. Additionally, the park lacks spatial compatibility with other knowledge workers, hindering its ability to attract and accommodate a diverse range of innovative businesses.

7.1.2 Strategies for Building the Third Place of Keyun Innovation District

The urban design of the Keyun Road Innovation District has been hindered by outdated planning, design, and construction concepts. Situated in the old city centre, the area has become a convergence point for numerous urban villages and real estate development projects. While this has contributed to economic growth over time, it has also given rise to a range of urban challenges, including mixed functions, uneven employment and housing distribution, ecological damage, loss of distinctiveness, and obstacles in achieving industrial transformation and upgrading.

To address these issues and align with the new requirements of the third place theory, the innovation district system will adopt a novel approach. By blending public spaces with semi-public spaces, the goal is to attract knowledge workers, invigorate the site with innovation, and, in turn, catalyze the development and transformation of neighbouring innovation districts.

Building upon an analysis of the innovation district's requirements and strategies, this study emphasizes the novel demands presented by knowledge workers within the innovation district. Rooted in the third place theory, the research aims to create the third place within the innovation district system by seamlessly integrating public spaces with

semi-public spaces. The ultimate goal is to attract knowledge workers and ignite a thriving culture of innovation at the site. Therefore, this paper proposes a strategy from the innovation district as a whole to the third place system:

(1) From the overall development strategy, create a space environment conducive to innovation; build a multi-level function mixed guidance system; pay attention to the innovation catalyst effect of "anchor" institutions; establish a sustainable planning and management mechanism.

(2) The overall urban design principles under the concept of the innovation district should adhere to the following: Openness Principle: Public spaces should be designed to make innovation visible and accessible to all. Network Principle: Establish a weak connection network through the utilization of public spaces.Accessibility Principle: Ensure seamless connectivity between public spaces and urban functional areas.Create a Dynamic and Relaxed Environment: Foster a vibrant and relaxed atmosphere, conducive to innovation and collaboration. Cultivate an Innovative and Energetic Atmosphere: Develop an innovation district that exudes vitality and encourages creativity.

(3) To address the design principle of the third place system, a space strategy is proposed to enhance the interplay between the building, the connected public spaces, the outdoor third place, and the third place itself.

To facilitate the sustainable renewal of the Keyun Innovation District and uphold the spirit of innovation, the following practical strategies are proposed, building upon urban design principles:

(1) To stimulate the public participation mechanism to involve the users in decision-making process.

In the design process of the innovation district, the user experience of knowledge workers plays a crucial role. As science and technology continue to advance rapidly, the needs of knowledge workers for the third place will evolve. Therefore, it is essential to gather timely feedback from the public regarding their spatial requirements and create a comprehensive overview of innovative spaces.

(2) Ongoing renewal of the Innovation District

The development of an innovation district is not an overnight achievement, nor is it set in stone. Consequently, the current design of the innovation district can be modified concerning spatial function and structure based on subsequent feedback. The primary purpose of the third place is to stimulate the innovation motivation of knowledge workers. As a result, in response to changes in the needs of knowledge workers, corresponding adjustments in spaces should be made.

7.2 Discussion

Given the author's limited academic expertise, it is important to acknowledge that the research results obtained during the thesis writing process may have certain deficiencies and shortcomings. Consequently, further improvement and enhancement are required. The key content encompasses three main aspects:

(1) The primary research method employed in this paper is qualitative analysis. Theoretical literature and exemplary case studies are utilized to illustrate the issue at hand. However, it's important to acknowledge certain limitations in the research concerning the design strategy of the Keyun Road Innovation District. To address these limitations and enhance the results' persuasiveness and scientific rigour, future work and studies will incorporate quantitative analysis methods, such as space syntax, the establishment of an evaluation system, or the application of big data. These additions are expected to further enrich the article's findings and overall quality.

(2) This article conducts urban design research from the perspective of the 'third place,' to discuss the urban design strategy for the innovation district that caters to the needs of knowledge workers. By summarizing both theory and practice, it strives to promote the construction of an innovative space within the area, enhance the overall spatial quality, attract knowledge workers to converge, foster a dynamic atmosphere for innovation and entrepreneurship, drive the city's innovative development, and offer valuable insights for design practices in other regions.

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