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South China University of Technology

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校城共生视角下华工一天河客运站片区
更新研究

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**A Study on the Regeneration of SCUT-Tianhe Coach
Terminal District from the Perspective of University-City
Symbiosis**

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摘 要

在国家创新驱动发展战略持续深化与城市更新转向存量提质的双重背景下，高校周边存量地区的空间转型日益成为重要议题。然而既有更新实践多将高校视为封闭地块，校城之间的要素流动渠道长期受阻。广州市天河区华工一天河客运站片区紧邻华南理工大学北校区，轨道交通3号线与6号线在此交汇，却长期处于功能废弃、活力低迷的状态，校城界面的空间与制度阻断持续存在。本研究以校城共生为核心视角，以华工一天河客运站片区为研究对象，综合运用文献研究、实地调研、案例分析与设计研究等方法，旨在建构面向旧城高校周边存量地区的校城共生更新原则框架，并通过场地实证加以检验与完善。

研究在梳理国内外相关研究的基础上，界定校城共生的核心概念与研究范围。基础理论层面，从大学与城市关系、共生理论与三螺旋理论三个层面展开推演，得出互利共生为校城关系更新的目标模式、中间领域的积极建构是激活共生动力的关键空间介质等核心判断。案例层面，选取肯德尔广场、代尔夫特理工大学、同济NICE2035与上海大学路四个代表性案例，从空间组织、功能配置、协同治理三个维度展开比较分析，归纳出将割裂要素转化为连接界面、混合使用制造使用者日常交叉、多主体制度性协作保障共生持续运转三项共同规律。结合理论推演与案例归纳，构建校城共生更新原则框架，提出空间连通与开放、功能复合与共生、多元共治与激活三条核心原则，三者由物质到功能、由功能到制度依次递进，相互支撑。在此基础上，对华工一天河客运站片区展开系统性场地分析，识别出空间连通性断裂、活力与品质缺失、产创生态断层、协同机制缺位四类核心问题，并将三条原则转化为针对具体场地的设计应用，提出立体缝合与边界渗透、复合协同与共生植入、载体营建与机制渐进三条场地策略，通过整体方案与节点设计加以呈现。

研究发现，空间连通与开放层面，以轨道节点为锚点整合路网、构建公共空间序列，将消极的校城边界转化为可渗透的中间领域，为功能共生提供物质前提；功能复合与共生层面，通过创新社区的双轨并行、功能的多维混合与三类共生空间的系统植入，激活校城之间的知识流动与创新交汇；多元共治与激活层面，以共治空间载体建构与多主体协商机制的逐步建立，支撑共生关系的长效运营。三条原则在实施上具有内在的先决条件结构，空间连通是功能共生与协同治理得以发生的物质前提，介入优先序应根据场地

主导矛盾加以判断。从介入方式看，对于中国既有城区内老校区周边的存量更新，柔性介入是更具适应性的基本取向，以界面柔化替代边界消除，以局部渗透替代整体开放，以渐进式制度建构替代一次性重组。华工一天河客运站片区的设计实践表明，上述策略框架在高校周边废弃枢纽类型的存量地块中具备现实可操作性，其分析视角与策略体系对国内同类校城割裂地区的更新实践具有一定的参考借鉴价值。

关键词：校城共生；华工一天河客运站片区；城市更新；柔性介入；协同治理

Abstract

Against the dual backdrop of the continued advancement of the national Innovation-driven Development Strategy and the shift of urban regeneration toward the Quality Enhancement of Existing Built-up Areas, the spatial transformation of existing areas surrounding universities has become an increasingly important issue. However, existing regeneration practices have predominantly treated universities as closed parcels, and channels for factor flows between the university and the city have long been obstructed. The SCUT-Tianhe Coach Terminal District in Tianhe District, Guangzhou, is adjacent to SCUT North Campus, with Metro Lines 3 and 6 intersecting at this location; yet the district has long remained in a state of functional abandonment and low vitality, with spatial and institutional obstruction at the University-City Interface persisting. Adopting University-City Symbiosis as the core perspective and the SCUT-Tianhe Coach Terminal District as the research subject, this study employs methods including literature review, field research, case study, and Research-by-Design, with the aim of constructing a Principles Framework for University-City Symbiotic Regeneration targeting existing areas surrounding universities in old urban districts, and testing and refining this framework through site-based empirical verification.

On the basis of reviewing relevant domestic and international research, the core concepts of University-City Symbiosis and the scope of the study are defined. At the level of foundational theory, deduction is conducted across three dimensions — the relationship between universities and cities, symbiosis theory, and the Triple Helix Theory—yielding core conclusions including that Mutualistic Symbiosis constitutes the target model for regenerating university-city relations, and that the active construction of the Intermediate Domain serves as the key spatial medium for activating symbiotic dynamics. At the case study level, four representative cases — Kendall Square, TU Delft, Tongji NICE2035, and Shanghai Daxue Road—are selected for comparative analysis across three dimensions: spatial organisation, functional configuration, and collaborative governance, from which three common patterns are identified: transforming fragmented elements into connecting interfaces, generating daily encounters among users of diverse backgrounds through mixed use, and sustaining the stable operation of symbiosis through multi-stakeholder institutional collaboration. Drawing on both theoretical deduction and case-based induction, a Principles Framework for University-City Symbiotic Regeneration is constructed, proposing three core principles—Spatial Connectivity

and Openness, Functional Hybridity and Symbiosis, and Multi-stakeholder Co-governance and Activation—which progress sequentially from the physical to the functional and from the functional to the institutional, and mutually reinforce one another. On this basis, a systematic site analysis of the SCUT-Tianhe Coach Terminal District is conducted, identifying four core problems: Fractured Spatial Connectivity, Deficit in Spatial Vitality and Quality, a Fractured Industry-Innovation Ecosystem, and the Absence of Multi-stakeholder Coordination Mechanisms. The three principles are then translated into design applications tailored to the specific site, proposing three site strategies — Three-Dimensional Stitching and Boundary Permeation, Hybrid Coordination and Symbiotic Implantation, and Spatial Carrier Construction and Incremental Institutionalisation — presented through an overall design scheme and node-specific designs.

The study finds that at the level of Spatial Connectivity and Openness, transit nodes serve as anchors for integrating the road network and constructing a public space sequence, transforming passive university-city boundaries into permeable Intermediate Domains and thereby providing the physical prerequisite for functional symbiosis. At the level of Functional Hybridity and Symbiosis, the Dual-track Approach for innovation communities, multidimensional functional mixing, and the systematic implantation of three types of symbiotic spaces activate the flow of knowledge and the convergence of innovation between the university and the city. At the level of Multi-stakeholder Co-governance and Activation, the construction of co-governance spatial carriers and the gradual establishment of multi-stakeholder negotiation mechanisms support the long-term operation of symbiotic relationships. These three principles share an inherent Precondition Structure in their implementation: spatial connectivity is the physical prerequisite for functional symbiosis and collaborative governance to occur, and the Intervention Priority Sequence should be determined according to the Dominant Contradiction of the Site. In terms of the mode of intervention, for the built-environment regeneration of existing areas surrounding established campuses within China's existing urban districts, Soft Intervention constitutes a more adaptive fundamental orientation: boundary softening in place of boundary elimination, partial permeation in place of wholesale opening, and incremental institutional construction in place of one-off restructuring. The design practice of the SCUT-Tianhe Coach Terminal District demonstrates that the above strategy framework possesses practical operability in existing plots of the abandoned-hub type adjacent to universities, and that its analytical perspective and strategy system hold reference value for the regeneration of similarly fragmented

university-city districts across China.

Keywords: University-City Symbiosis; SCUT-Tianhe Coach Terminal District; Urban Regeneration; Soft Intervention; Collaborative Governance

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Chapter 1 Introduction

1.1 Research Background

1.1.1 Innovation-Driven Strategy and Built-environment Regeneration

China's economic development is currently undergoing a profound transformation from factor-driven to innovation-driven growth. The report of the 20th National Congress of the Communist Party of China identified innovation as the core driving force of modernisation, and the introduction of the concept of "New Quality Productive Forces" has further reinforced the strategic importance of scientific and technological innovation in the national competitive landscape. In terms of policy direction, the state continues to promote the construction of a technology innovation system centred on enterprises and featuring deep integration of industry, academia, and research, requiring urban spaces to transform from traditional containers for production factors into multifunctional venues capable of supporting innovation. As the spatial policy response to this transformation, Industry-city Integration emphasises the synergistic advancement of industrial development and urban functions, providing an important policy context for understanding the evolution of spatial relationships between universities and cities.

At the same time, China's urbanisation process has entered a stage of stable development, with the development model undergoing a paradigm shift from "extensive expansion" to "intensive growth." The traditional path of large-scale incremental expansion has given way to a new focus, and the centre of gravity of urban development has shifted toward the Quality Enhancement of Existing Built-up Areas. Against this backdrop, urban regeneration is no longer merely an improvement of the physical environment, but has become a systematic endeavour to optimise urban functions and elevate industrial capabilities through the precise activation of existing spatial resources. For megacities with increasingly constrained land resources, the implantation of innovative functions into existing land and the construction of spatial carriers for knowledge transformation have become core issues in high-quality urban transformation. The aforementioned strategic context collectively points to a practical proposition: to meet the implementation needs of the Innovation-driven Development Strategy through spatial regeneration measures within the existing built environment.

1.1.2 The Shift in the Social Functions of Higher Education

The underlying driving force behind the evolution of the relationship between universities and cities lies in the historic transformation of higher education's social functions.

From a longitudinal perspective, the functions of universities have undergone a significant expansion, progressing from a singular focus on teaching to the Dual-track Approach of "teaching plus research," and finally to the now widely recognised "Third Mission." Guerrero and Menter^[1] point out that the global higher education system is undergoing a "second academic revolution," with universities accelerating their evolution from closed institutions of knowledge production toward "Entrepreneurial Universities" and "Innovative Universities."

The so-called "Third Mission" refers to universities directly serving regional socioeconomic development through knowledge transfer, technology commercialisation, and broader social engagement, in addition to their traditional functions of education and research. The establishment of this mission has expanded the criteria for evaluating university performance from internal academic output to include their spillover effects on surrounding communities and urban industries. To achieve this goal, universities are required to develop "dynamic capabilities"—the ability to flexibly reconfigure internal resources such as faculty and student talent, laboratory facilities, and intellectual property—so as to respond rapidly to external socioeconomic changes^[2].

This shift in function places structural demands on the spatial relationship between the university and the city. Under the traditional model, universities were bounded by walls, forming relatively closed functional islands within the city, where physical boundaries also served as institutional and psychological barriers. Driven by the "Third Mission," a high-frequency exchange loop must be established between university faculty, students, and research outcomes on one hand, and urban industries and residents' daily lives on the other. Research indicates that the effectiveness of knowledge transfer and technology commercialisation relies heavily on an open, interactive urban environment that continuously fosters entrepreneurial attitudes and behaviours. Consequently, the nature of the university-city relationship has undergone a fundamental shift: evolving from "spatial adjacency" at the neighbourhood level to "symbiotic evolution" at the systemic level, with universities gradually becoming the core engines of regional innovation ecosystems. Although a consensus has been reached at the conceptual level regarding the shift in the university's functions, the physical spatial response remains comparatively lagging. The boundaries symbolised by university walls have yet to open accordingly, and the functional configuration of the urban spaces surrounding universities has not effectively aligned with the institutions' expanding social service needs. Activating the flow of elements between the university and the city through spatial design has thus become a structural challenge shared by higher

education reform and urban spatial planning.

1.1.3 Regeneration Challenges of the SCUT- Tianhe Coach Terminal District

Under the overall framework of the national Innovation-driven Development Strategy, policy responses at the regional level continue to deepen. The 13th Party Congress of Guangdong Province explicitly proposed accelerating the construction of a full-process innovation ecosystem chain comprising "basic research + technological breakthroughs + technology transfer + tech finance + talent support"^[3], listing the enhancement of technology transfer and industrialisation capabilities as strategic priorities. Building on this, Guangzhou further implemented the "Guangzhou Action Plan for Promoting the Integrated Development of Innovation and Industrial Chains (2022–2025)"^[4] which clearly outlines the planning and construction of the Huanwushan Innovation Source Area, encouraging universities and research institutions within the area to convert their own properties into incubation platforms for technology transfer; the 2024 Guangzhou Municipal Government Work Report further emphasised the vigorous promotion of the renovation of the four major zones within the Huanwushan Innovation Source Area, accelerating the development of a globally influential hub for scientific and technological innovation. These policy initiatives collectively define the strategic positioning of the Huanwushan area: leveraging the concentrated intellectual resources of universities such as South China University of Technology (SCUT) and South China Agricultural University to promote deep integration among academia, industry, and the city, and to establish a regional innovation ecosystem characterised by Quadruple Chain Linkage—innovation, industry, talent, and capital.

As a key node within the Huanwushan Innovation Source Area, the SCUT- Tianhe Coach Terminal District is geographically adjacent to SCUT North Campus. With Metro Lines 3 and 6 intersecting at this location, the district possesses significant spatial potential to support the regional innovation strategy. Tianhe Coach Terminal was once a major regional transportation hub in Guangzhou; however, with the restructuring of the city's transportation network, its passenger transport functions have substantially contracted, leaving the district as a whole in a state of functional abandonment. The site contains a large amount of underutilised and idle land, and the quality of its buildings varies widely. The physical boundary between the site and SCUT North Campus is clearly defined yet rigid; this spatial fragmentation impedes the effective spillover of the university's knowledge resources into the surrounding urban hinterland. Furthermore, the locational advantages brought by the rail transit system have yet to be translated into substantive developmental momentum, owing to the absence of

compatible functional sectors and adequate spatial quality.

1.2 Research Objectives and Significance

1.2.1 Research Objectives

Current research and planning practices regarding the regeneration of university clusters such as the Huanwushan area primarily approach the issue from a macro-urban perspective, focusing on industrial introduction and spatial expansion. Universities are often treated as clearly bounded, closed parcels, discussed in isolation from the surrounding urban space. The abundant knowledge, talent, and spatial resources within universities have yet to be incorporated into the overall urban regeneration system for coordinated consideration. This research paradigm—which treats "the campus as the campus and the surrounding area as the surrounding area"—has prevented the formation of substantive element flows and relationship activation between physically adjacent university campuses and the surrounding urban areas.

Based on this, this study takes the SCUT- Tianhe Coach Terminal District in Guangzhou as its research subject. Adopting University-City Symbiosis as the core perspective, it employs methods including literature review, field research, case analysis, and Research-by-Design to systematically organise relevant theories on University-City Symbiosis. By integrating symbiosis theory with the Triple Helix Theory, a foundational research framework is constructed. Through comparative analysis of typical domestic and international cases, actionable principles are distilled and a Strategy Framework for University-City Symbiotic Regeneration is established at the theoretical level; at the empirical level, based on the aforementioned Strategy Framework and on-site survey analysis, a systematic study of the SCUT- Tianhe Coach Terminal District is conducted to propose regeneration guidance strategies, which are further validated and refined through practical implementation. The study aims to employ University-City Symbiosis as a methodological perspective to promote the synergistic integration of existing spaces surrounding universities in old urban areas with university resources, to provide a design basis for the transformation of the SCUT- Tianhe Coach Terminal District from underutilised plots to a University-City Symbiotic Interface Zone, and to offer a referenceable analytical perspective and Strategy Framework for the built-environment regeneration of similar existing areas surrounding universities in old urban districts across China.

1.2.2 Research Significance

1.2.2.1 Theoretical Significance

Current domestic research on the regeneration of urban spaces surrounding universities

predominantly focuses on existing campuses or newly developed university towns; systematic studies targeting existing areas surrounding universities in old urban districts remain comparatively limited. In terms of research scope, most studies address only a single dimension—space, function, or governance—in isolation, and studies that integrate these three dimensions as an organically interconnected whole are relatively scarce.

This study adopts symbiosis theory as its core framework and the Triple Helix Theory as a supplementary analytical tool. Within the context of Built-environment Regeneration, a Strategy Framework for University-City Symbiosis is constructed for existing areas surrounding universities in old urban districts. By integrating the three intervention levels of space, function, and governance into a unified discussion, the study aims to enrich the theoretical perspectives of existing research on university-city relationships and provide theoretical support and reference for the regeneration of similar areas.

1.2.2.2 Practical Significance

As a key node in the Huanwushan Innovation Source Area, the SCUT-Tianhe Coach Terminal District is adjacent to SCUT North Campus. It simultaneously bears the high-level positioning mandated by regional innovation strategies and the realistic predicament of underutilised existing land. The physical boundary between the district and SCUT North Campus is clearly defined yet rigid, impeding the effective spillover of the university's knowledge resources into the surrounding urban hinterland. Furthermore, the locational advantages brought by rail transit have yet to be translated into substantive developmental momentum, owing to the absence of compatible functional sectors and adequate spatial quality.

Taking the SCUT-Tianhe Coach Terminal District as the empirical subject, this research proposes systematic regeneration strategies and urban design guidelines across three dimensions—spatial connectivity, functional mix, and collaborative governance—to provide a design basis for the district's regeneration practices. The research findings also offer an analytical framework and strategic references for the built-environment regeneration of similar existing areas surrounding universities in China's older urban districts.

1.3 Key Concepts and Research Scope

1.3.1 University-City Symbiosis

The concept of symbiosis originates from biology, referring to a state in which different species coexist and continuously exchange matter and energy. Japanese architect Kisho Kurokawa introduced the idea of symbiosis into the fields of planning and architecture,

centring on two key concepts: the Intermediate Domain and the Sacred Zone. The Intermediate Domain refers to a transitional space situated between opposing sides that possesses dual meanings; it serves as the key medium for transcending binary oppositions and achieving symbiosis. The Sacred Zone emphasises that symbiosis does not mean eliminating differences or absorbing the other party, but rather achieving coexistence and interaction on the premise of actively acknowledging and respecting each party's independence^[5]. Once introduced into urban spatial research, symbiosis theory offers significant guidance for mending and restoring the negative boundary spaces and unequal spatial relationships found within cities.

Building upon this foundation, University-City Symbiosis regards universities and their surrounding urban areas as interdependent organic systems. Through necessary spatial and institutional interventions, it promotes continuous material exchange and resource sharing between campus and urban spaces, achieving a state of co-evolution while respecting the distinct spatial attributes of both parties^[6].

1.3.2 Delineation of the Study Scope

The subject of this study is the SCUT-Tianhe Coach Terminal District in Tianhe District, Guangzhou, with a total area of approximately 59 hectares. The study area is delineated by referencing the main entrances of SCUT North Campus, based on two principles: walkability and the integrity of plot boundaries. The area encompasses diverse land types, including the Tianhe Coach Terminal site itself, surrounding village-owned commercial and industrial park land, auto parts-related commercial land, and plots north of North Lake on the SCUT North Campus. Land ownership is complex, and the quality of existing development varies significantly.

The SCUT-Tianhe Coach Terminal District is adjacent to SCUT North Campus, separated by a clearly defined yet rigid physical boundary; spatially, the two are proximate but not integrated. With Metro Lines 3 and 6 intersecting within the district, it possesses strong locational accessibility. As a key node in the Huanwushan Innovation Source Area, the district simultaneously bears the high-level positioning mandated by regional innovation strategies and the realistic predicament of low-efficiency existing land use. It constitutes a typical spatial manifestation of the university-city separation problem, and thus holds strong representativeness for research.

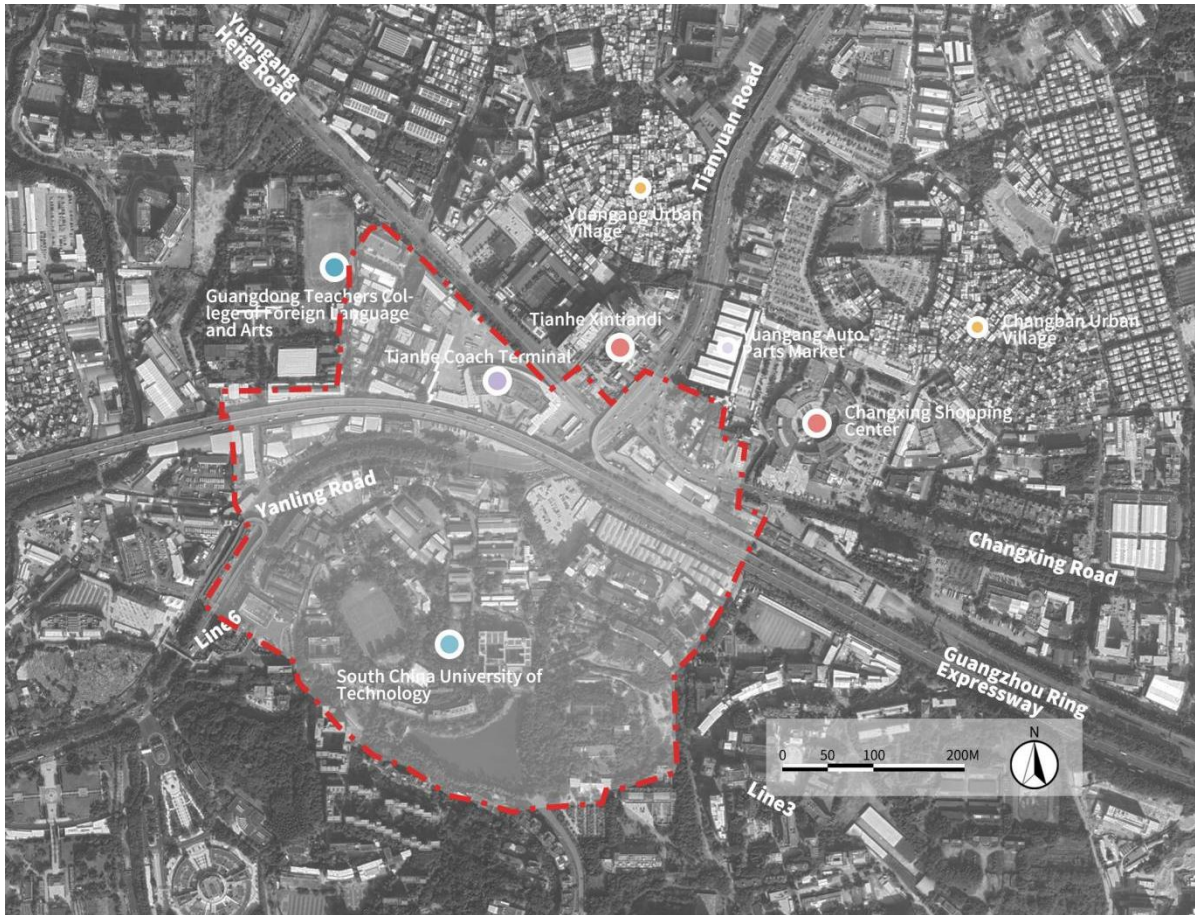


Figure 1-1 : Study Area of the SCUT-Tianhe Coach Terminal District
(Source: Drawn by the Author)



Figure 1-2 Tianhe Coach Terminal and South China University of Technology North Campus
(Source: Drawn by the Author)

1.4 Literature Review

1.4.1 Review of Relevant Domestic Research

Domestic spatial research on the university-city relationship has generally followed an evolutionary trajectory, progressing from early explorations of physical openness, to systematic deepening of boundary spaces and functional mixing, and finally to the

introduction of a symbiotic theoretical framework.

Early Exploration Phase (1999–2015): Preliminary Discussions on Spatial Openness and Interactive Relationships

Research during this phase centered on campus openness and spatial interaction between the university and the city, with a primary focus on the opening of physical boundaries. Ye Jing (1999) was among the first to explore the possibility of opening university campuses to surrounding communities from the perspective of facility sharing, proposing a preliminary vision for the integrated development of the university and the city^[7]. Tang Gala and Lü Bin (2006)^[8] further expanded the scope to the interactive relationship between universities and community development, elucidating the characteristics of this interactive mechanism as well as its impact on and the logic of restructuring urban spatial structures. Hu Jing (2007)^[9], using Tongji University's Siping Road Campus as a case study and taking "interactive space" as the core concept, analyzed the morphological patterns and impact mechanisms resulting from the interaction between the university campus and the surrounding urban areas from the perspective of spatial relationships, representing a relatively systematic spatial research attempt during this phase. Zheng Chenwei (2012)^[10] proposed two key physical environmental factors—"internal mix" and "external openness"—in the integration of university communities with the city, laying a conceptual foundation for subsequent research on functional mixing. Overall, research during this phase was primarily descriptive and analytical, with a relatively narrow perspective, and had not yet formed a systematic theoretical framework.

Systematic Deepening Phase (2016–2019): Comprehensive Advancement of Boundary Spaces, Functional Mixing, and Renewal Strategies

As practices in Built-environment Regeneration progressed, research during this phase began to focus on the spatial integration and functional convergence of the university-city boundary, with a significant increase in research depth and systematicity. Liu Cui (2016)^[11] Building upon research on the Triple Helix Theory, this study examined the interactive relationship between university spatial planning and old urban area renewal. By comparing multiple urban renewal projects, it revealed the balancing mechanisms through which universities influence urban spatial structures and argued that university-city interaction must be grounded in the alignment of university resources with urban needs. This work represents one of the earliest domestic contributions to introduce interdisciplinary theories into university-city spatial research. Ma Wenrui (2017)^[12] Starting from the ontology of boundary spaces, this study analyzes the trends of demarcation and territorialization evident at the

university-city boundary and proposes strategies for the integration and optimization of boundary spaces, extending the research perspective from within the campus to the boundary zones. Zhang Donghui (2019)^[13] Based on symbiosis theory, this study systematically examines the elements of University-City Symbiosis across three levels—boundary ontology, boundary margins, and boundary influence zones—providing theoretical support for spatial renovation strategies in the university-city boundary influence zone. It represents an early application of symbiosis theory in University-City spatial research. Tan Qian (2019)^[14], on the other hand, adopts a three-dimensional perspective encompassing economic, social, and planning dimensions to construct an integrated "function-space-facility" technical framework. It proposes concepts such as the "university-based industrial innovation circle" and the "flexible University-City Interface," providing a systematic technical reference for existing districts to achieve complementary university-city resource utilization through flexible integration.

Theoretical Deepening Phase (2020–2025): Construction of a Symbiotic Framework and Comprehensive Advancement of a Multi-dimensional Strategy System

As we entered the 2020s, research on university-city relations has shown a marked trend toward the diversification of theoretical tools and the systematization of research methods, with the introduction of the concept of symbiosis and the theory of collaborative innovation becoming key characteristics of this phase. Wang Aobo (2020)^[15] used the concept of symbiosis as a starting point to construct a campus symbiosis system linked to urban space, thereby promoting a comprehensive discussion on the integration of university and city spaces, resource sharing, and cultural catalysis. Liang Yue (2020)^[16] introduced the theory of collaborative innovation to analyze the functions and spatial layout of urban university campuses, proposing systematic renewal strategies—a relatively in-depth attempt to apply interdisciplinary theories in campus renewal research. Chen Zong (2021)^[17] Within the "Two Views and Three Characters" design theory framework, this study systematically analyzes the interactive logic between campus and city from three perspectives—relationships, functions, and structural networks—and proposes renewal strategies for the spatial layout of "campus-city" transition zones, forming a relatively complete research chain ranging from functional classification to public space integration and institutional mechanism construction. Huang Shuili (2021)^[18] Drawing on connection theory and place theory, this study focuses on the external spaces of the campus, exploring design strategies guided by campus-city interaction from the dual dimensions of transportation spaces and activity spaces. Zhong Jiabin (2022)^[19] Using Zhejiang University's Xixi Old Campus as a case study,

this work constructs a three-dimensional "function-transportation-landscape" renewal analysis framework, emphasizing that the renewal of old campuses must respect historical heritage while achieving deep integration with the urban environment through multidimensional spatial interventions. Liu Huanyu (2022)^[20] focuses on the University-City Interface, analyzing the spatial genesis of campuses with a high degree of university-city integration from two perspectives: the handling of university-city relationships and spatial form design. Mi Weisong (2023)^[21] establishes a scenario analysis framework and, using two universities in Xi'an as case studies, systematically proposes a planning methodology for the integrated development of "university-city" relationships. Zhou Jiading (2023)^[22] Drawing on urban morphological typology and cluster morphology theory, and through empirical analysis of 131 campus samples in Italy, this study classifies university-city morphologies into five types and quantitatively evaluates the performance of university-city relationships under different morphological structures, providing a systematic pathway for the spatial integration of universities and cities in high-density existing environments. Wang Jing (2024)^[6] From the perspective of the University-City Symbiosis domain, this study explores the bidirectional interactive effects of university-city boundaries based on the concept of symbiosis and introduces the Triple Helix Theory at the mechanism level. It is one of the most explicit achievements in current domestic research that combines the Triple Helix Theory with the University-City Symbiosis framework. Gao Youchun (2025)^[23] constructs an evaluation mechanism for university-city integration based on the measurement of peripheral space and proposes optimization design strategies for university-city integration, thereby further enriching the research tools for evaluating the spatial performance of university-city integration.

Table 1- 1 Summary of Domestic Research on University-City Symbiosis

Author (Year)	Research Object	Core Perspective	Main Conclusions
Ye Jing (1999)	University Campuses and Surrounding Communities	Facility Sharing and Campus Openness	Proposing a new model for opening campus facilities to the community and exploring pathways for integrated university-city development
Tang Gala, Lü Bin (2006)	Universities and Community Development	Interactive Relationships and the Reconstruction of Urban Space	Elucidating the Characteristics of University-Community Interaction Mechanisms and Their Impact on Urban Spatial Structures
Hu Jing (2007)	Tongji University, Siping Road Campus	Interactive Spatial Forms and Influence Mechanisms	Analysis of the patterns and developmental directions of interactive spatial forms resulting from the interaction between the campus and the surrounding urban areas
Zheng Chenwei (2012)	Integration of University Communities and the City	Elements of Physical Environment Integration	Proposes "Internal Mixing" and "External Openness" as the Two Key Physical Environmental Factors for University-City Integration
Liu Cui (2016)	University Spatial Planning and Old City Renewal	Triple Helix Theory, Spatial Counterbalancing Mechanism	Reveals the mechanism by which universities counterbalance urban spatial structures, pointing out that university-city interaction must be based on the alignment of resources and needs
Ma Wenrui (2017)	Border Spaces on University Campuses	Boundary Integration and the Trend Toward Territorialization	Analysis of the Trends Toward Demarcation and Domain Formation at University-City Boundaries, and Proposals for Strategies to Optimize the Integration of Boundary Spaces
Zhang Donghui (2019)	The Influence Zone of University-City Boundaries	Symbiosis Theory, Hierarchical Classification of Boundaries	A systematic study of the elements of University-City Symbiosis across three levels, providing theoretical support for the spatial transformation of the boundary influence zone
Tan Qian (2019)	Wuhan: "City of Universities"	A Three-Dimensional Economic-Social-Planning Framework	Establishing an integrated "Function-Space-Facility" technical framework, and proposing the concepts of "flexible university-city interface" and "university-based industrial innovation circle"
Wang Aobo (2020)	University Campus Space	Symbiosis Concept, University-City System Construction	Building a University-City Symbiosis system linked to urban space to promote the integration of campus and city spaces and the sharing of resources
Liang Yue (2020)	Urban University Campuses	Theory of Collaborative Innovation, Core-Periphery Theory	Applying the theory of collaborative innovation to analyze campus functions and spatial layout, and proposing systematic renewal strategies
Chen Zong (2021)	Contemporary University Campus Spaces	"Two Views and Three Characters" Theory, Interdisciplinary Approach	Proposing strategies for the renewal and transformation of spatial layouts in "campus-city" transition zones from the perspectives of relationships, functions, and structural networks
Huang Shuili	Campus External Spaces	Connectivity Theory, Place Theory	Proposing Design Strategies for External Spaces Guided by Campus-City Interaction

Author (Year)	Research Object	Core Perspective	Main Conclusions
(2021)			from the Dimensions of Transportation and Activity Spaces
Zhong Jiabin (2022)	Zhejiang University Xixi Old Campus	A Three-Dimensional Framework of Function, Transportation, and Landscape	Proposing that the renewal of the old campus requires multidimensional spatial interventions to achieve deep integration with the urban environment
Liu Huanyu (2022)	Street-Facing Interface of Hunan University's South Campus	Façade Spatial Form and University-City Interface	Analyzing the Spatial Determinants of University-City Integration in University-City Interfaces from the Perspectives of University-City Relations and Spatial Form Design
Mi Weisong (2023)	Surrounding Areas of Two Universities in Xi'an	Scenario Analysis Framework, Integrated Development Strategy	Establishing a Scenario Analysis Framework and Systematically Proposing a Planning Methodology for "Campus-City" Integrated Development
Zhou Jiading (2023)	131 University Campuses in Italy	Urban Morphology Typology, Cluster Morphology Theory	Classifying university-city morphologies into five types and quantitatively evaluating the performance of university-city relationships under different morphological structures
Wang Jing (2024)	Zhejiang University Xixi Campus	University-City Symbiosis Domain, Triple Helix Theory	Explores the bidirectional impact of university-city boundaries and explicitly incorporates the Triple Helix Theory into research on University-City Symbiosis mechanisms
Gao Youchun (2025)	Peripheral Spaces of University Campuses	Peripheral Space Measurement, Integration Evaluation Mechanism	Establishing a university-city integration evaluation mechanism based on edge space metrics, and proposing optimization design strategies

(Source: Compiled by the author)

1.4.2 Review of Relevant International Research

Early international research on university-city relationships primarily focused on empirical studies of spatial forms in Asia, Europe, and the United States. Since the 2010s, research has gradually deepened to explore functional mechanisms and the construction of innovation ecosystems driven by the university's "Third Mission." The research perspective has become increasingly macro-level, and theoretical tools have also become more diverse.

In the early stages of empirical exploration, Seo and Dohi (1993) conducted a systematic analysis of 89 Japanese campuses and 76 Korean campuses, identifying two key factors that determine the spatial relationship between campuses and their surrounding communities: the maturity of the surrounding area and the openness of the campus itself. This laid an important empirical foundation for subsequent research on campus-community relations. Maurrasse (2002)^[24], on the other hand, approached the issue from the perspective of community partnerships. He called on universities to transcend campus boundaries and establish collaborative relationships with surrounding communities and local institutions to contribute

to the shared development of urban communities, representing a particularly influential practice-oriented study of this period.

Regarding the theoretical construction of the university-city spatial relationship, Benneworth, Charles, and Madanipour (2010)^[25] conducted case studies of five universities, including MIT and Harvard, to systematically examine how university spatial development serves as a core medium for university-city interaction. They pointed out that collaborative spatial development between universities and cities can generate competitive Innovation Spaces, and benefits from joint governance by both parties to ensure positive outcomes. van Geenhuizen and Soetanto (2012)^[26] approach the topic from the perspectives of knowledge spillovers and open innovation. Using spin-off companies from TU Delft as case studies, they explore the critical role cities play in facilitating the commercialization of university knowledge and argue that city governments need to assume a more proactive role as connectors in open innovation contexts. Research by Goddard and Vallance (2013)^[27] indicates that regardless of whether a university is located in an urban or suburban area, it establishes an inseparable connection with its host city or community, as the university itself serves as a central source of knowledge and personnel flow both within and outside the city.

Regarding the campus design revolution and spatial integration, Hebbert (2018)^[28] systematically traces the fundamental shift in design philosophies for urban university campuses since the mid-20th century from a design-historical perspective. He notes that contemporary campus design is shifting from an emphasis on separation from the city to a pursuit of integration with it, and explores the design logic behind this transformation across three scales: the urban context, internal layout, and building use. Borsi and Schulte (2018)^[29] Focusing on London's "Knowledge Quarter," this study traces the evolution of university architecture from the "ivory tower" to the "Innovation District," noting that contemporary knowledge architecture deeply interweaves urban life with academic activities through the layering and interweaving of internal and external spaces. Den Heijer and Curvelo Magdaniel (2018)^[30] , drawing on the context of global competition in the knowledge economy, systematically trace the historical evolution of the university-city relationship. They argue that future campuses will increasingly adopt the multifunctional form of a "city within a city," and that the continued blurring of spatial boundaries between the university and the city will become a core strategy for attracting and retaining talent.

Regarding the Third Mission of universities and mechanisms of urban interaction, Brennan and Cochrane (2019)^[31] , based on an empirical study of four British universities, explored three distinct levels of university-city relationships—"in the city," "of the city," and

"beyond the city"—and argued that the relationship between universities and cities is a dynamic process of ongoing negotiation between institutional priorities and the urban context. Addie et al. (2019)^[32], using Singapore as a case study, challenge the research paradigm on urban universities that centers on Western experiences. They point out that, driven by the combined forces of global urbanization pressures and national development agendas, urban universities are forming more holistic relationships of mutual embedding between the university and the city. Bou Abdo, Carrard, and Hanin^[33] further integrate the university's "Third Mission" with "Third Place" theory. Using Dunkirk and Leuven as case studies, they demonstrate that the existence of Third Places facilitates informal interactions among government, universities, and industry, providing crucial spatial support for the growth of the regional knowledge economy.

Mohammed et al. (2022)^[34] conducted a systematic review of 50 studies on university-city relations from 1990–2021, indicating that existing international research has extensively explored university-city relations from multiple dimensions, including safety, transportation, housing, and community participation; yet opportunities remain to explore the deep connections between the physical spatial relationship and the dynamic mechanisms of university-city interactions; Research-by-Design studies aimed at activating the potential for University-City Symbiosis within existing abandoned plots offer a promising direction.

Table 1- 2 : Summary of International Research on University-City Symbiosis

Author (Year)	Research Subject	Core Perspective	Main Conclusions
Seo and Dohi (1993)	89 Japanese schools and 76 Korean schools	Empirical Analysis of School-City Spatial Relationships	The maturity of the surrounding area and the degree of campus openness are the two key factors determining the school-city spatial relationship
Maurrasse (2002)	University-Community Partnerships	Community Collaboration and Expanding Campus Boundaries	Universities should transcend campus boundaries to establish collaborative relationships with surrounding communities, jointly promoting the development of urban communities
Benneworth et al. (2010)	Case Studies of Spatial Development at Five Universities	University Spatial Development and University-City Collaboration	University spatial development can serve as a central vehicle for university-city interaction and requires joint governance by both parties to generate positive urban effects
Goddard and Vallance (2011)	Urban and Suburban Universities	The Relationship of Knowledge Flow Between Universities and Cities	Universities are the primary source of knowledge and personnel flows into and out of cities, establishing an inseparable connection with their host cities or communities
van Geenhuizen and Soetanto	Startups from TU Delft	Open Innovation	City governments must assume the

Author (Year)	Research Subject	Core Perspective	Main Conclusions
(2012)		and Knowledge Spillover Mechanisms	role of active connectors in open innovation contexts to facilitate the transfer of university knowledge to the city
Hebbert (2018)	Urban University Campuses in Europe and the United States	History of Campus Design and Spatial Integration	Contemporary campus design has shifted from segregation to integration, reconfiguring the university-city relationship across three scales: the urban context, internal layout, and building use
Borsi and Schulte (2018)	London's "Knowledge Quarter"	Architectural Typology and the Evolution of Innovation Districts	University architectural typologies have evolved from "ivory towers" to "Innovation Districts," with spatial typologies themselves constituting integral components of the urban innovation ecosystem
Den Heijer and Curvelo Magdaniel (2018)	Campuses in the Context of the Global Knowledge Economy	The Historical Evolution and Future Trends of the University-City Relationship	Future campuses will take on the form of a "city within a city" with mixed-use functions, and the continued integration of the campus and the city is a key strategy for attracting talent
Brennan and Cochrane (2019)	Four universities in the UK	The Multilayered Relationship Between Universities and Cities	The relationship between universities and cities manifests in three levels—"within the city," "belonging to the city," and "transcending the city"—and is a dynamic process of ongoing negotiation
Addie et al. (2019)	Singapore's Higher Education System	Urban Universities and Global Urbanization	Expanding beyond a Euro-American-centric paradigm, this study points out that urban universities are forming a university-city interembedded relationship that goes beyond the binary framework
Bou Abdo et al. (2022)	Dunkirk and Leuven	The Third Mission and Third Place Theory	Third Place facilitates informal interactions among government, universities, and industry, providing spatial support for the regional knowledge economy
Mohammed et al. (2022)	Systematic review of 50 studies on university-city relations	Systematic Review, Physical and Functional Relationships	Existing research largely focuses on functional relationships, and there is an opportunity to increase attention to the deep connections between physical space and dynamic mechanisms; studies on University-City Symbiosis in existing land parcels offer particular potential for future exploration

(Source: Compiled by the author)

1.4.3 Critical Review

A review of relevant domestic and international research reveals a substantial body of academic work in the field of university-city relations. Overseas studies have evolved from empirical analyses of spatial forms to deeper explorations of knowledge spillover mechanisms, the evolution of design typologies, and multi-stakeholder collaboration; domestic research has progressed from early explorations of opening physical boundaries to the introduction of University-City Symbiosis and the construction of systematic regeneration frameworks. Together, these provide important theoretical references and empirical foundations for this study. In recent years, domestic and international research has gradually shifted its focus toward "symbiotic development" and "collaborative governance"; however, studies that systematically address this trend at the operational level of spatial design remain comparatively limited^[35].

Nevertheless, existing research still exhibits several notable shortcomings. First, most studies focus on existing campuses or newly developed university towns, with relatively few systematic investigations of existing areas surrounding universities in older urban districts. Second, existing research on university-city relations largely remains confined to the descriptive analysis of physical spatial forms and functional configurations, with insufficient attention to the intrinsic dynamic mechanisms of element flow between universities and cities^[34]; adequate theoretical explanation of how improvements in physical space translate into the substantive activation of university-city relationships has yet to be provided. Third, although existing research has begun to address the zone-level influence of university-city boundaries, the scope of investigation has remained largely concentrated on the boundary zones themselves, with relatively few holistic studies of the University-City Symbiosis areas influenced and permeated by these boundaries.

Based on the above analysis, this study takes the SCUT-Tianhe Coach Terminal District as its research subject and adopts University-City Symbiosis as its core perspective. Within the context of Built-environment Regeneration, it explores regeneration pathways for coordinating university resources and urban space as an integrated system, aiming to supplement existing research in both the expansion of research perspectives and the exploration of spatial practices.

1.5 Research Content, Methods, and Framework

1.5.1 Research Content

The content of this study comprises four levels: foundational research, case studies,

principle-based research, and site research and design practice.

First, foundational research. The historical evolution of the relationship between universities and cities is traced, the core concepts of symbiosis theory and the Triple Helix Theory are systematically organised, and, on this basis, the levels, mechanisms, objectives, and key elements of University-City Symbiosis are summarised to provide a theoretical basis for subsequent case analysis and the formulation of principles.

Second, case studies. Four representative domestic and international cases — Kendall Square, TU Delft, Tongji NICE2035, and Shanghai Daxue Road—are selected for systematic comparative analysis across three dimensions: spatial organisation, functional configuration, and collaborative governance. Spatial experiences and institutional patterns that may be adapted for practical application are thereby distilled.

Third, principle research. Building on the dual foundations of the theoretical and case studies, a Principles Framework for University-City Symbiotic Regeneration is constructed at two levels: conceptual connotations and regeneration principles. At the level of regeneration principles, three core principles are proposed: Spatial Connectivity and Openness, Functional Hybridity and Symbiosis, and Multi-stakeholder Co-governance and Activation. These correspond respectively to specific strategic pathways including transit hub and road network integration, public framework construction, and boundary-interface treatment; the parallel development of innovative communities, multidimensional functional mixing, and symbiotic space implantation; and the establishment of co-governance platforms and negotiation mechanisms.

Fourth, site research and design practice. Taking the SCUT-Tianhe Coach Terminal District as the subject, systematic site analysis is conducted from two perspectives: site overview and resource conditions, and the challenges facing University-City Symbiosis. On this basis, the three regeneration principles are translated into design applications tailored to the specific site, proposing three site strategies: Three-dimensional Stitching and Boundary Permeation, Hybrid Coordination and Symbiotic Implantation, and Platform Construction and Incremental Institutionalisation. These strategies are presented through a comprehensive master plan and node-specific designs.

1.5.2 Research Methods

(1) Literature Review

By systematically reviewing academic literature on symbiosis theory, the Triple Helix Theory, and the university-city relationship, a theoretical foundation and analytical framework

are established. On this basis, relevant policy documents at the national and local levels are reviewed and interpreted to understand the macro-policy context and regional development orientation of the SCUT-Tianhe Coach Terminal District, thereby providing a policy basis for site analysis and strategy formulation.

(2) Field Research

Multiple on-site surveys are conducted in the SCUT-Tianhe Coach Terminal District, focusing on documenting the site's spatial form, current land use conditions, boundary constraints, patterns of human activity, and spatial relationships with SCUT North Campus, so as to obtain first-hand data on current conditions. Interviews with various types of site users are also conducted to supplement the understanding of the site's social activity characteristics and usage needs.

(3) Case Study

Representative cases of University-City Symbiotic Regeneration from both domestic and international contexts are selected for systematic comparative analysis across three dimensions: spatial organisation, functional configuration, and collaborative governance. Through the synthesis and distillation of case-based insights, spatial patterns and institutional references that may be adapted for constructing the Principles Framework for University-City Symbiotic Regeneration are provided.

(4) Research-by-Design

Taking the SCUT-Tianhe Coach Terminal District as the application site for the theoretical framework and strategy system, the operability and adaptability of University-City Symbiosis strategies under actual site conditions are tested through the design of specific regeneration plans and the formulation of urban design guidelines. Design practice serves both as a spatial manifestation of research conclusions and as a practical verification of the theoretical framework's validity.

(5) Inductive-Deductive Method

At the level of overall logic, both inductive and deductive reasoning pathways are employed: in the initial phase, through literature review and case analysis, regeneration principles for University-City Symbiosis with universal applicability are inductively derived from existing theories and practical experience; in the subsequent phase, these principles are deductively applied to the specific design practice of the SCUT-Tianhe Coach Terminal District, thereby advancing the research from the general to the specific.

1.5.3 Research Framework

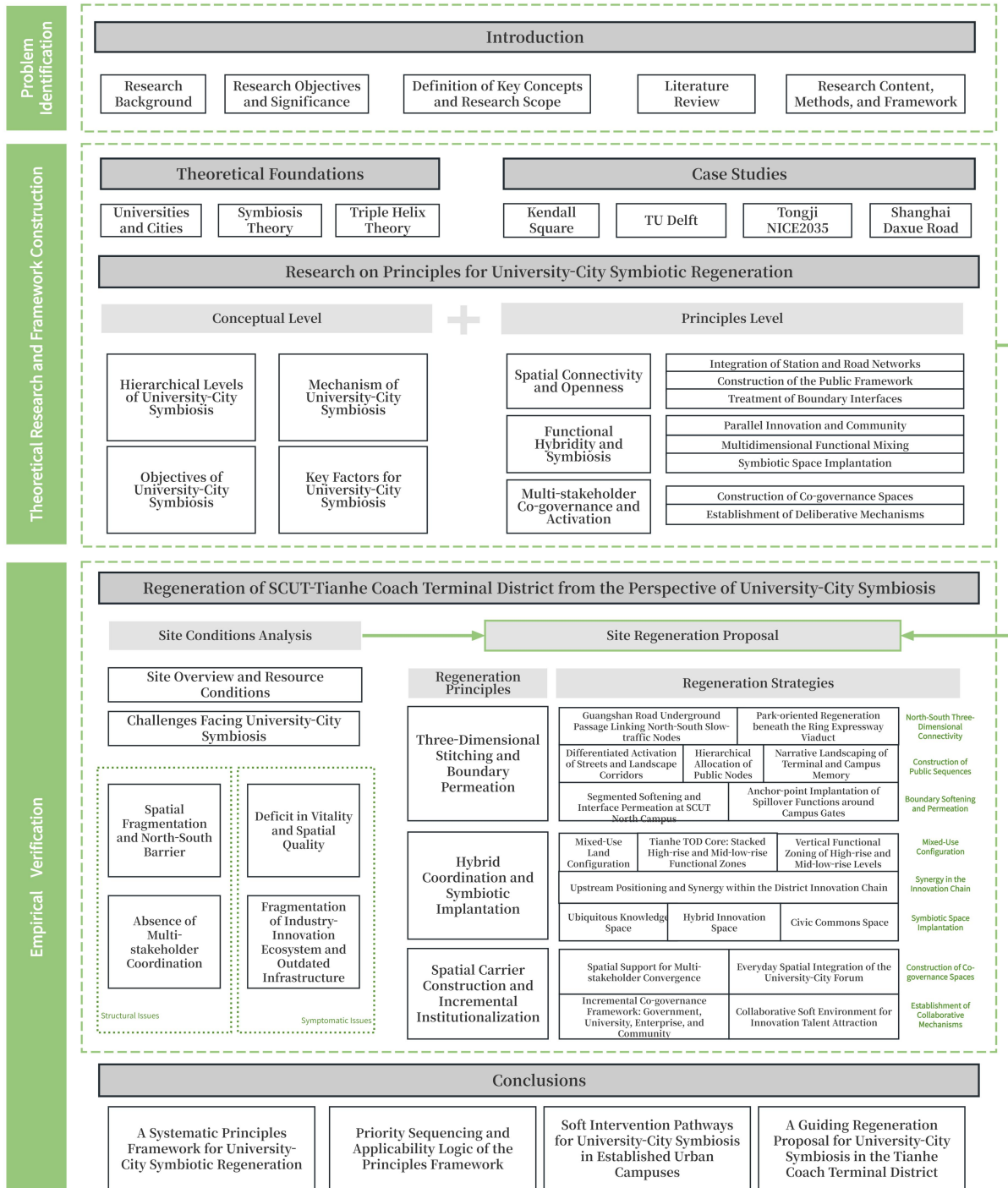


Figure1- 3 Research Framework
(Source: Drawn by the Author)

Chapter 2 Theoretical Foundations

2.1 Universities and Cities

2.1.1 Historical Development of the Relationship Between Universities and Cities

Development Models of University-City Interaction Abroad

The development models of university-city interaction abroad are closely linked to the transformation of universities' social functions, which have evolved from a singular focus on teaching to a composite model of "teaching, research, and entrepreneurship." Concurrently, university-city interaction has progressed from a closed, academic-oriented phase to a relatively open phase emphasizing both teaching and research, and further to a phase of Entrepreneurial Universities driven by regional innovation.

Phase One: "Monastic-Style" Enclosure Rooted in Religious Ideology

In the early Middle Ages, universities primarily served the functions of theological education and the cultivation of elites. Influenced by religious autonomy and the guild system, universities were often located in independent areas on the outskirts of cities, adopting a cloistered layout similar to that of monasteries (such as early Oxford and Cambridge). During this period, although universities were geographically close to cities, they maintained focused "spiritual walls," forming the well-known "Town-Gown Relationship," with interactions primarily characterized by a unidirectional, closed educational model^[36].

Phase Two: Relative Openness Driven by the Industrial Revolution

In the early 19th century, with the introduction of Humboldt's concept of "the integration of education and research," scientific research transformed from a peripheral function of the university into a core one. This fundamental shift in function propelled the rise of the "research university" and ushered in a new historical phase in which universities transitioned from closed, church-like architectural forms and actively integrated into the urban system. Universities began to break away from their cloistered, monastic isolation and actively integrate into the urban functional system. For example, the University of Cambridge in the UK demolished its original monastic walls and adopted a decentralized approach to constructing colleges and academic buildings, allowing the campus fabric to organically intertwine with the urban space. During this period, the interaction between universities and cities shifted from opposition to relative openness, marking the emergence of a model that moved from closed independence toward a relatively open and shared environment that

emphasized both teaching and research^[37].

Phase Three: Entrepreneurial Symbiosis in the Knowledge Economy

After World War II, the rapid development of science and technology, coupled with the practical demands of national competition, drove increasingly close cooperative relationships between universities, government, and industry. The traditional research-oriented university model gradually evolved to better meet society's urgent demand for knowledge transformation and applied talent. With the enactment of the Bayh-Dole Act in the United States in 1980, the university's central role in patent applications and technology transfer was legally affirmed, marking the formal establishment of the "Entrepreneurial University" model. Represented by the Triple Helix Theory proposed by scholars such as Etzkovitz, the academic community during this period began to systematically describe the collaborative innovation relationship among universities, industry, and government, with universities thereby becoming the core engine of regional innovation. The University-City Symbiosis between Stanford University and Silicon Valley became the quintessential paradigm of this phase. It not only achieved a high degree of spatial integration between the university and the city's industrial zones but also, through institutional mechanisms, fostered a deep coupling between research outcomes and the urban economy, propelling the university-city relationship into a phase of comprehensive interaction^[38].

Development Models of University-City Interaction in China

The development model of university-city interaction in China has also evolved continuously in response to political systems, social changes, and economic transformation, undergoing a journey from "spatial polarization" to "passive dependence," then to "isolation," and finally toward "interactive Symbiotic Mode."

Phase One: "Urban-Rural Polarization" in Ancient Times

Traditional higher education in China originated during the Xia and Shang dynasties and developed into a dual-track system of state-run and private schools by the Sui and Tang dynasties. As the educational system primarily served either the feudal ruling class through state-run schools or those seeking to cultivate their character through private schools, it exhibited distinct urban-rural polarization in spatial characteristics. State-run schools were located in imperial capitals or central cities, attached to the political core; private schools, to focus on learning, were often situated in mountainous areas or scenic spots far from cities. During this period, interaction with cities was focused on political dimensions for both state-run and private schools. Although state-run schools were situated in bustling urban

centers, their connection to the city was primarily political, with opportunities for socio-economic engagement still emerging; private schools, meanwhile, maintained a state of "seclusion" from the city in both material and spiritual terms^[39].

Phase Two: "Passive Dependence" in the Modern Period

In the mid-19th century, in response to external challenges and the presence of foreign powers, the Qing government initiated reforms in modern higher education during the Self-Strengthening Movement. Unlike the bottom-up, endogenous development of Western universities, modern Chinese universities were strategically established from the top down against the backdrop of "saving the nation and ensuring its survival." From the early Fuzhou Naval Academy to the later modern schools, their spatial distribution was initially concentrated in the southeastern coastal regions and riverine treaty ports, and later extended to frontier cities due to border defense needs. After the abolition of the imperial examination system in 1905, the number of modern schools surged and spread to inland cities^[39]. However, the relationship between universities and cities during this period reflected the specific conditions of the semi-colonial and semi-feudal context: whether it was the cultural presence of missionary universities or the "technological salvation of the nation" pursued by government-run schools, universities were often functionally aligned with political reforms or early industrialization needs in the cities, with opportunities for an independent and autonomous mechanism for two-way interaction still emerging.

Phase Three: "Structural Segregation" in the Early Years of the People's Republic

From the Land Revolution period through the era preceding the Reform and Opening-Up, universities and cities experienced a prolonged separation and isolation due to the impact of war, social change, and specific political conditions. During the War of Resistance Against Japan, to preserve education, coastal universities relocated en masse to remote mountainous regions and rural areas in the northwest and southwest. Although this "great migration of universities" objectively stimulated cultural development in the host regions, from a spatial perspective, universities established new environments separate from their original urban settings. After the founding of the People's Republic of China, as cities were rebuilt, universities either returned to or were newly established on the outskirts of cities. However, influenced by the "Soviet model," they predominantly adopted a closed "Danwei Compound" layout, surrounded by high walls and functioning as self-contained entities. The "Great Leap Forward" and the "Cultural Revolution" further shaped this trend, and a clear physical and institutional boundary was established between universities and cities, maintaining a distinct

university-city relationship^[40].

Phase Four: "Aggregation and Integration" Following Reform and Opening-Up

Since the launch of Reform and Opening-Up, with the acceleration of economic reforms and urbanization, universities have begun to cluster on a large scale in large and medium-sized cities. In 1985, the Central Committee issued the "Decision of the Central Committee of the Communist Party of China on Educational System Reform," implementing a three-tier university administration system at the central, provincial, and central city levels, which greatly stimulated enthusiasm for establishing universities in cities^[41]. After the turn of the 21st century, with the influx of diverse ideas, the university-city relationship entered a new era, marked by the emergence of "urban-style" campuses that bridge the gap between university and city spaces, connecting the two in new ways. During this phase, the model of university-city interaction underwent a qualitative leap: universities are no longer merely embellishments of the city but have become intellectual engines of regional innovation; cities, in turn, provide universities with the necessary physical infrastructure and industrial hinterland. With the emergence of industry-university-research collaboration platforms such as university-enterprise alliances and university science parks, the university-city relationship is gradually transcending administrative boundaries, evolving toward cross-regional cooperation, global integration, and deep "interactive symbiosis."

2.1.2 Forms of University-City Interaction

The relationship between universities and cities is essentially a bidirectional interactive mechanism based on resource heterogeneity^[42]. As core institutions for knowledge production and talent cultivation, universities have formed a relationship with cities characterized by continuous factor flows and functional interdependence. This interaction is not limited to traditional scientific research and production domains but permeates more deeply into the daily lives of faculty, students, and citizens. This two-way interaction is not a naturally occurring, passive process, but rather one realized through specific spatial mediators and institutional mechanisms. The state of the physical boundary between the university and the city, along with the configuration of their functions, directly determines the efficiency and depth of factor flows. Based on a "supply-demand" analytical framework, the interaction mechanism between universities and cities can be analyzed from the dual dimensions of "production" and "living."

2.1.2.1 Universities Promote Urban Development

As a core provider of knowledge and talent, the spillover effects of universities on cities

exhibit distinct dual attributes of production and daily life. "Supply-side Spillovers" refer to the release of the university's internally accumulated knowledge capital, human resources, and spatial assets into the city as externalities, with the city assuming a passive beneficiary role in this process; whereas "Demand-side Spillovers" refer to the consumption and spatial demands placed on the city by the university community to meet its own operational needs, thereby triggering corresponding functional responses within the city.

In the productive dimension, the spillover effects of universities primarily manifest as the external dissemination of knowledge and intellectual resources^[22]. Beyond traditional patent licensing and technology transfer, universities continuously channel knowledge capital into the city by opening up academic resources, hosting public lectures, and offering continuing education programs, thereby establishing a lifelong learning system that serves diverse segments of the population^[43]. Universities serve as the central source of knowledge and human capital flowing into and out of cities. This flow is not only reflected in the formal commercialization of research outcomes but also permeates the daily activities of university faculty and students as they proactively engage in urban public affairs through professional research and community practice, thereby facilitating the diffusion of intellectual resources into broader society^[27].

In the realm of daily life, the spillover effects of universities manifest in two dimensions: consumption-driven activity and cultural atmosphere^[44]. The consumption demands for food, clothing, housing, and transportation generated by the large student and faculty population have fostered diverse commercial formats and residential amenities around campuses, forming vibrant consumption hubs dominated by young people. This has significantly influenced the commercial structure and land values of surrounding urban spaces^[17]. On the other hand, as scarce high-quality public resources in the city, universities' cultural and sports facilities and public spaces effectively address the structural deficiencies in urban public services through their orderly opening to the public. Furthermore, the unique youthful cultural atmosphere and creative activities within universities continuously infuse cultural vitality into the surrounding urban spaces^[45].

2.1.2.2 Cities Promoting University Development

As the spatial context for the existence and development of universities, cities generate a continuous feedback effect on the operation and growth of universities through two mechanisms: supply-side Penetration and Demand-side Penetration. "Supply-side Penetration" refers to the city's proactive provision of material conditions, policy support, and

ancillary services to universities; "demand-side Penetration" refers to the actions taken by urban residents and enterprises to access university resources based on their own needs, which objectively promotes the social circulation of university resources.

In the production dimension, the city's supportive role is primarily manifested in the provision of physical space and infrastructure, including land resource supply, planning policy adjustments, and the construction of supporting public infrastructure. Building on this foundation, the specialized service sectors that emerge around the research and teaching needs of universities constitute an external industrial chain network that supports the efficient operation of universities^[46]. Collaborative development between universities and cities centered on campus spaces can foster competitive innovative urban spaces. Meanwhile, by commissioning industry-academia research projects and recruiting talent, urban enterprises provide universities with a continuous stream of research topics and employment opportunities, forming the core driving force behind the transformation of research outcomes and their integration into the socio-economic cycle^[25].

In terms of daily life, cities primarily support the daily operations of university communities through two mechanisms: basic living services and shared spaces. The city's well-developed commercial service network and municipal infrastructure are indispensable external conditions for ensuring the efficient operation of the campus. At the same time, urban residents' demand for access to universities' high-quality spatial environments and public service resources objectively promotes the socialized use of campus spaces, making universities an integral part of urban public life and creating a micro-symbiotic landscape where civic life and campus life are intertwined^[35].

Table 2-1 Interaction Between Universities and Cities

Main Flow	Type	Dimension	Specific Spaces and Behaviors
University Spillover	1. Supply-side Spillover (Output of Knowledge and Resources)	Production-oriented (Research and Education)	Technology Transfer: Licensing of indigenous technology patents, commercialization of scientific and technological achievements Educational Outreach: Academic education, skills training, and open academic lectures Intellectual Outreach: Legal aid, community medical clinics, mural design, volunteer teaching services
		Lifestyle (Facilities and Culture)	Facility Sharing: Staged access to gyms, swimming pools, museums, and theaters Vitality Projection: Street art performances, community outreach by social groups, and youth-oriented activities

Main Flow	Type	Dimension	Specific Spaces and Behaviors
Urban Penetration	2. Demand-side Spillover (Consumption and Space Claims)	Production-Driven (Teaching and Practical Training)	Practical Training Bases: Course research sites, off-campus internship opportunities Incubation Spaces: Maker Spaces, Pilot Testing Workshops, Off-Campus Startup Parks
		Lifestyle-Oriented (Food, Clothing, Housing, and Transportation)	Housing Spillover: Postgraduate exam preparation housing, faculty apartments, youth apartments Social Consumption: Interactive mystery games, KTV, dining out, night markets, creative markets, and other experiential consumption
	3. Supply-side Penetration (Support and Supporting Services)	Production-oriented (Specialized Support)	Academic Support Services: Quick printing, model making, various exam preparation training institutions Policy Support: Land allocation, floor area ratio incentives, joint laboratory construction
		Residential (Daily Living)	Basic Services: Courier stations, food delivery, convenience stores, barbershops Municipal Services: Public transportation, sanitation and cleaning, security patrols
	4. Demand-side Penetration (Resource and Environmental Utilization)	Production-oriented (Intellectual Resource Extraction)	Intellectual Purchasing: Corporate-commissioned collaborative research projects, hiring professors as consultants Talent Acquisition: Hiring graduates, part-time work for current students
		Lifestyle-oriented (Shared Environment)	Space Use: Residents' morning exercises, walks, and community activities Resource Sharing: Access to campus cafeterias, health clinics, and library study rooms

(Source: Drawn by the Author)

Overall, the two-way interaction mechanism between universities and cities exhibits a high degree of complementarity and interdependence across both the production and lifestyle dimensions. The realization of this complementary potential relies heavily on the quality of the spatial interface connecting the two parties and the capacity for institutional coordination. Whether it is the spillover of university knowledge resources or the reverse pull of urban capital demands, effective spatial reception mechanisms enable the aforementioned interactions to translate into tangible momentum. When physical boundaries facilitate the flow of elements and functional configurations respond to mutual needs, the interaction mechanism functions effectively, and the university-city relationship benefits from close integration. This dynamic forms the micro-foundation of this study's research problem and serves as one of the starting points for subsequent discussions on design strategies for University-City Symbiosis.

2.1.3 Major Models of University-City Interaction

In the long-term evolution of the university-city relationship, several representative interaction models have emerged both domestically and internationally, collectively reflecting the organizational logic of university-city relations under different developmental stages and

institutional contexts.

In international practice, the Entrepreneurial University model and the central knowledge district model represent two development pathways with significant influence. The Entrepreneurial University model is centered on meeting diverse internal and external demands. Through connecting mechanisms such as incubators, science and technology parks, and industrial technology research institutes, it links the university's internal knowledge production capabilities with external market demands and capital resources. In terms of spatial organization, this model tends to form a functional layout centered on scientific and technological R&D, surrounded by concentric layers of commercial services and residential communities. Public service corridors link these layers, enabling the organic spatial integration of knowledge production, technology transfer, and daily life^[47]. The long-established symbiotic relationship between industry and academia at Stanford University and the surrounding Silicon Valley region is a typical example of the synergistic evolution of this model at both the spatial and institutional levels. The Central Knowledge District model emphasizes the clustering of university-centered technological innovation functions in specific urban areas, creating a spatial platform where knowledge-economy headquarters, high-tech industries, and productive services are highly integrated. At the urban structural level, it establishes a complementary division of labor between research and innovation and commercial services with the Central Business District. The core contribution of this model lies in combining the knowledge spillover effects of universities with the city's spatial restructuring needs, driving the transition of the university-city boundary from physical separation to functional integration. The innovation district in Cambridge, Massachusetts, which developed around Harvard University and the Massachusetts Institute of Technology (MIT), serves as a representative example of this model.

In domestic practice, the evolution of the university-city interaction model has been closely linked to economic system transformation and innovation policy orientations, primarily undergoing two developmental stages: traditional industry-university-research collaboration and the "Three-zone Linkage" model. The traditional industry-university-research collaboration model centers on linear cooperative relationships among universities, research institutes, and enterprises, focusing on technology transfer and the commercialization of research outcomes. The promulgation of the 1999 "Decision of the Central Committee of the Communist Party of China and the State Council on Strengthening Technological Innovation, Developing High Technology, and Achieving Industrialization" marked the formal establishment of this model^[14]. However, the primary limitation of this

model lies in its exclusive focus on bilateral cooperation between universities and enterprises, neglecting the mediating role of intermediary institutions and the strategic intervention of government, making it difficult to establish a systemic innovation framework encompassing multi-stakeholder collaboration. The "Three-zone Linkage" model originated from the strategic practice of the Knowledge Innovation Zone in Yangpu District, Shanghai, in 2003. Centered on university campuses, using science and technology parks as platforms, and relying on urban communities, it achieves a systematic enhancement of regional innovation capacity through the complementary advantages and resource sharing of these three elements^[48]. Compared to traditional industry-university-research models, the "Three-zone Linkage" model expands beyond the linear cooperation framework between universities and enterprises by incorporating the community as a third pole in university-city interaction, representing a development paradigm with Chinese characteristics^[49].

A review of the evolution of models both domestically and internationally reveals that the shift of university-city interaction from unidirectional technology transfer toward multi-stakeholder collaborative spatial integration represents a common developmental trend. Whether it is the concentric spatial layout of Entrepreneurial Universities or the "Three-zone Linkage" synergy among campus, industrial park, and community, both point to the same core proposition: universities and cities must actively construct spatial and institutional conditions to transform potential resource complementarity into substantive symbiotic gains. This assessment serves as a crucial reference for the intervention logic of this study.

2.1.4 Structural Barriers to University-City Interaction

Although universities and cities exhibit profound resource complementarity and symbiotic needs at the theoretical level, their collaborative development continues to face serious challenges in China's current urban regeneration practices. These barriers are not only manifested in the visible fragmentation of physical space, but are also rooted in deeper contradictions within management systems and social structures.

2.1.4.1 Observed Barriers

At the physical level, the boundary enclosure between the university and the city is evident not only in rigid walled barriers, but also in the passive peripheral zones that invisibly reinforce this separation. The majority of universities maintain enclosed walls that sever the micro-circulation of the urban road network. Campus fringe areas, lacking facilities for people to linger and guidance for activities, have been reduced to functionally vacant passive spaces.

High-quality landscapes and public resources within campuses are unable to permeate the surrounding high-density urban hinterland, resulting in the structural underutilisation of public resources.

At the functional level, formal commercial facilities within and around campuses consistently lag behind the actual needs of student and faculty communities, causing a concentration of consumer activity in the informal intermediate zones where campus and city meet. These spontaneously formed low-end commercial districts, while partially compensating for functional deficiencies, give rise to problems of poor environmental quality and spatial disorder, creating a stark contrast in spatial quality between the campus interior and its surroundings.

At the level of social relations, the absence of intermediate zones capable of facilitating exchange between different groups perpetuates a pronounced class divide and cultural barrier between the homogeneous knowledge communities within universities and the diverse, complex urban communities surrounding them. Closed physical boundaries further reinforce the psychological divide between "insiders" and "outsiders," and these relations of mutual distrust constitute a significant obstacle to the advancement of University-City Symbiosis^[50].

2.1.4.2 Underlying Causes

The barriers described above are not attributable to any single dimension, but rather result from the overlapping effects of multiple factors: the administrative system, management approaches, and social structure.

First, the heterogeneity of development goals and the compartmentalisation of the administrative system constitute the institutional roots of university-city conflict. Universities are typically under the vertical management of education administrative departments, with their core objectives focused on academic development and campus order; urban spaces, by contrast, are led by local governments, whose core priorities lie in economic growth and public vitality. Differences in administrative affiliation give rise to a natural misalignment of interests between the two sides, and the absence of a unified coordination mechanism means that they frequently struggle to reach consensus on planning and land use^[17].

Second, the rigidity of management approaches and the pressure of security governance have produced an entrenched pattern of closed administration. Universities, as key security units, place high priority on campus safety. In the absence of tiered control technologies and institutional safeguards, administrators tend to adopt closed management as the lowest-cost strategy, making it difficult to implement flexible mechanisms such as time-based opening

and zone-based management, and causing the university-city boundary to become increasingly entrenched.

Finally, the heterogeneity of community structures has exacerbated social-spatial segregation. Between the highly homogeneous knowledge community within the university and the diverse, heterogeneous urban communities outside, cultural barriers prove difficult to dissolve in the absence of effective spatial mediators and interaction mechanisms. Neither side is able to derive sufficient benefit from University-City Symbiosis, generating a social obstacle to the improvement of university-city relations.

2.2 Symbiosis Theory

Symbiosis theory serves as the core theoretical foundation for this study's analysis of university-city relations. Compared to the descriptive generalizations of university-city interactions found in existing research, symbiosis theory provides a systematic framework that uses heterogeneous entities as analytical units, energy exchange as the core mechanism, and Mutualistic Symbiosis as the goal. This framework can more accurately reveal the intrinsic logic of resource complementarity and factor flows between universities and cities.

The term "symbiosis" originates from the field of biology, with its root in the Greek word "sumbiosis," meaning "living together." In 1879, German mycologist Anton de Bary, while studying the coexistence of fungi and algae, first defined it as the phenomenon of "organisms of different species living together." Subsequently, biologist Scott systematically refined this concept, defining symbiosis as: in a natural environment, two or more organisms establish a lasting physical connection to share living space and resources, thereby forming a mutually beneficial relationship that maximizes their survival interests. From a biological perspective, symbiosis emphasizes the cooperative survival strategies of heterogeneous organisms in environments with limited resources, analyzing the intrinsic logic by which different entities achieve mutual benefit through complementarity rather than competition.

Since the 1960s, with the deepening development of systems theory and ecological perspectives, the concept of "symbiosis" has transcended disciplinary boundaries and been introduced into fields such as sociology, economics, anthropology, and architectural planning, becoming a crucial analytical tool for understanding the relationships between heterogeneous entities within complex systems. In the fields of architecture and urban planning, this concept is regarded as a significant marker of the shift from the "mechanistic era" to the "biological era"^[5]. Renowned Japanese architect Kisho Kurokawa is the founder and central proponent of the theory of symbiosis in the field of architecture. He formally proposed the concept of the

"symbiotic city" in the 1970s and systematically constructed its theoretical framework in his book **New Symbiotic Thought**, advocating for the embrace of integrated thinking beyond the dualistic approach found in modernist architecture and promoting the coexistence and harmony of different cultures, opposing elements, and heterogeneous entities^[5].

2.2.1 The Composition of Symbiotic Systems

According to the analytical framework of symbiotic theory developed by Yuan Chunqing, the occurrence and evolution of any symbiotic phenomenon hinges on the interaction of three core elements: Symbiotic Units, Symbiotic Modes, and the Symbiotic Environment^[51].

2.2.1.1 Symbiotic Unit

Symbiotic Units are the basic energy units constituting a symbiotic system and the primary agents of symbiotic behavior. In urban systems, Symbiotic Units refer to social entities or spatial entities possessing independent functional attributes, resource endowments, and interest-based demands. The theory emphasizes that the "Quality Parameters" of Symbiotic Units must possess compatibility and complementarity. Although each Unit differs in nature, they possess the potential for energy exchange, which serves as the material foundation for establishing symbiotic relationships. When Symbiotic Units demonstrate complementary Quality Parameters, symbiotic relationships can be established; conversely, the greater the heterogeneity and the greater the potential for complementarity, the more significant the synergistic effects that symbiotic relationships can unleash.

2.2.1.2 Symbiotic Mode

Symbiotic modes describe the methods, pathways, and stability of energy exchange between units. Based on the distribution of benefits among the entities involved, symbiotic modes typically follow a pattern of evolution from lower to higher levels: progressing from parasitism—a one-way extraction—to commensalism, where one party benefits while the other remains unaffected, and ultimately reaching Mutualistic Symbiosis, where both parties complement each other's resources and achieve mutual gain. Among these, Mutualistic Symbiosis represents the most stable and efficient ideal state of a symbiotic system, and it is the target model advocated by symbiosis theory. The formation of symbiotic relationships is essentially a natural selection made by each entity to maximize its own interests, rather than the result of external pressure. This intrinsic driving logic implies that the key to propelling symbiotic relationships toward higher stages lies in creating the spatial conditions and institutional environment that allow each entity to perceive and obtain symbiotic benefits.

The evolution of Symbiotic Modes is highly dependent on the accumulation of

interactions between Symbiotic Units and the establishment of trust. In actual university-city relationships, physical separation and institutional barriers can limit the channels for energy exchange between Units, causing these relationships to remain at a low level of Symbiosis for extended periods and requiring deliberate intervention to evolve toward the ideal state of Mutualistic Symbiosis.

2.2.1.3 Symbiotic Environment

The Symbiotic Environment encompasses the sum of external conditions and mediating factors that facilitate symbiotic relationships. It includes both the physical "hard environment" (such as physical spaces, infrastructure, and transportation networks) and the institutional "soft environment" (such as policy mechanisms, governance structures, and cultural atmospheres). The core function of the Symbiotic Environment lies in reducing transaction costs for interactions between units, providing channels and catalytic conditions for the flow of energy. A healthy Symbiotic Environment can proactively stimulate the potential for interaction among units, driving the evolution of Symbiotic Modes from lower to higher levels; conversely, closed spatial configurations and rigid institutional arrangements present opportunities to develop more open and flexible structural conditions for symbiotic relationships^[13].

2.2.2 Conditions for Symbiosis

Unlike the physiological dependence emphasized in biology, Kisho Kurokawa, in **The Philosophy of Symbiosis**, proposes three key conditions for achieving a virtuous symbiosis from the dimensions of space and culture: the Sacred Zone, the Intermediate Domain, and The Way. Together, these three constitute the logical prerequisites for the coexistence and interaction of heterogeneous entities within space.

2.2.2.1 Sacred Zone

"Sacred Zone" refers to the inviolable core territory and independent characteristics that each Symbiotic Unit must preserve. Within a symbiotic relationship, each entity maintains its identity while pursuing integration; each preserves its unique cultural DNA and core functions. When the boundaries of each Unit are clearly defined and their characteristics distinct, they possess the qualifications for equal dialogue and the foundation for energy exchange. When each unit maintains its identity, the symbiotic relationship flourishes, preserving the value of Heterogeneous Complementarity. The establishment of the Sacred Zone essentially protects the subjectivity of Symbiotic Units and supports the sustainability of the symbiotic relationship^[52].

2.2.2.2 Intermediate Domain

The "Intermediate Domain" is a central concept in Kisho Kurokawa's philosophy of symbiosis. He believed that between any pair of opposites—whether inside and outside, public and private, or order and vitality—there must exist a vague, subtle "gray zone," similar to the "Engawa" space found in traditional Japanese architecture. The Intermediate Domain belongs equally to both sides and simultaneously encompasses the attributes of both; it serves as a venue for the permeation, exchange, and buffering of heterogeneous elements. Through flexible transitions, the Intermediate Domain resolves rigid conflicts and transforms opposition into dialogue, functioning as the key spatial vehicle for achieving symbiosis. Its significance lies not only in providing physical buffering but also in creating a "space of possibility" where heterogeneous entities that would otherwise remain separate can meet and interact.

2.2.2.3 The Way (“道”)

The Way (“道”) symbolizes the dynamic network and spiritual bond connecting independent units. On the spatial level, it manifests as a system of pathways facilitating the exchange of people, goods, and information; on the institutional level, it manifests as a communication mechanism for coordinating the interests of different entities; on the spiritual level, it represents an open, fluid worldview. The Way (“道”) connects isolated systems and ensures the sustained metabolic capacity within symbiotic systems; it is the fundamental guarantee for maintaining the dynamic vitality of symbiotic relationships.

2.2.3 The Applicability of Symbiosis Theory

This study introduces symbiotic theory as the theoretical foundation for analyzing the relationship between universities and cities, not merely as a conceptual borrowing, but based on the high degree of alignment between their intrinsic logics. This alignment is manifested at three levels—subject attributes, relational evolution, and spatial mediation—and has been concretely validated in the real-world challenges of the SCUT-Tianhe Coach Terminal District.

Modern universities and urban communities exhibit significant differences in functional positioning, resource types, and cultural attributes: universities focus on knowledge production, talent cultivation, and technological innovation as their core functions, while urban communities are primarily characterized by daily consumption, industrial operations, and social governance. This heterogeneity is precisely the prerequisite for energy exchange emphasized by symbiosis theory—that is, the greater the differences, the stronger the

potential for complementarity, and the more significant the synergistic effects that the symbiotic relationship can unleash. From the perspective of Symbiotic Units, universities and cities possess the fundamental conditions required to form a symbiotic system: each has distinct functional boundaries and resource endowments, while simultaneously exhibiting profound complementary needs in dimensions such as knowledge spillover, consumption-driven growth, and spatial sharing.

Symbiosis theory classifies inter-entity relationships into three Symbiotic Modes: parasitic, Commensalism, and Mutualistic Symbiosis, establishing the latter as the most stable and efficient ideal state. However, an examination of the current state of University-City Symbiosis in China reveals that opportunities remain for most universities to fully develop a Mutualistic Symbiosis relationship with their surrounding urban areas^[53]. In areas where university infrastructure is relatively outdated and surrounding urban spaces are undergoing rapid renewal, a city-dominated form of commensalism often emerges. The city benefits from the population concentration and consumer vitality brought by the university, while the university has opportunities to enhance its benefits from the surrounding urban environment. Conversely, in areas where university facilities are relatively well-developed but surrounding urban spaces are in need of improvement, a campus-dominated form of commensalism emerges. While universities maintain internal order and quality, their boundaries can limit the channels through which knowledge resources can spill over into the city. The transition toward a mutualistic symbiosis in university-city relations can be guided by proactive spatial design interventions and the establishment of institutional mechanisms.

Symbiosis theory emphasizes the role of Symbiotic Environments as conduits for energy flow, while Kisho Kurokawa further established the "Intermediate Domain" as the key spatial vehicle for achieving University-City Symbiosis. In the context of university-city relations, this theoretical insight carries direct implications for spatial design: the key to resolving university-city conflicts often lies not in transforming the internal structure of the entities, but in reconfiguring the University-City Interface. Existing research indicates that the boundaries created by university walls present opportunities to enhance the flow of elements between the university and the city^[54]; conversely, the active construction of flexible transitional spaces—such as functionally mixed boundary zones, open and shared public nodes, and continuous pedestrian networks—can effectively reduce the transaction costs of university-city interaction and provide a physical foundation for the development of University-City Symbiosis^[50]. Kisho Kurokawa's discourse on the "Sacred Zone" is equally relevant: promoting University-City Symbiosis means preserving the boundaries and distinct

characteristics of the university and the city while, maintaining the independence of both entities, creating a space for the encounter, dialogue, and interaction of heterogeneous entities through the active construction of the Intermediate Domain.

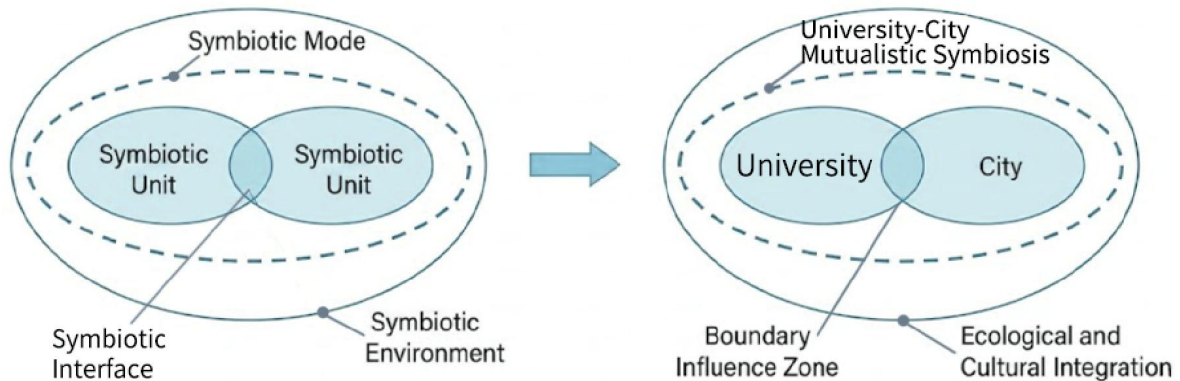


Figure 2- 1 University-City Symbiosis Theory and University-City Relations
(Source: Drawn by the Author based on Reference^[13])

2.3 The Triple Helix Theory

The Triple Helix Theory was jointly proposed in the 1990s by American sociologist Henry Etzkowitz and Dutch scholar Loet Leydesdorff to explain the driving mechanisms of innovation systems in the knowledge economy era. Understanding of the relationship between universities and society had previously focused on bilateral interaction models such as "state–university" or "industry–university." The Triple Helix Theory extends beyond the traditional linear, binary paradigm, positing that as the role of knowledge in economic development has risen, a spiral-like, intertwined relationship—similar to a biological genetic chain—is forming among universities, industry, and government. The core tenet of this theory is that universities are now one of three equal actors in innovation, alongside industry and government. Through continuous interaction, overlap, and circulation, these three entities form a complex, nonlinear innovation system that replaces traditional "government-led" or "market-led" models, becoming the core engine driving regional innovation and industrial upgrading^[55].

In 2013, Ranga and Etzkowitz further developed the Triple Helix Theory into a Triple Helix Innovation System analytical framework. Drawing on systems theory, they deconstructed the tripartite interaction into three levels—components, relationships, and functional spaces—thereby translating macro-level institutional interactions into micro-level system operations^[56]. Within this framework, the tripartite relationship among universities, industry, and government is understood as a complex adaptive system jointly coupled by

heterogeneous components, interactive relationships, and functional spaces^[57]. The component level focuses on the composition and attributes of participating entities; the relational level examines the dynamic pathways of knowledge flow, resource alignment, and consensus-building among entities; and the spatial level projects the interactions between these components and relationships into three specific functional domains, providing structural vehicles for the emergence of innovative activities. These three levels are mutually nested, collectively forming a comprehensive analytical framework of the Triple Helix Innovation System^[58]. The analytical framework employed in this study is primarily based on this systematic extension.

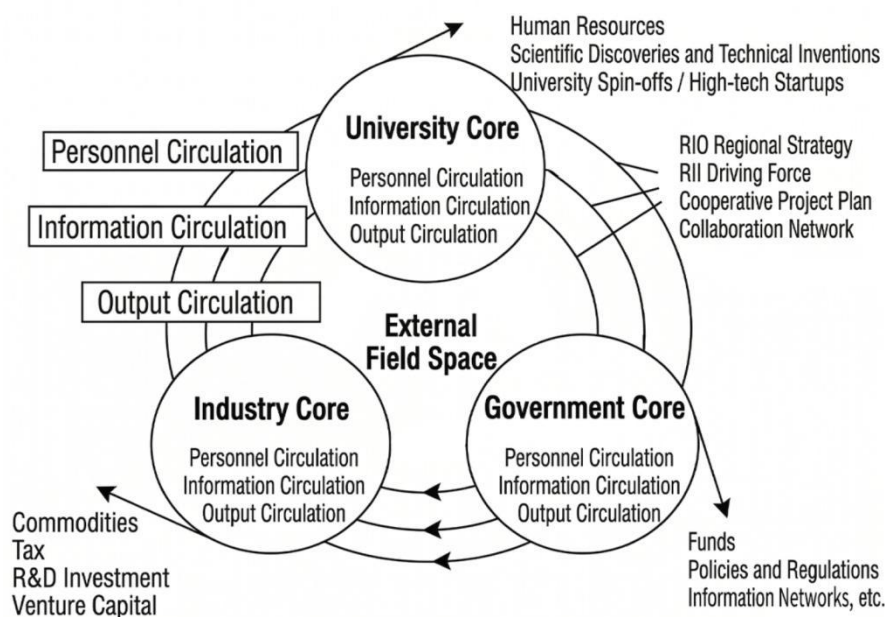


Figure 2- 2 : The Public Space Network of Kendall Square
(Source: Drawn by the Author based on Reference^[57])

2.3.1 Constituent Components of the Triple Helix System

Research on the traditional triple helix model focuses on the overall interaction among the three institutional spheres of academia, industry, and government, whereas the systems theory perspective further deconstructs these three spheres into complexes composed of heterogeneous elements. Based on this, Ranga and Etzkowitz refine them into three groups comprising six core components to more accurately depict the micro-mechanisms of innovation.

The first group distinguishes between R&D innovators and non-R&D innovators based on functional attributes, emphasizing the equal importance of technological and non-technological elements in the innovation chain: the former is responsible for knowledge production and technological R&D, serving as the core supplier of the system's original

knowledge capital; the latter undertakes soft-link functions such as technology transfer, market integration, and professional services, bridging the structural gap between technology and the market. The second group distinguishes between Single-sphere Institutions and Hybrid Institutions based on organizational form: Single-sphere Institutions have single-function roles and follow traditional institutional logic, forming the foundational base of the system; Hybrid Institutions possess multiple attributes, transcend institutional boundaries, and serve as key platforms for reducing cross-organizational transaction costs and integrating innovation resources. The third group distinguishes between individual innovators and institutional innovators from the perspective of acting agents: the former are "ambivalent talents" who transcend institutional boundaries, facilitating the informal diffusion of tacit knowledge through mobility and part-time work; the latter provide the institutional groundwork for innovation activities through rule reform and mechanism design.

Table 2-2 : Components of the Triple Helix System

Component Grouping	Specific Types	Core Definition	System Function
Functional Attribute Group	R&D Innovators	Entities directly engaged in knowledge production and technological R&D	Source of Supply: Determines technological capabilities
	Non-R&D Innovators	Entities engaged in non-technical innovation activities such as design, marketing, and services	Commercialization Support: Determines Market Soft Power
Organizational Structure Group	Single-sphere Institution	Traditional organizations with single functions and clearly defined boundaries	Foundation: Maintaining core strengths across all fields
	Hybrid Institution	A new type of organization with multiple functions and flexible boundaries	Evolutionary Node: Integrating resources and reducing transaction costs
Action-oriented groups	Individual Innovators	Boundary-spanning scientists, entrepreneurs, and multidisciplinary talents	Micro-level agency: Vectors of knowledge and information flow
	Institutional Innovators	Leaders and institutions driving rule changes and mechanism design	Macro-level Support: Optimizing the innovation ecosystem and incentive mechanisms

(Source: Compiled by the author based on references^[57])

2.3.2 Interactions within the Triple Helix System

Nonlinear interactions among components serve as the driving force behind the evolution of innovation systems. In contrast to the simple bilateral contractual cooperation found in traditional models, the Triple Helix Innovation System forms a complex network of interdependent relationships, primarily supported by five core interaction mechanisms that

collectively determine the efficiency of knowledge capital flow and the system's innovation capacity.

Technology transfer is the most fundamental linear interaction, referring to the flow of knowledge capital from the generation end to the application end; its efficiency directly determines the speed at which scientific research achievements are transformed into productive capacity. Collaboration and conflict resolution address the conflicting objectives arising from the different institutional logics followed by the three parties, resolving interest divergences through dialogue and negotiation mechanisms to maintain the stability of the system's operation. Collaborative leadership is a form of governance that transcends single-point administrative directives. It involves representatives from the knowledge, industrial, and administrative sectors jointly participating in the formulation of regional innovation strategies, thereby forming a polycentric governance structure. Substitutive relationships embody the system's resilience: when a functional gap arises in one sector, other components proactively step in across boundaries to fill the void, ensuring that overall operations remain stable even when localized challenges emerge. Networked relationships serve as the social capital bonds that bind these interactions together, placing particular emphasis on the critical role of frequent informal exchanges in building trust and disseminating tacit knowledge.

Table 2- 3 Interactive Relationships in the Triple Helix System

Relationship Type	Core Definition	System Function	Typical Characteristics
Technology Transfer	The flow and transformation of knowledge and technology between components	Value Realization: Transforming Research Outcomes into Productive Capacity	Patent Licensing, Technology Equity Participation, and Part-time Employment
Collaboration and Conflict Resolution	Reaching Cooperation and Resolving Disagreements Among Heterogeneous Entities	System Stability: Maintaining the Stability of System Operations	Industry-Academia-Research Alliances, Joint Meetings, and Consultation Platforms
Collaborative Leadership	A governance model featuring multi-stakeholder decision-making	Strategic Direction: Formulating a Shared Innovation Strategy	Innovation Council, Multi-stakeholder Governance Committee
Substitution Relationships	Interpenetration and Complementarity of Functions Among Actors	System Resilience: Ensuring Continuous Operation Despite Component Challenges	Entrepreneurial University, Government-Led Funds
Networked	Weaving of Formal and Informal Social Relationships	Facilitation and Catalysis: Reducing Transaction Costs and Promoting Exchange	Academic salons, informal social gatherings, alumni networks

(Source: Compiled by the author based on references^[57])

2.3.3 Functional Spaces of the Triple Helix System

The nonlinear interactions among components ultimately manifest across three specific functional dimensions, forming the three core domains: the Knowledge Space, the Consensus

Space, and the Innovation Space. It should be noted that the term "space" here primarily refers to functional and social domains rather than mere physical structures; however, as the logical starting point for subsequent translations into physical space, these three domains hold significant implications for spatial design. These three spaces are interwoven, collectively constituting the top-level architecture of the regional innovation system.

The Knowledge Space serves as the resource foundation of the Triple Helix Innovation System, referring to the high-density concentration of R&D activities and tacit knowledge within a specific region. Its formation relies on spatial proximity and critical mass, and its core function lies in the continuous supply of original knowledge capital and high-quality human resources; it acts as the fuel reservoir for the operation of the entire innovation system. The Consensus Space serves as the system's governance mechanism and strategic engine. It is a neutral domain that brings together the three key stakeholders—universities, industry, and government. Here, the three parties unite beyond their institutional differences and jointly formulate regional innovation strategies through dialogue and negotiation. The Innovation Space serves as the system's execution endpoint and value realization platform, typically led by Hybrid Institutions. Its core function is to transform resources from the Knowledge Space and strategies from the Consensus Space into concrete commercial value and technological products, acting as the direct driving force behind regional economic growth^[59].

These three spaces are interdependent and indispensable: the Knowledge Space provides essential driving force, the Consensus Space ensures resource integration, and the Innovation Space transforms outcomes into practical applications. Through the analysis of the Triple Helix Innovation System, we identify three core functions of a regional innovation system: the production and accumulation of new knowledge, the commercialization of innovation outcomes, and the coordinated governance among diverse stakeholders. Only through the combined action of these three can a region develop sustainable innovation capabilities grounded in science and technology^[58].

Table 2-4 Innovation Spaces of the Triple Helix Innovation System

Space Type	Core Definition	Components	Operational Logic
Knowledge Space	A source of innovation for the concentration and production of knowledge resources, emphasizing the original accumulation of knowledge and academic spillover.	Universities, public research institutions, and corporate R&D centers; basic research facilities, talent development systems, and academic networks	Spillover Logic: Achieves knowledge diffusion through talent mobility and informal exchanges. Emphasizes the transformation from tacit to explicit knowledge
Innovation Space	A hub for the realization of value through knowledge capitalization and commercialization, characterized by highly overlapping functions and high density.	Hybrid Institutions (science parks, incubators or accelerators, startups, venture capital firms); technology transfer mechanisms, venture capital, testing grounds	Restructuring logic: the reconfiguration of technological, capital, and managerial elements. Emphasis on the translation from scientific value to commercial value
Consensus Space	A systemic engine where multiple stakeholders converge, engage in dialogue, and establish rules, serving as a catalyst and governance mechanism.	A "neutral zone" where universities, industry, and government entities meet; strategic committees, forums, and informal social networks	Recursive logic: refining expectations and forming a feedback loop through iterative dialogue. Emphasis on the integration of bottom-up and top-down approaches

(Source: Compiled by the author based on the following references:)

2.3.4 Applicability of the Triple Helix Theory

This study introduces the Triple Helix Theory as an analytical tool to examine the dynamic mechanisms of University-City Symbiosis. This approach is grounded in the theory's three-tiered framework—comprising the components, interactions, and functional spaces of the Triple Helix system—which exhibits a high degree of logical alignment with the practical challenges facing University-City Symbiotic Regeneration.

First, the concept of diverse actors at the component level aligns with the reality of the actors involved in University-City Symbiosis. The Triple Helix Innovation System expands the categories of actors from three to six, reflecting the blurring of identity boundaries and the trend toward hybrid organizational forms among innovation actors. This provides a more precise analytical tool for understanding the collaborative logic among diverse actors in University-City Symbiosis.

Second, the perspective on dynamic mechanisms at the relational level aligns with the activation logic of University-City Symbiosis. Substantive activation of their relationship is most effective when specific interactive mechanisms facilitate the flow of elements between universities and cities. The five types of interactive relationships revealed by the Triple Helix Theory constitute the dynamic foundation for this exchange, providing a systematic framework for analyzing the conditions for activating university-city relationships.

Third, the perspective of the three spatial domains at the spatial level highlights the systemic requirements for spatial intervention in University-City Symbiosis. The Knowledge Space, Consensus Space, and Innovation Space proposed by the Triple Helix Theory are not independent, parallel functions, but rather constitute an interdependent, indispensable organic

whole. The Knowledge Space provides the system with a continuous supply of knowledge capital and talent; the Innovation Space transforms these resources into economic value and technological products; and the Consensus Space provides an institutional platform for coordinated governance to ensure the smooth operation of both. The presence of all three enables the regional innovation system to function fully, and the inclusion of each space contributes to the system's integrity. The core insight this framework offers for University-City Symbiosis spaces is that spatial interventions should aim for comprehensive progress, simultaneously covering the three dimensions of knowledge production, technology transfer, and multi-stakeholder collaboration in their functional configuration, using systemic integrity as the fundamental criterion for measuring the effectiveness of University-City Symbiosis spaces.

2.4 Insights from the Foundational Theories

University-City Symbiosis is not a one-dimensional spatial phenomenon, but rather a complex system encompassing multiple levels, driven by specific mechanisms, oriented toward clear objectives, and dependent on key spatial conditions. The following provides a systematic analysis of the theoretical connotations of University-City Symbiosis from four dimensions—levels, mechanisms, objectives, and key factors—to provide a theoretical basis for subsequent strategy formulation.

2.4.1 The Hierarchical Levels of University-City Symbiosis

The interactive essence of University-City Symbiosis is not a one-dimensional linear relationship, but rather encompasses two interrelated levels—economic and social—which together constitute the complete picture of University-City Symbiosis.

At the economic level, University-City Symbiosis manifests as a two-way exchange between the university's knowledge resources and research outcomes and the city's industrial system. As a core hub of knowledge production, the university continuously supplies the city with talent and research outcomes possessing transformative potential, providing sustained momentum for urban innovative industries; conversely, the city's market demands and industrial ecosystem help recalibrate the direction of the university's disciplinary development, fostering a virtuous cycle between knowledge production and societal needs.

At the social level, University-City Symbiosis manifests as the open sharing of the university's tangible resources with the city, as well as the integration and interaction between university faculty, students, and residents of surrounding communities in daily life^[22]. The collaborative use of public spaces, cultural facilities, and supporting services not only

enhances the efficiency of the city's existing spatial resources, but also establishes tangible, everyday connections between the university and the city at the physical level, forming a foundation of social identity conducive to deepening the symbiotic relationship.

These two levels are not separate but mutually reinforcing. Industry-Education Integration at the economic level provides functional content for spatial sharing at the social level, while daily interaction at the social level creates informal opportunities for knowledge spillover at the economic level. Spatial design is employed in this study as the means of intervention, aiming to create favourable spatial conditions for interaction at both levels simultaneously, rather than targeting either dimension in isolation.

2.4.2 The Mechanism of University-City Symbiosis

The establishment and operation of University-City Symbiosis rely on two interrelated intrinsic mechanisms: Heterogeneous Complementarity and resource interaction. The former constitutes the structural prerequisite for the symbiotic relationship, while the latter provides the driving force for its sustained operation.

Heterogeneous Complementarity is a prerequisite for establishing a symbiotic relationship. As two systems of distinctly different natures, universities and cities respectively possess intangible resources such as knowledge, talent, and culture, and tangible resources such as markets, capital, and space. The structural differences in the attributes of these resources constitute a latent potential for complementarity. Symbiosis theory indicates that the Quality Parameters of Symbiotic Units must possess compatibility and complementarity. In the context of University-City Symbiosis, the knowledge-production capacity of universities and the market-transformation capacity of cities are highly complementary in nature, providing the material foundation for forming a symbiotic relationship. However, complementarity constitutes only the potential condition for symbiosis; in the absence of effective interaction mechanisms, this latent potential energy will remain perpetually unactivated.

Resource interaction is the core mechanism for the sustained operation of symbiotic relationships. Analysis of the Triple Helix Theory indicates that the effective functioning of a regional innovation system does not rely on a single driving force, but rather presupposes the synergistic integration of three functional categories: knowledge production, technology transfer, and coordinated governance. These three elements constitute a cyclical and progressive dynamic structure, rather than mutually independent parallel processes. Applying this dynamic structure to the analysis of university-city relationships clarifies the operational

logic of resource interaction: universities, as core nodes of knowledge production, continuously generate research outcomes and talent with transformative potential; the urban industrial system, as the primary arena for technology transfer, converts these resources into economic value and uses market demand to recalibrate the direction of knowledge production; the government and intermediary institutions, as the agents of coordinated governance, resolve institutional frictions among heterogeneous actors through policy guidance and platform development, thereby ensuring the smooth operation of the first two functions. These three functions are interdependent and mutually reinforcing, driving a continuous exchange of knowledge, talent, and capital between universities and cities, transforming the symbiotic relationship from a static complementarity of resource endowments into a dynamic process of interactive gain.

2.4.3 Objectives of University-City Symbiosis

According to the typology of symbiotic modes in symbiosis theory, symbiotic relationships evolve from lower to higher levels, sequentially manifesting as parasitism, Commensalism, and Mutualistic Symbiosis. Mutualistic Symbiosis represents the most stable and efficient ideal state of a symbiotic system, characterised by both parties deriving positive benefits from resource exchange and forming a mutually reinforcing virtuous cycle. In the context of university-city relations, Mutualistic Symbiosis implies that universities gain external momentum for development from the city's demand for innovation and spatial resources, while cities acquire sustained innovative capacity through knowledge spillovers and talent supply from universities, enabling both parties to achieve coordinated development through mutual benefit. However, Mutualistic Symbiosis is not a linear outcome that emerges spontaneously; it is highly dependent on the gradual accumulation of interaction frequency and the establishment of trust between Symbiotic Units. In reality, physical separation and institutional barriers often cause university-city relationships to remain at a low level of symbiosis for extended periods. Promoting the evolution of these relationships toward Mutualistic Symbiosis therefore requires the proactive creation of spatial conditions and institutional environments conducive to energy exchange.

2.4.4 Key Factors for University-City Symbiosis

The realisation of University-City Symbiosis depends on two interrelated and mutually reinforcing key conditions: Spatial Proximity serves as the geographical prerequisite for symbiosis to occur, while the active construction of the Intermediate Domain provides the spatial means for symbiosis to transform from potential contact into effective exchange. Both

are essential, and together they constitute the pathway for realising University-City Symbiosis in the spatial dimension.

Spatial Proximity is the foundational condition for activating symbiotic relationships [9]. Empirical studies of knowledge spillover theory indicate that the efficiency of knowledge spillover declines significantly with increasing spatial distance; face-to-face interaction, as the primary vehicle for the transmission of tacit knowledge, relies heavily on geographical proximity for its effective occurrence. Empirical studies of Chinese universities further indicate that the intensity of knowledge spillovers within a 0.5-kilometre radius of a university is significantly higher than at greater distances, with patent activity levels dropping precipitously beyond this threshold. This implies that the physical distance between a university and a city is not a neutral geographical parameter, but rather a structural variable that directly determines whether symbiotic relationships can occur and their efficiency. Building on this, the openness of space further influences whether the advantages of Spatial Proximity may be translated into actual interactive outcomes. The permeability of boundaries between different systems determines whether flows of people, information, and resources can freely cross system boundaries; a closed spatial configuration, even if geographically proximate, will significantly diminish the advantages of Spatial Proximity owing to insufficient permeability.

However, Spatial Proximity and openness provide only the external conditions for symbiosis to occur, and do not automatically guarantee the realisation of effective exchange between heterogeneous actors. The active construction of the Intermediate Domain is the key spatial mechanism for transforming these external conditions into genuine symbiotic relationships. Kisho Kurokawa points out that a "grey zone"—a space that is ambiguous and encompasses the attributes of both parties — must exist between heterogeneous entities. Similar to the Engawa space in traditional Japanese architecture, which belongs to neither party yet simultaneously accommodates the attributes of both, it serves as a venue for the permeation, exchange, and buffering of heterogeneous elements. Through flexible transitions, the Intermediate Domain dissolves rigid oppositions and transforms conflictual relationships at the boundary into dialogical ones. Its significance lies not only in physical buffering, but also in creating an open "space of possibility" where entities that could not previously come into direct contact are enabled to meet and interact. In the context of the university-city relationship, the Intermediate Domain does not arise spontaneously between the university and the city; it requires active construction through spatial design intervention.

2.5 Summary of This Chapter

Synthesising the theoretical research presented in this chapter, three core conclusions regarding the pathways to achieving University-City Symbiosis may be drawn: first, Mutualistic Symbiosis is the target model that University-City Symbiotic Regeneration should pursue, requiring both parties to derive sustained positive benefits from the symbiotic relationship; second, the synergistic integration of three functional categories — knowledge production, technology transfer, and coordinated governance — constitutes the core dynamic structure of University-City Symbiosis; these three elements are interdependent and mutually reinforcing, and the absence of any single element will result in the structural breakdown of the symbiotic relationship; third, the active construction of the Intermediate Domain serves as the key spatial medium for activating the aforementioned dynamics, requiring coordinated intervention across the three dimensions of space, function, and governance. These three conclusions collectively form the theoretical foundation for the subsequent work of this study, and will be further translated into universally applicable principles for University-City Symbiotic Regeneration in Chapter 4, in conjunction with the case studies presented in Chapter 3.

Chapter 3 Case Studies

Existing University-City Symbiosis practices provide important empirical references for understanding the evolution of spatial relationships between universities and cities. This chapter selects four representative domestic and international cases — Kendall Square in Cambridge, USA; the TU Delft campus in the Netherlands; the Tongji NICE2035 district in Shanghai; and the Shanghai Daxue Road district—which respectively represent four distinct implementation pathways: university-led TOD innovation districts, systematic campus opening and transformation, incremental acupuncture-style interventions, and market-driven spontaneous symbiosis. These cases complement one another in terms of geographical distribution, developmental stage, and governing mechanisms. Each case is analysed across three dimensions: spatial organisation, functional configuration, and collaborative governance, which correspond respectively to the physical framework, functional platforms, and operational mechanisms through which University-City Symbiosis is realised. The purpose of the case analysis is to derive common patterns that may serve as reference points from diverse practical pathways, thereby providing empirical support for the subsequent distillation of principles for University-City Symbiotic Regeneration.

3.1 Case Study 1: Kendall Square

3.1.1 Overview

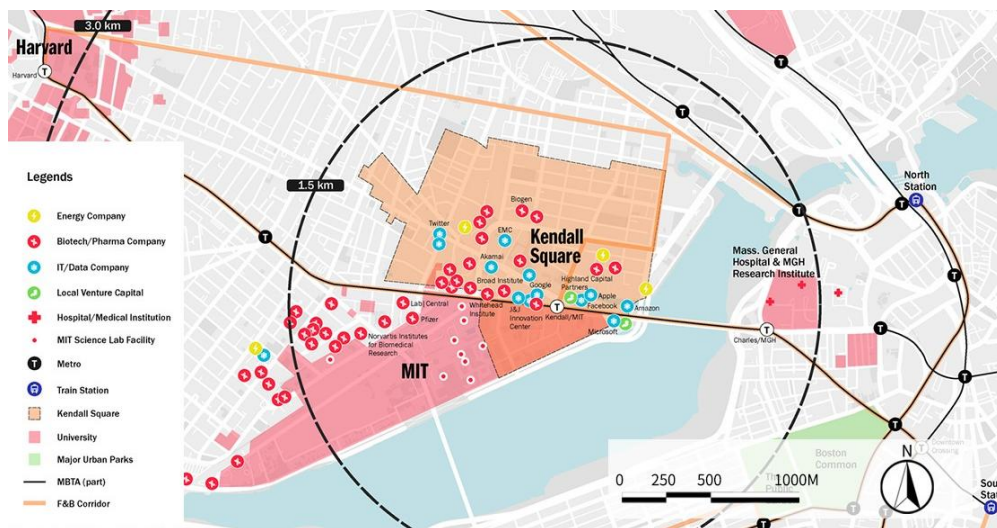


Figure 3- 1 Kendall Square Site Plan

(Source:

<https://www.hassellstudio.com/cn/conversation/decoding-the-dna-of-innovation-lessons-from-kendall-square?selected-locale=%E2%9C%93>)

Kendall Square is located in Cambridge, Massachusetts, adjacent to the east side of the

Massachusetts Institute of Technology (MIT) main campus and approximately 3 kilometers from downtown Boston. Historically, the site was primarily used for industrial manufacturing, and as manufacturing evolved after the mid-20th century, the area experienced a transition that created large tracts of available land.

Since the 1980s, MIT, in collaboration with the City of Cambridge and private developers, has initiated a phased revitalization of the area. After approximately four decades of development, Kendall Square has become one of the world's most concentrated hubs for the biotechnology and innovation industries, hosting R&D centers for multinational corporations such as Pfizer, Novartis, Google, and Amazon, as well as hundreds of startups.

3.1.2 Analysis from the Perspective of University-City Symbiosis

3.1.2.1 Spatial Organization

(1) TOD Concentric Zone Structure

Kendall Square centers its structure around transit stations, forming a clearly defined concentric zone system. The core zone (radius 200–400 m) concentrates the most location-sensitive functions, such as financial services and cutting-edge laboratories, achieving the highest spatial density of innovation resources through exceptional walkability; The intermediate zone (radius 600–800 m) accommodates primary R&D functions, providing ample land resources while maintaining pedestrian connectivity with the core area; The peripheral zone (radius 1.2–1.6 km) facilitates a scale transition from productive spaces to mixed-use residential communities. As the distance from the core increases, each zone undergoes a systematic gradient shift in development intensity, land use types, and spatial character. The core zone primarily features vertical stacking, while outer zones gradually transition to horizontal juxtaposition, forming an overall pattern of "core concentration and peripheral diffusion." This approach maintains vibrant activity throughout the site and provides differentiated spatial options for innovation entities at different stages of development^[61].

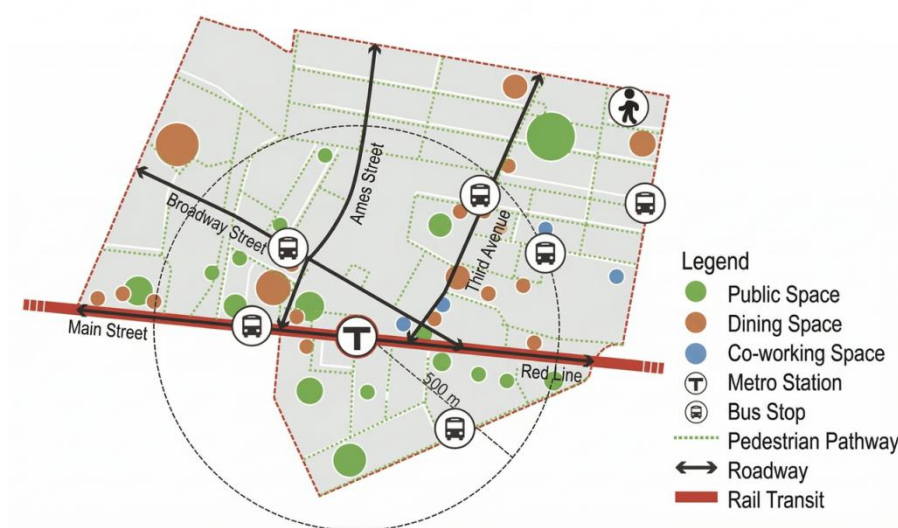


Figure 3- 2 The connectivity network of Kendall Square

(Source: Development Characteristics and Creation Strategies for the Third Space in Innovation Spaces)

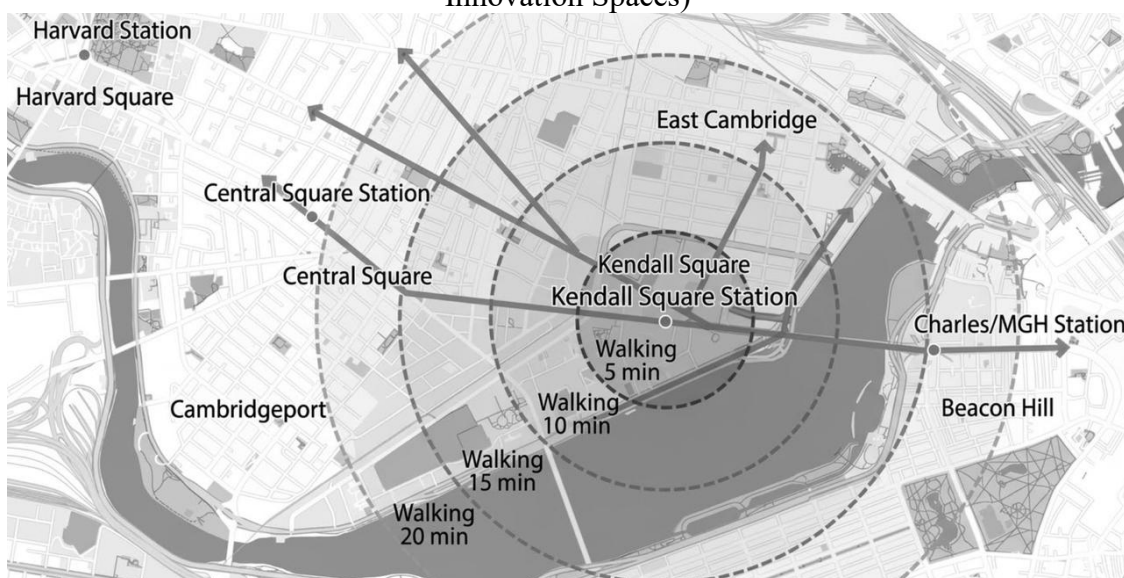


Figure 3- 3 Pedestrian Zones in the Innovation District Centered on Kendall Station

(Source: Reference^[61])

(2) Main Street Functional Axis

As the core functional axis, the main street integrates research institutions, biopharmaceutical and information technology companies, venture capital firms, commercial retail, and residential amenities into a continuous, tangible urban corridor. This functional juxtaposition along the axis is intentional and arises from the combined effects of long-term planning guidance and spontaneous market aggregation: industries tend to cluster due to the need for collaboration; venture capital firms locate near R&D clusters to facilitate information exchange; and the integration of commercial and residential elements ensures the axis remains

vibrant around the clock. The spatial distance between industry and academia is thus compressed to within walking distance, forming a crucial physical prerequisite for the creation of knowledge spillover effects^[62].



Figure 3- 4 Kendall Square Main Street

(Source: https://mp.weixin.qq.com/s/NiKaGg9ZX_2G0le0bAadsbA)

(3) Public Space Network

The public space network uses pedestrian streets as its backbone, connecting various types of nodes such as parks and plazas. Radiating outward 500 meters from Kendall Metro Station as its core, it is arranged along both sides of four main roads: Main Street, Third Street, Broadway, and Ames Street. This structure ensures high spatial proximity between public spaces and transit stations, effectively capturing the foot traffic generated by rail transit and transforming it into a source of vitality for the area. At the user level, the integration of mixed-use facilities and the ongoing planning of seasonal activities allow the same space to meet diverse needs at different times, fostering daily interactions and informal exchanges among people from various backgrounds.^[63].



Figure 3- 5 The public space network at Kendall Square
(Source: Reference^[63])

(4) Treatment of the Campus-City Boundary

The MIT East Campus plan replaces a single main entrance with multiple gateways, transforming the campus-city boundary into a series of spatial nodes capable of generating independent vitality, thereby making the boundary spatially diffuse and porous. The spatial logic of the "Endless Corridor" extends toward the city, achieving continuous integration of campus-city landscapes, circulation routes, and micro-ecologies through a pedestrian- and bicycle-priority slow-traffic network. At the architectural level, the principle of "liberating the ground floor" requires the ground level to maintain a high degree of public openness, while relocating research functions—which demand greater privacy—to upper floors or underground levels. This ensures that functions of the highest public value occupy the most accessible ground floor, thereby establishing a system of interconnected public spaces that bridges the indoor and outdoor environments at the architectural scale^[64].

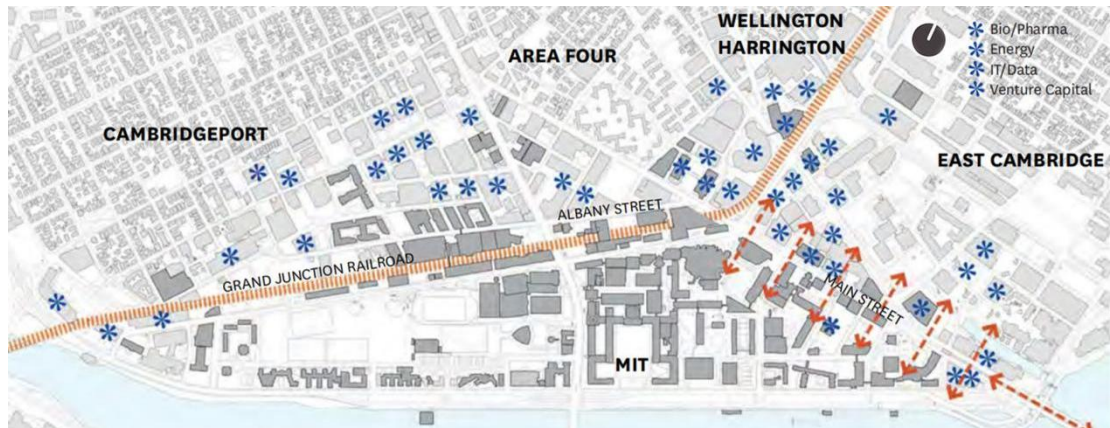


Figure 3- 6 : Landscape Permeability Between Kendall Square and MIT
(Source: East Campus Urban Design Study: Final Report)

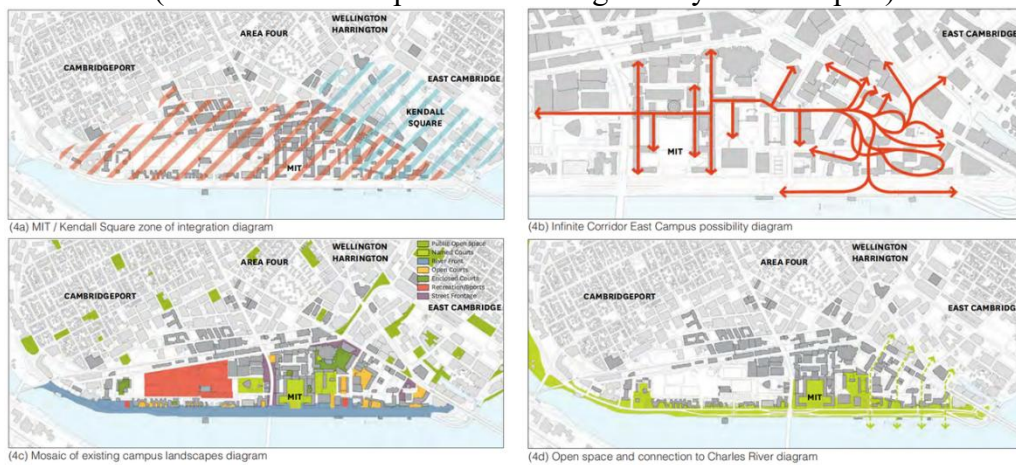


Figure 3- 7 : Extension of the Landscape Fabric at Kendall Square
(Source: East Campus Urban Design Study: Final Report)

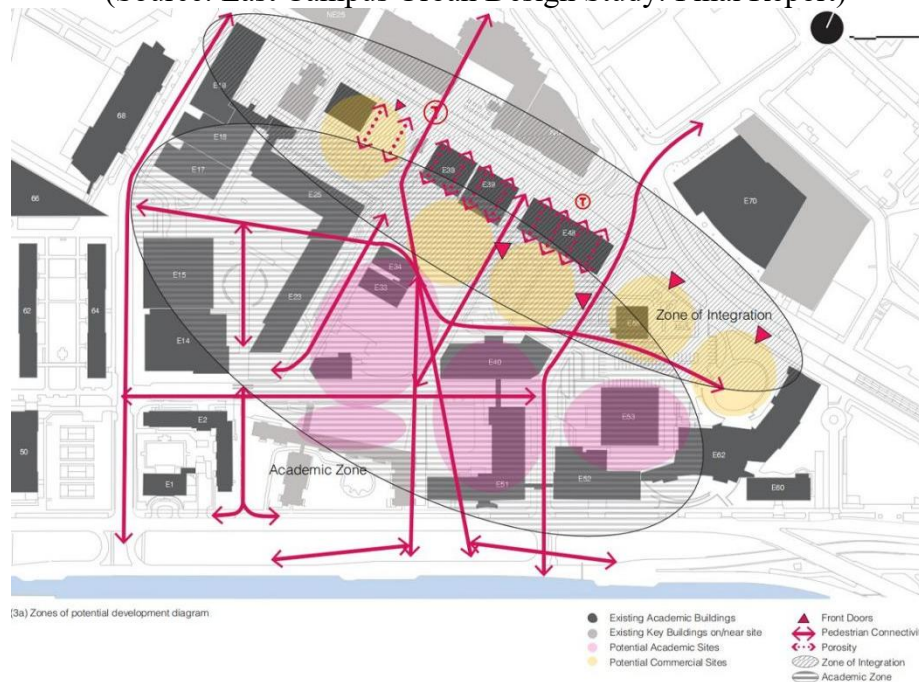


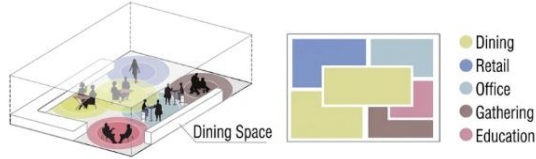
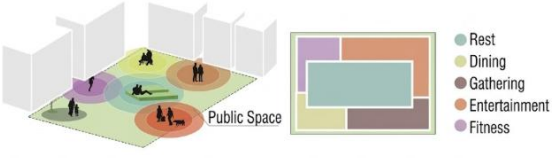
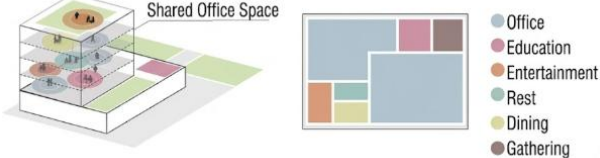
Figure 3- 8 : Ground-Level Interface of Kendall Square
(Source: East Campus Urban Design Study: Final Report)

3.1.2.2 Functional Configuration

(1) Mixed-Use Third Spaces

The third-space system adopts functional integration as its core strategy, combining dining, retail, education, recreation, and entertainment within a single spatial framework through diverse combinations such as "dining + office," "recreation + socializing," and "office + entertainment." Functional mixing at Kendall Square is primarily horizontal, with opportunities for further vertical integration. Temporally, different functions take turns dominating the same space at different times. Taking the Catalyst Restaurant as an example, it serves as a dining and informal workspace during weekday daytime hours, and transforms into a social gathering venue at night and on weekends. This maximizes the utilization of limited spatial resources throughout the day and night while continuously creating opportunities for spontaneous interaction among people from diverse backgrounds^[63].

Table 3- 1 Typical Mixed-Use Spaces at Kendall Square

Category	Case Study	Functions	Model Diagram
Dining Space	Catalyst Restaurant	Dining, Retail, Office, Gathering, Education	 3D model and 2D floor plan of Catalyst Restaurant. The 3D model shows a multi-level space with people in various areas. The 2D floor plan shows a central yellow area (Dining) surrounded by blue (Retail), grey (Office), brown (Gathering), and pink (Education) areas. Legend: Dining (Yellow), Retail (Blue), Office (Grey), Gathering (Brown), Education (Pink).
Public Space	Marriott Plaza	Rest, Dining, Gathering, Entertainment, Fitness	 3D model and 2D floor plan of Marriott Plaza. The 3D model shows a multi-level space with people in various areas. The 2D floor plan shows a central green area (Rest) surrounded by yellow (Dining), brown (Gathering), orange (Entertainment), and purple (Fitness) areas. Legend: Rest (Green), Dining (Yellow), Gathering (Brown), Entertainment (Orange), Fitness (Purple).
Shared Office Space	Cambridge Innovation Center	Office, Education, Entertainment, Rest, Dining, Gathering	 3D model and 2D floor plan of Cambridge Innovation Center. The 3D model shows a multi-level space with people in various areas. The 2D floor plan shows a central blue area (Office) surrounded by pink (Education), orange (Entertainment), green (Rest), yellow (Dining), and brown (Gathering) areas. Legend: Office (Blue), Education (Pink), Entertainment (Orange), Rest (Green), Dining (Yellow), Gathering (Brown).

(Source: Reference^[63])

(2) Symbiotic Implantation

Kendall Square has built a structural bridge connecting academic knowledge production with diverse social groups by implementing a Symbiotic Implantation of a group of symbiotic institutions with specific missions in its core area. The Link (255 Main Street), a workforce development center operated by the nonprofit organization TSNE, occupies space at low rent and extends the benefits of innovation to low- and middle-income residents through biotechnology training, programming instruction, and career advancement pathways; The Fab Foundation (325 Main Street), spun off from MIT, provides instruction and shared access to

equipment such as 3D printers and CNC machines for K-12 students and the general public, driving the democratization of technology to foster innovation within the community; LabCentral, as a life sciences incubator, provides startups with shared wet labs, analytical instruments, and capital-intensive platforms like the AI BioHub, significantly lowering the barriers to entry for new drug R&D and serving as a critical hub for academic research to cross the "Valley of Death" in commercialization.

These three types of institutions correspond to the dimensions of knowledge and skill transfer, technology and tool sharing, and support for commercialization, respectively. Their common characteristics include: occupying a symbiotic position in the market that market logic alone cannot fully address through a nonprofit model; lowering the barriers to entry into the innovation ecosystem for diverse groups through an open and shared resource organization model; and continuously benefiting from knowledge spillovers through spatial proximity to academic institutions.



Figure 3- 9 Photo
(Source: Kendell website)

3.1.2.3 Collaborative Governance

(1) Innovation Space Allocation System

Through planning regulations, the City of Cambridge explicitly requires that new large-scale commercial development projects allocate 5%–10% of their floor area to short-term, shared "Innovation Spaces," with at least 25% of these spaces provided to

community organizations and nonprofit institutions at below-market rental rates. This institutional arrangement ensures that market forces consistently support vulnerable groups and nonprofit organizations within the highly land-scarce innovation district, enabling Kendall Square's symbiotic ecosystem to maintain structural openness and inclusivity even as commercial pressures continue to rise.

(2) Town-Gown Information Coordination Mechanism

MIT is required to submit an annual "Town-Gown Report" to the City of Cambridge, covering issues directly related to municipal infrastructure and community quality of life, such as housing supply plans, climate change and flood resilience strategies, and transportation emissions reduction targets. This mechanism transforms information flow between the university and the city from one-way reporting to two-way consultation, reinforcing the university's role as a participant in urban governance rather than merely a developer.

(3) Open Space Activity Management System

MIT has established a dedicated Open Space Programming Office to plan and execute over 100 public events throughout the year, ranging from farmers' markets and outdoor fitness sessions to science exhibitions and hackathons. By institutionalizing these operational functions into a dedicated department, MIT ensures the stability and professionalism of its public space revitalization efforts, enabling open spaces to consistently serve as the "public living room" of the Innovation Space throughout the year, while also generating sustained engagement beyond specific events.

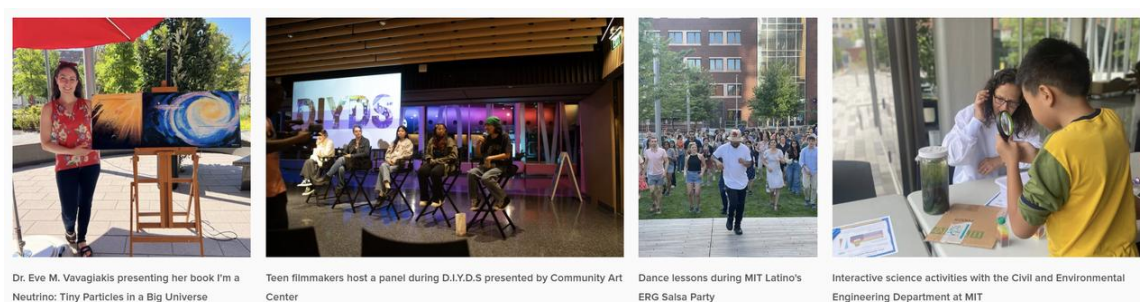


Figure 3- 10 Event operations

(Source: <https://www.openspace.mit.edu/kendallmit-open-space>)

3.2 Case Study 2: TU Delft

3.2.1 Overview



Figure 3- 11 Floor Plan

(Source: <https://dezwartehond.nl/projecten/tu-delft-campus-midden/>)

TU Delft is located in the city of Delft, the Netherlands, and is one of Europe's largest universities of science and technology, with a current student and faculty population of over 20,000. The campus covers an area of approximately 160 hectares, adjacent to the city center of Delft, and is closely bordered by the Schieoevers industrial zone to the south and residential areas to the east. Since the mid-20th century, guided by functionalist planning principles, the campus has gradually evolved into a closed, self-contained form with clearly defined boundaries and single-function zones, which has led to a distinct spatial separation between the campus and the city. Starting in the 2000s, TU Delft launched a systematic campus transformation. Using Campus Vision 2040 as a strategic framework, the university positioned the campus as an organic component of Delft's urban fabric. It explicitly proposed the development vision of "Campus = City," guiding the relationship between the university and the city toward functional integration and University-City Symbiosis.

3.2.2 Analysis from the Perspective of University-City Symbiosis

3.2.2.1 Spatial Organization

(1) Linear Spatial Framework

Mekelweg was originally a major vehicular thoroughfare running through the campus, clearly separating the academic departments on the east and west sides. Following its transformation, this axis was converted into Mekelpark—an 800-meter-long, 80-meter-wide, car-free linear park spanning approximately 10 hectares—serving as the central spatial spine connecting eight major academic departments and serving the entire university community. Mekelpark integrates shaded walking paths with meandering tour routes, featuring a 1,547-meter-long granite promenade and an 832-meter-long system of sawn granite seating, forming a pedestrian and cycling framework that supports both circulation and public gathering. According to Campus Vision 2040, the Mekelpark green network will extend further toward the city's edge, ensuring a seamless connection between the campus landscape system and urban public green spaces, allowing citizens and the campus community to share the same pedestrian and cycling network.

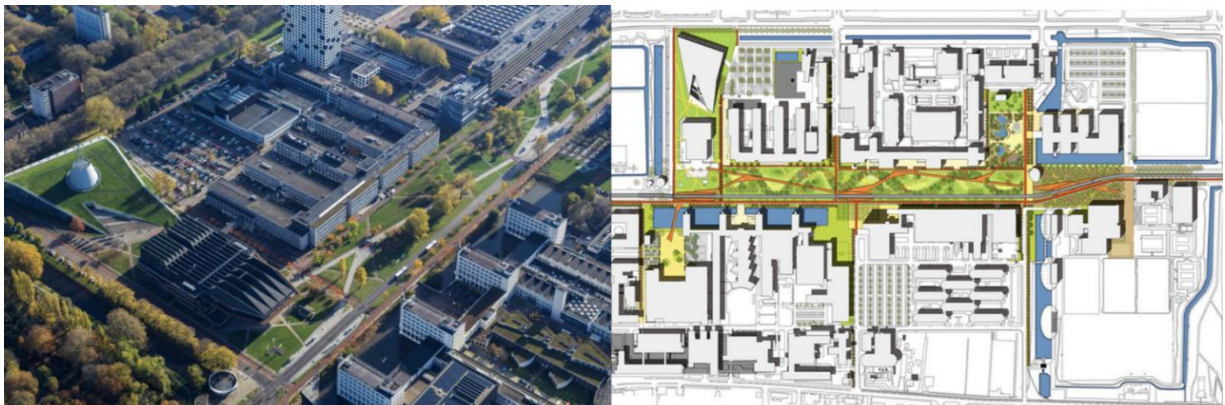


Figure 3- 12 Linear Park

(Source:

<https://landezine.com/mekel-park-and-library-in-the-campus-of-the-delft-university-of-techology-by-mecanoo/>)

(2) Permeability of Boundary Transition Zones

The North Campus is planned as a green transition zone connecting Delft's city center with the Wippolder-East residential area, serving as a conduit for the integration of campus and urban spaces. The Botanical Garden will feature a new entrance facing the city street (Kanaalweg), opening up the previously enclosed campus boundary to allow direct public access. The Gelatine bicycle bridge establishes a new lateral connection for non-motorized traffic on the western side of the campus. At the bridgehead, a mixed-use cluster is integrated

with the Hammen Farm area, reinforcing the spatial integration between the campus and the city through a representative entrance node. These interventions collectively form a clearly defined boundary permeation system: with Mekelpark serving as the north-south spine and the bicycle bridge and green transition zone providing east-west connections, they create a grid-like framework for non-motorized movement between the campus and the city.

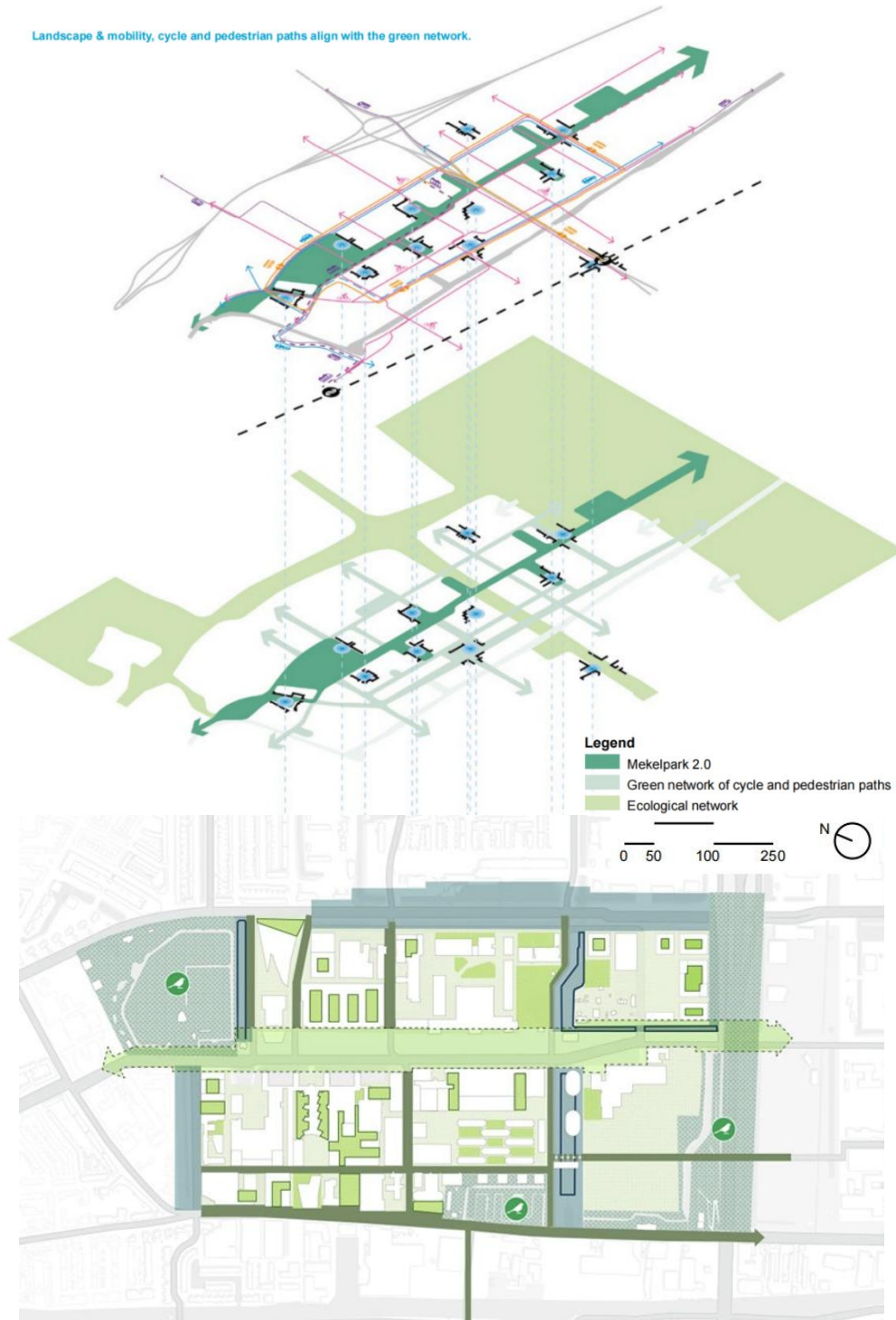


Figure 3- 13 Campus-City Landscape Permeability
(Source: TU Delft Campus Vision 2040)

(3) Traffic Organization and Rail Stations

The area surrounding Campus Station (total planned area of approximately 246,500 square meters; design phase: 2024–2025) serves as the southern anchor point of the campus-city spatial framework. This node is situated in the heart of Delft's Innovation District, adjacent to the Schieoevers industrial park, the Kabeldistrict mixed-use development, and surrounding residential areas, positioning it at the intersection of multiple urban functional zones. The plan centers on a green station plaza as the core public space. Spanning both sides of the tracks, the plaza unifies the area previously divided by the railway into a continuous urban interface^[65].



Figure 3- 14 Rendering of the Campus Station

(Source: <https://www.mecanoo.nl/Projects/project/330/Delft-Campus-Station-Vision>)

As a multimodal public transportation hub, the station integrates various modes of transport—including trains, buses, bicycles, and walking—transforming the rail transit node from a simple transfer point into a spatial anchor and catalyst for vitality at the University-City Interface. This mechanism shares structural similarities with the development logic of the Kendall Square subway station: both utilize existing rail transit nodes as spatial anchors and drive the revitalization of the University-City Interface through the layering of

functional density.

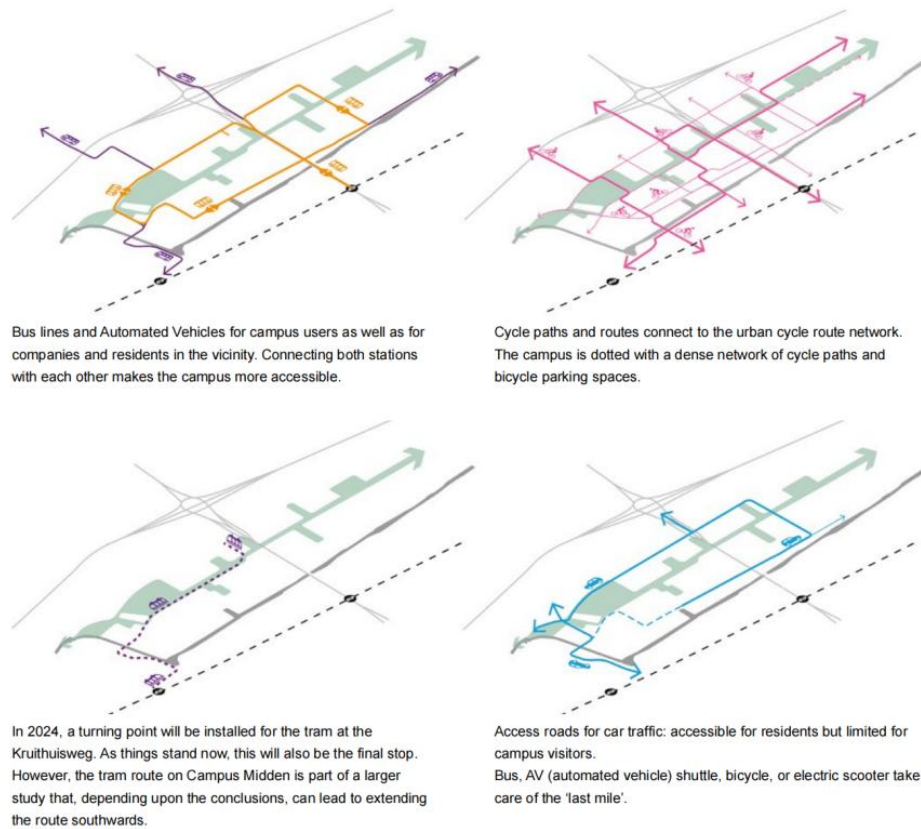


Figure 3- 15 Rendering of the campus station
(Source: TU Delft Campus Vision 2040)

3.2.2.2 Functional Configuration

(1) Clustered Mixed-Use Units

Campus Vision 2040 adopts the "cluster" as the basic unit of functional organization, defined as a multifunctional area within walking distance that integrates work, study, dining, leisure, and social facilities, centered around attractive public spaces. The cluster model emphasizes high-density, mixed-use spatial layering; its core logic centers on fostering daily interactions among users of diverse backgrounds within the same spatial context through the intersection of usage times and user groups.

Clusters are deployed both on and off campus: On campus, the School of Industrial Design Engineering serves as a prime example, comprising the Pulse teaching building, the IDE Café, teaching laboratories, and Coffee and Bikes, which together enclose a small green public space. Cyclists can park their bicycles directly near the entrance, creating a seamless transition from the urban transportation system to the academic space; Off-campus clusters are situated at key nodes such as the Gelatine Bridgehead and the vicinity of Campus Station, serving dual functions as urban public services and open to both faculty, students, and the

general public.



Figure 3- 16 Floor Plan of the Hybrid Unit
(Source: TU Delft Campus Vision 2040)

(2) Innovation and R&D Functions

At the innovation level, campus R&D activities and corporate activities in the adjacent industrial zone and Delfttechpark are integrated into a unified functional system; the plan explicitly proposes integrating the two into a continuous entity. Startups share laboratories, offices, and recreational facilities with faculty and students, while flexible, temporary structures provide adaptable incubation spaces. The Campus Station cluster is a concentrated manifestation of this integration of industry, academia, and research functions: four towers of distinct styles and surrounding buildings layer functions such as educational and research institutions, high-tech offices, startups, and maker spaces, while the ground floor houses community amenities, co-working spaces, and dining facilities, forming the node with the highest functional density at the University-City Interface. The concept that "the entire city is a living laboratory" further extends the boundaries of innovation from the campus into the real urban environment; the "Blue Village" plan for South Campus serves as one of its spatial manifestations.



Figure 3- 17 : Innovation and R&D
(Source: Reference^[65])

3.2.2.3 Collaborative Governance

(1) System Construction of Habitable Interfaces

TU Delft's place-making strategy centers on "clusters" as core spatial units, with a pedestrian and bicycle network serving as the connecting system, systematically embedding recognizable, habitable public space nodes at the University-City Interface. The promenades, seating, and meandering paths in Mekelpark form a human-scale "social furniture" system that supports the occurrence of everyday, informal interactions. The Campus Station Green Plaza is planned as a flexible public space capable of hosting community markets, sports activities, and experimental events, serving dual functions of transportation transfer and urban living. All public space designs must adhere to "social safety design standards," which require unobstructed views, clear sightlines, and adequate lighting to ensure a sense of safety and inclusivity during off-peak hours. This regulatory framework transforms place-making from an aesthetic intention into an operational standard for spatial quality.

(2) Multi-stakeholder Institutional Arrangements

At the governance level, TU Delft has established a collaborative network encompassing multiple tiers and types of stakeholders. Regarding government collaboration, the university maintains regular project exchanges with the City of Delft to jointly address space shortages and undertake joint development directly in the areas bordering the campus. Regarding regional infrastructure, the university collaborates with the City of Delft and the Rotterdam-The Hague Metropolitan Area (MRDH) to advance transportation and infrastructure planning, extending the boundaries of campus-city governance to the metropolitan scale. At the community engagement level, the plan explicitly mandates that community participation be an integral part of the university's vision and mission. The university holds regular consultation meetings with local residents and plans to establish a

"Campus Liaison Center"—either independently or in collaboration with the municipal government—to create an institutionalized mechanism for addressing residents' concerns. At the industrial ecosystem level, the collaborative network has expanded horizontally to include universities of applied sciences (HBO), secondary vocational education institutions (MBO), and traditional manufacturing enterprises, forming a comprehensive innovation governance ecosystem that spans theoretical research, technology transfer, and actual production—rather than being limited to the single dimension of high-tech enterprises. These institutional arrangements demonstrate that TU Delft's role in the governance structure has shifted from that of a developer to an organizer of the urban innovation ecosystem, and the driving force behind governance has evolved from external policy impetus to an endogenous mechanism proactively built by the university.

3.3 Case Study 3: Tongji NICE2035

3.3.1 Overview

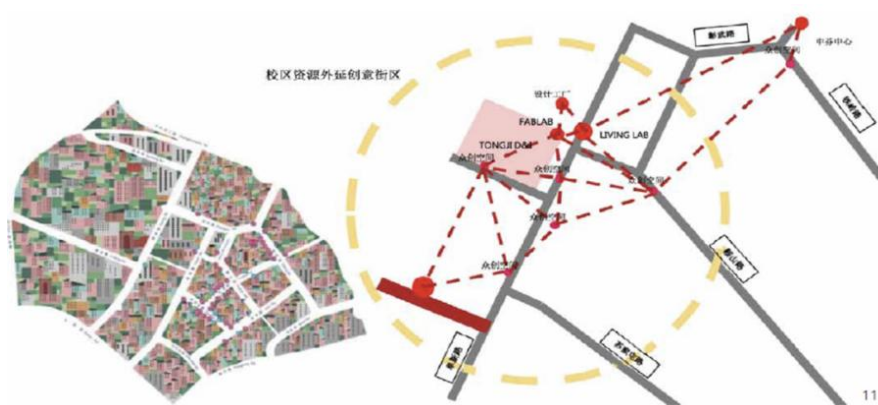


Figure 3- 18 Siping Community Innovation Space
(Source: Reference^[66])

The NICE 2035 Future Living Innovation District project was jointly initiated by Tongji University and the Yangpu District Government. NICE 2035 stands for a community of innovation, creativity, and entrepreneurship oriented toward the year 2035. Based on the concept of "Three-zone Linkage" between campuses, industrial parks, and communities, the project employs design and design thinking to promote crowdfunding, mass innovation, and social innovation, thereby driving the spillover of campus resources and facilitating their transformation and integration into the community. Through "acupuncture-style" micro-renewal, the project transforms the community's previously underutilized spaces into a series of small, interconnected, and hybrid "Hybrid Innovation Spaces"—such as future living prototype laboratories, innovative public service spaces, incubators, and concept stores. This gradually fosters a "choice-based" collaborative community, as well as an ecosystem for

innovation and entrepreneurship. The project integrates the dual imperatives of urban renewal and university innovation transformation. By combining "top-down" and "bottom-up" strategies, it resolves multiple urban renewal challenges—including investment, innovation actors, and sustainability—while transforming the community from a mere endpoint of urban innovation into a source of urban innovation. This approach explores new pathways for the "Tongji Knowledge Economy Circle" to advance toward a 100-billion-yuan-scale economy.

3.3.2 Analysis from the Perspective of University-City Symbiosis

3.3.2.1 Spatial Organization

(1) Acupuncture-Style Intervention Logic

Unlike the top-down concentric planning system of Kendall Square, the spatial organization of NICE2035 is based on an acupuncture-style intervention strategy. Taking the Tongji University campus as the source of knowledge spillover, the project identifies and activates specific spatial opportunities within the existing street fabric. Starting with the insertion of individual functional nodes, it gradually drives the overall transformation of surrounding neighborhoods through demonstration effects and network synergy, forming a progressive spatial expansion pattern of Point-to-area Catalysis.



Figure 3- 19 : Community Projects Surrounding the School of Design and Innovation at Tongji University
(Source: Reference^[66])

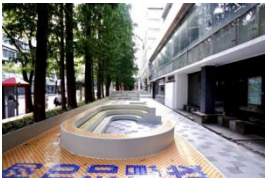
(2) Treatment of the University-City Boundary

The boundary treatment for the Chifeng Road block centers on low-cost, high-frequency cultural Micro-interventions, and adopts a distinct approach from the large-scale physical spatial reorganization strategy of Kendall Square. The project densely integrates micro-public installations along the campus perimeter wall, such as interactive walls, cultural graffiti walls, small stages combined with greenery, and telephone booth installations incorporating historical memories. These elements organically combine with street benches and gathering spaces to form a boundary activation interface that exhibits continuity both visually and functionally. The locations of these interventions are concentrated at key nodes where the perimeter wall intersects with street foot traffic, transforming the boundary zone from a passive transitional space into an everyday place with value for lingering.



Figure 3- 20 Boundary Node
(Source: Reference^[66])

Table 3- 2 Summary of Chifeng Road Nodes

Node Name	Before Renovation	After Renovation	Treatment Approach	Symbiosis Approach
Rainbow Stage			Transformed into an exhibition space and stage, preserving the memory of the cedar trees	Student design projects are physically displayed on the street, allowing citizens to directly experience the knowledge produced on campus
New Phone Booth			Retains the iconic telephone booth symbol while integrating information kiosk and mini-art gallery	Urban historical memory and campus innovation culture coexist within the same structure, allowing citizens to encounter

Node Name	Before Renovation	After Renovation	Treatment Approach	Symbiosis Approach
			functions	university information through daily use
Reversed Tongji			Modular two-tone cylindrical units form configurable patterns that citizens can freely rotate to express themselves	The perimeter wall transforms from a one-way barrier into a two-way interactive installation where citizens can engage
Neighborhood Graffiti			A collaborative project involving students, shop owners, and residents to document everyday scenes in the community	Collaboration between campus and community members during the creative process, resulting in works that embody both campus culture and community memories
Ruler Sculpture			Modelled after symbols from disciplines such as architecture and civil engineering, interactive measuring installations are set up	Disciplinary symbols are integrated into everyday streets, allowing citizens to engage with architectural culture through physical interaction
Light Playground			Color-painted floors and mirrored stainless steel display stands create low-cost spaces that encourage people to linger	Provides a highly recognizable gathering space, attracting people from the campus and city to naturally congregate at the boundary

(Source: Compiled by the author based on "A Comprehensive Analysis of the NICE2035 Future Living Prototype Street on Chifeng Road")

3.3.2.2 Functional Configuration

(1) Dual-track Approach Functional Organization Logic

The functional integration of NICE2035 adopts a Dual-track Approach as its core strategy: while each functional node serves as a hub for knowledge spillover—such as design creativity, urban science, and innovation incubation—it simultaneously incorporates facilities like pocket gardens, neighborhood centers, and community labs to continuously address the daily spatial needs of existing residents. The Dual-track Approach ensures that every intervention point serves both dimensions of knowledge production and community activation, thereby promoting a balanced Innovation District development that integrates community functions with innovative business models.

(2) Symbiotic Implantation and Typology of Spaces

The interventions employed in this "acupuncture-style" approach introduce not

single-function spaces in the traditional sense but rather a series of "hybrid" composite spaces that transcend the boundaries of their original prototypes. Functionally, these spaces are neither purely academic venues nor ordinary commercial or community facilities; rather, through functional layering and open interventions, they transform originally closed spatial prototypes into symbiotic interfaces capable of accommodating diverse groups and facilitating cross-sectoral exchange^[66]. It is precisely this openness and hybrid nature that fosters a synergistic relationship among the nodes, characterized by mutual traffic flow and functional complementarity, gradually stimulating a holistic innovation ecosystem effect at the neighborhood level. The symbiotic spaces in the Chifeng Road neighborhood can be categorized into three types: laboratory-style spaces centered on knowledge spillover, co-creation commercial spaces oriented toward innovation incubation, and lifestyle service spaces dedicated to community cohesion.

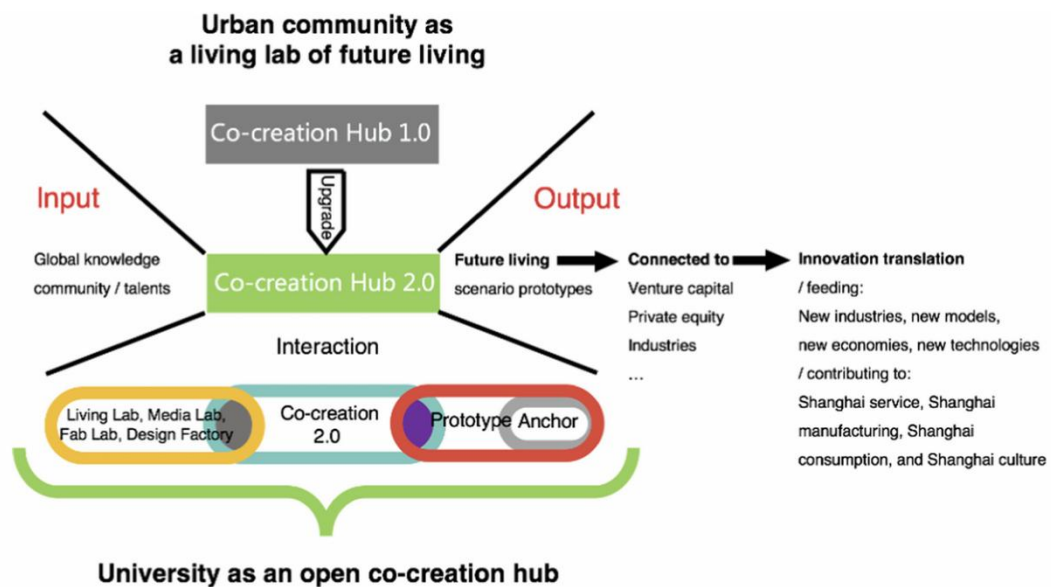


Figure 3- 21 Operational Model of the Co-creation Hub 2.0

(Source: Reference:)

The Tongji-MIT Shanghai Urban Science Lab was jointly established by the School of Design and Innovation at Tongji University and the MIT Media Lab, and is located in a repurposed scrap recycling station adjacent to the school. The lab integrates open workshops, data research, innovation incubation, and community exhibitions within a single space. A large, adaptable area at the entrance serves as a workshop zone, replacing traditional closed meeting rooms. It focuses on topics such as urban transportation, smart living, and community building, and collaborates with industry capital to facilitate the commercialization of research outcomes. Here, community residents, local entrepreneurs, and university researchers converge, serving respectively as providers of data and needs, facilitators of technology and

capital, and researchers of urban contexts, fostering continuous interaction through collaboration.

Table 3-3 Tongji-MIT Shanghai Urban Science Lab

Partners	Prototype Evolution	Functional Expansion	Models of Symbiosis
School of Design and Innovation, Tongji University + MIT	Closed Academic Research Laboratory → Open Interdisciplinary Urban Research Platform	Open Workshops, Data-Driven Urban Research, Innovation Incubation and Acceleration, Community Exhibition Interface	Open physical interface (large windows, glass display cases, interactive walls); diverse and intersecting use by residents, entrepreneurs, and researchers; two-way knowledge flow between the local community and the global MIT network

(Source: Compiled by the author based on available materials)



Figure 3- 22 Tongji-MIT Shanghai Urban Science Lab

(Source: <https://tjdi.tongji.edu.cn/about.do?ID=75&lang=>)

The Tongji-Aston Martin Creative Lab was jointly established by the School of Design and Innovation at Tongji University and Aston Martin. It is located in a ground-floor retail space within a residential building—a former deli. The spatial layout features a functional gradient from the exterior to the interior: the street-facing side houses display windows and showcase areas; the central section serves as a discussion area and workshop; and the innermost area contains private functional spaces such as acoustic modules, a lounge, and a kitchen. The lab is regularly open to the public and hosts experiential workshops for the community, making the university and corporate design resources accessible to residents in a tangible and participatory manner. The company provides students with real-world industry

insights, while students and community residents offer the company observations of local life and creative input, fostering a two-way flow of resources among the university, the company, and the community.



Figure 3- 23 : Tongji-Aston Martin Creative Lab Design Rendering
(Source: Community Renewal Based on the Construction of Innovation Ecosystems)



Figure 3-24 : Tongji-Aston Martin Creative Lab (Actual View)
(Source: <https://tjdi.tongji.edu.cn/about.do?ID=75&lang=>)

Table 3- 4 Tongji-Aston Martin Creative Lab

Partners	Prototype Evolution	Functional Extensions	Symbiosis
School of Design and Innovation, Tongji University + Aston Martin	Closed University-Industry Joint Laboratory → Open University-Industry Co-creation Design Studio	Street-facing display interface, design education and cross-disciplinary workshops, specialized acoustic research, and community-oriented experiential workshops	Street-facing display windows form an open exhibition interface; shared use by students, corporate designers, and community residents; two-way flow of corporate resources and local creativity

(Source: Compiled by the author based on available materials)
Fablab O-Shanghai, the first open fabrication lab in mainland China to receive

certification from the global Fab Lab network, was established at Tongji University in 2013. It provides the public with access to equipment such as 3D printers, laser cutters, and CNC machines. The lab operates around three core missions: "community building, education, and entrepreneurship." It offers regular free or low-cost access to community residents; establishes a localized digital manufacturing education system for students based on MIT-derived courses; and provides entrepreneurs with support for rapid transformation from concept to physical prototype. As a member of the global Fab Lab network, it also connects the local community with the international maker ecosystem, facilitating a two-way flow of knowledge and experience.

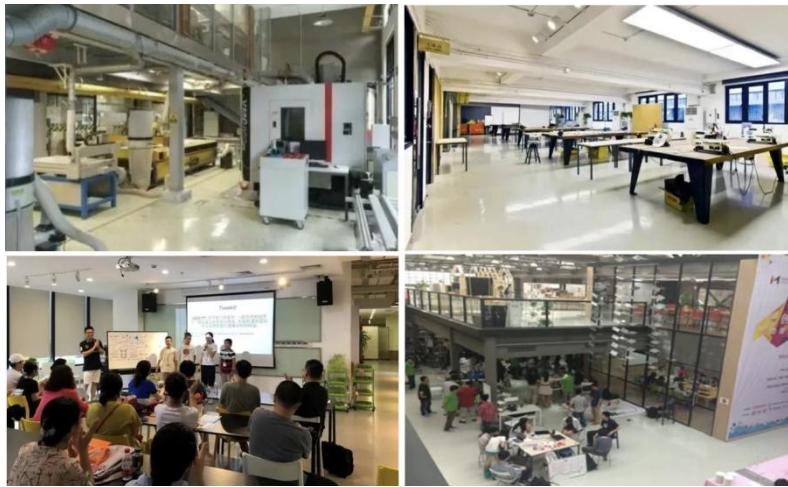


Figure 3- 25 Fab Lab interior view

(Source: <https://mp.weixin.qq.com/s/8VJ7OGBm-wsSydqFcu4EPA>)

Table 3- 5 Fab Lab O-Shanghai

Partners	Prototype Evolution	Functional Extensions	Symbiosis Model
MIT Fab Lab Global Network Certification	Closed-door school fabrication lab → Open, interdisciplinary digital fabrication sharing platform	Open Equipment Sharing, Digital Manufacturing Education (MIT-derived courses and K-12 maker education), and Maker Incubation	High-value equipment is made accessible to residents, students, and entrepreneurs with low barriers to entry; university manufacturing capabilities are transformed into public educational resources; integration into the global Fab Lab network facilitates international knowledge exchange

(Source: Compiled by the author based on available materials)

The co-creation commercial space at 81 Chifeng Road was jointly developed by three brands—Starbucks, Hao Commune, and hello campus cultural and creative—and features functional zoning within an approximately 130-square-meter space: the Yellow Box campus cultural and creative zone, the Red Box innovation workshop zone, and the Green Box green coffee zone, integrating coffee consumption, cultural and creative experiences, and innovation

incubation into a single commercial interface. The three brands form a symbiotic relationship characterized by mutual traffic generation and complementary functions: Starbucks drives steady foot traffic through its brand appeal; Hao Commune focuses on community building and event operations; and hello campus cultural and creative transforms Tongji University's campus culture into a consumable experiential interface. The Red Box Innovation Workshop Zone, with a capacity of 60 people, hosts diverse activities such as lectures, salons, co-creation workshops, and brand events, transforming the commercial space into a public platform for innovation and exchange during non-consumption hours.



Figure 3- 26 Floor Plan of the Co-creation Commercial Space
(Source: https://mp.weixin.qq.com/s/LbTpw1aHplejG1vxx1_G4w)

Table 3- 6 Co-creation Commercial Space

Partners	Prototype Evolution	Functional Expansion	Symbiosis Model
Starbucks + Hao Commune + hello Campus Cultural and Creative	Single-purpose commercial space → Multifunctional, mixed-use third space	Green Coffee Zone, Campus Cultural and Creative Experience Zone, Innovation Workshop Zone (Lectures, Co-creation, Live Streaming)	Brands drive traffic to expand reach; campus culture is transformed into tangible consumer experiences; faculty, students, residents, and innovators naturally interact through daily use

(Source: Compiled by the author based on available materials)

Hao Commune integrates diverse functions—including a café, shared kitchen, shared multipurpose hall, and shared office space—within a roughly 300-square-meter area, creating a subtle gradient between open and private spaces. Outside, planting boxes are set up on idle community land to invite resident participation; the building's display windows regularly showcase works in collaboration with artists or Tongji students, allowing creative activities to permeate the street in a visible way. Within the overall NICE2035 ecosystem, Hao Commune serves as a unifying force. While each prototype laboratory focuses on independent themes, the openness and public service functions at the neighborhood level rely on Hao Commune to sustain them through ongoing event operations, providing ordinary community residents with an entry point into the innovation ecosystem through down-to-earth, everyday life scenarios.



Figure 3- 27 Current Status

(Source: Community Renewal Based on the Construction of an Innovation Ecosystem)

Table 3- 7 Hao Commune

Partners	Prototype Evolution	Functional Expansion	Symbiosis Model
Crowdfunding and Crowdsourcing Model (Haier Customization and other enterprises + Tongji Team)	Traditional Community Activity Center → Self-Sustaining, Multi-Functional Community Space	Café, Shared Kitchen, Shared Multipurpose Hall (meditation, yoga, workplace events), Shared Office and Startup Space, Outdoor Planting Boxes, Storefront Displays	Provide residents with accessible entry points through everyday life scenarios; sustain community cohesion through ongoing event operations; connect various labs to build overall community cohesion within the neighborhood

(Source: Compiled by the author based on available materials)

3.3.2.3 Collaborative Governance

(1) Governance Vehicle: Hao Commune's Role as a Binding Agent

The core function of Hao Commune within the NICE2035 ecosystem is not the provision of any specific service, but rather serving as the community-binding mechanism for the entire Innovation District's innovation ecosystem. While each prototype lab focuses on its own knowledge-production agenda, opportunities for routine horizontal interaction among them are emerging. Through ongoing event operations, Hao Commune continuously attracts users from diverse backgrounds to the same space, ensuring that exchange between different groups occurs consistently on a daily basis. The significance of this mechanism lies in its ability to transform neighborhood-level collaborative relationships from a reliance on sporadic events into a sustainable community structure. It represents a critical turning point in NICE2035's transition from a spatial collection to an ecosystem.

(2) Three-Stage Evolution of Collaboration

The university-city collaboration mechanism in the Chifeng Road neighborhood has evolved gradually through long-term coordination and adaptation among multiple

stakeholders, with substantial shifts in the structure of participants and the depth of their involvement occurring at each stage.

In the initial phase of the collaboration (Phase 1.0), the basic framework was characterized by sub-district leadership, university implementation, and resident participation that was primarily focused on awareness. The sub-district proactively sought cooperation with a team from Tongji University, with the university assuming core responsibilities for design and event organization, while the neighborhood committee assisted in mobilizing residents. The primary objective of this phase was to complete basic spatial renovations and build community trust. As a foundation of trust was established, the subdistrict transferred some autonomy to residents, promoting micro-governance projects centered on stairwell beautification. A funding mechanism with a "subdistrict:residents = 1:1" ratio incentivized residents to contribute independently, while the university team gradually transitioned from a leading role to that of a facilitator and collaborator. Consequently, the collaborative relationship evolved from a one-way delegation to an initial form of multi-stakeholder co-governance.

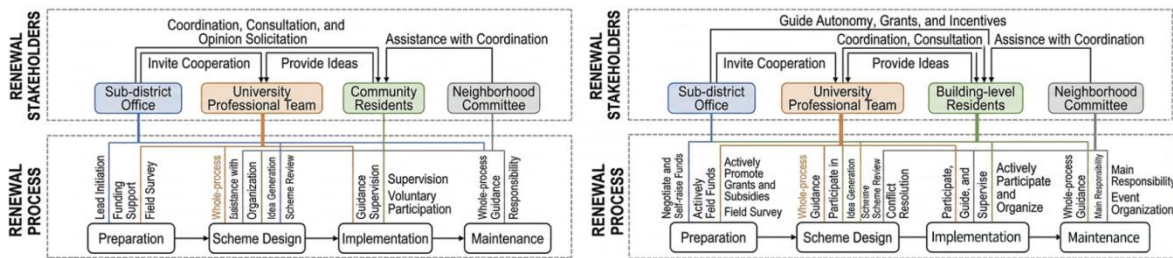


Figure 3- 28 Multi-Party Collaboration Model 1.0
(Source: Reference^[69])

The core changes in the mid-stage of collaboration (Phase 2.0) lie in the systematic introduction of social resources and the institutional refinement of participation mechanisms. Subdistricts opened up diverse funding channels through policy innovations such as establishing community public welfare funds and implementing tax and fee deductions, while the role of universities further evolved into that of organizational coordinators, bringing together residents and businesses to form volunteer teams. Concurrently, social organizations became involved in operations through government procurement of services or applications for community funds. They established a consultative mechanism combining core member joint meetings with expanded joint meetings, incorporating residents, volunteers, and representatives of social organizations into a regularized framework of co-governance. As a result, the collaborative mechanism shifted from relying on ad hoc case-by-case initiatives to stable, institutionalized arrangements.

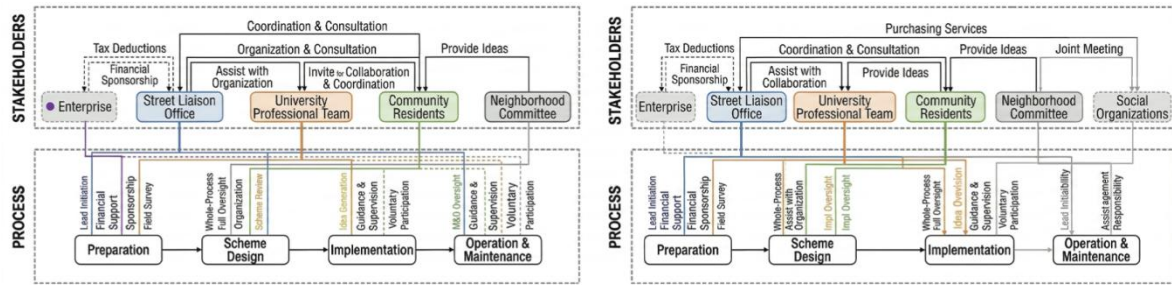


Figure 3- 29 Multi-Stakeholder Collaboration Model 2.0

(Source: Reference^[69])

The Deepening Cooperation Phase (Phase 3.0) marked a qualitative shift from project-based collaboration to substantive integration between the university and the community. The subdistrict pioneered a model where university departments physically co-locate within the community, facilitating the School of Design and Innovation at Tongji University to secure usage rights for community properties at reduced rent, thereby transforming former low-end commercial spaces into the school's innovation and practice base. The school regularly opens its facilities to residents, establishing an institutional channel for knowledge spillover. The collaborative relationship in this phase relies on shared interests and complementary resources among the subdistrict, the university, and community residents, forming a stable symbiotic structure. Consequently, the university-city collaboration mechanism has evolved from a governance tool into an endogenous driving force for the neighborhood's continuous renewal.

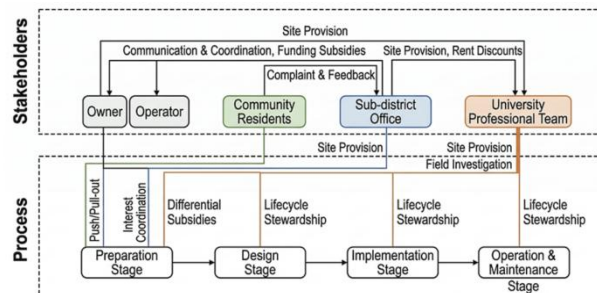


Figure 3- 30 Multi-Party Collaboration Model 3.0

(Source: Reference^[69])

3.4 Case Study 4: Shanghai Daxue Road

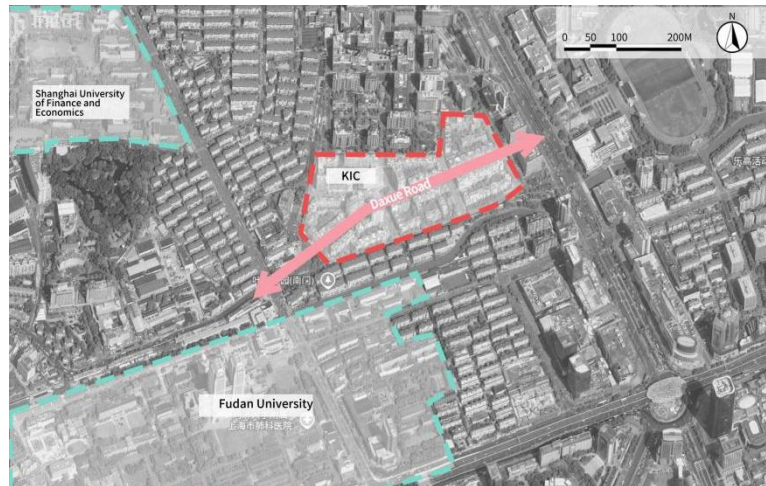


Figure 3- 31 : Location Map of Shanghai Daxue Road
(Source: Drawn by the Author)



Figure 3- 32 Isometric View of the Shanghai Daxue Road Area
(Source: <https://mp.weixin.qq.com/s/BvhupOLEx15nTB4OJEovRg>)

3.4.1 Overview

The Daxue Road neighborhood is located in the core area of the Wujiaochang Knowledge and Innovation Community (KIC) in Yangpu District, Shanghai. It is adjacent to Fudan University and Shanghai University of Finance and Economics, and connects to the service zone of Tongji University. The street is approximately 700 meters long and 8 meters wide, serving as the primary residential thoroughfare within the open, mixed-use KIC district. Developed and operated by KIC, a subsidiary of the Shui On Group, the project was launched in the early 2000s with the vision of a "Knowledge and Innovation Community." After nearly two decades of evolution, it has gradually developed into a composite Innovation District integrating residential, commercial, entrepreneurial incubation, and public activity functions. In contrast to the aforementioned case, the University-City Symbiosis on University

Road developed independently of direct university management and instead emerged spontaneously through the combined effects of the university clustering effect and market-driven development mechanisms, representing a typical practice of University-City Symbiosis under a market-led approach.

3.4.2 Analysis from the Perspective of University-City Symbiosis

3.4.2.1 Spatial Organization

(1) Dense Road Network Structure and Pedestrian- and Cyclist-Priority Environment

The Daxue Road neighborhood features a dense, capillary-like road network with a density of 217 intersections per square kilometer—far exceeding the average of approximately 40 in surrounding urban areas and on par with pedestrian-friendly cities such as Paris and Barcelona. The neighborhood incorporates two types of turning radii—3 meters and 5 meters. The combination of increased intersection density and tight turning radii effectively reduces vehicle speeds and enhances pedestrian safety^[70] At the eastern end of Daxue Road, a paved plaza replaces the direct connection to Songhu Road originally planned, redirecting through traffic at the road network level and creating the conditions for mixed-use, pedestrian- and bicycle-oriented traffic. With the exception of a few residential areas, all community roads connect to the outside, and the open road network creates a strolling experience similar to that of historic districts.

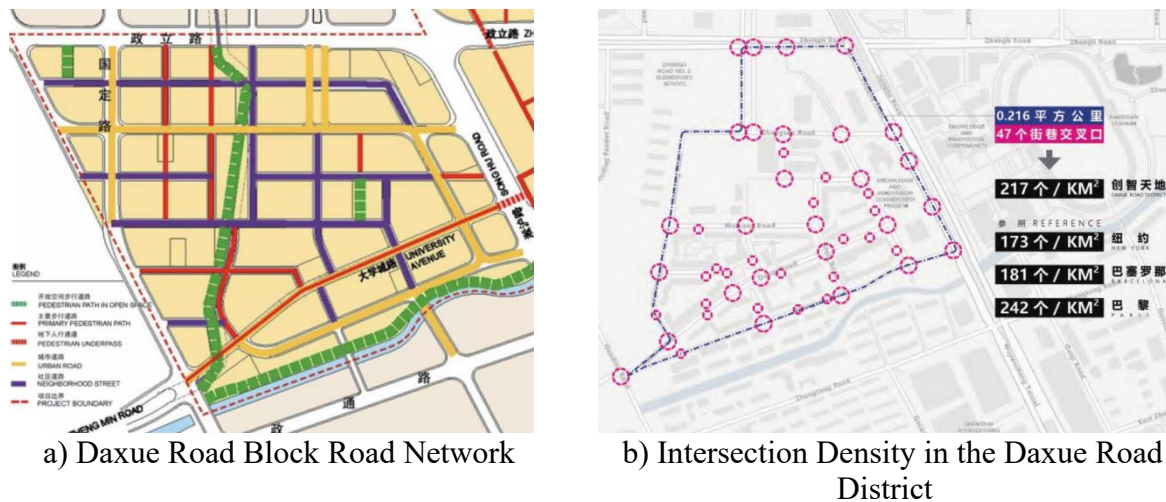


Figure 3- 33 Pedestrian Network of the Shanghai Daxue Road Area
(Source: Reference^[70])

(2) Public Space System

Daxue Road organically integrates public spaces with privately owned spaces open to the public, creating a mixed-use spatial network. Buildings adopt an open, enclosed layout that extends along the perimeter of the block, forming courtyards at the center. These courtyard

spaces function as semi-public domains that extend into the street. Outdoor planting areas are established on idle community land, inviting residents to participate; display windows on building facades regularly showcase works in collaboration with artists or university students, extending creative activities visibly onto the street. This mixed-use spatial model allows urban spaces to complement and respond to one another, satisfying microclimate and livability needs while fostering daily vitality at the public-private interface.



Figure 3- 34 , Daxue Road Block Public Space

(Source: Urban Renewal from the Perspective of Urban Regeneration)

3.4.2.2 Functional Configuration

(1) Multi-tiered Functional Integration

The Daxue Road neighborhood emphasizes the integration of multi-level functions encompassing work, study, residence, and daily life. At the regional level, it integrates differentiated functional zones such as office and R&D, residential, commercial, and recreational areas; at the neighborhood level, it adopts a small-plot development model to accommodate the coexistence of various functions; at the architectural level, the ground floor incorporates continuous commercial uses to facilitate public access to street-facing spaces, while the upper floors feature SOHO residential-office spaces that balance residential and entrepreneurial needs. Stand-alone office buildings house institutions such as an overseas entrepreneurship center, attracting people from diverse backgrounds to the neighborhood and further enriching the user composition.



Figure 3- 35 Land Use Characteristics of the Daxue Road Block
(Source: Reference:)



Figure 3- 36 : Street-Facing Retail Mix for Plot 6-5 of Chuangzhi Fang in 2017
(Source: Reference^[70])

(2) Continuous Ground-Floor Commercial Facade

Street-facing ground-floor commercial spaces form Active Frontage. Shops generally feature outdoor seating areas and artistic installations, with façade designs that are uniquely crafted. Together, these elements create a linear public boundary that is both visually appealing and functional, inviting people to linger. Lower rents on the second floor and above attract young entrepreneurs with limited capital, fostering a differentiated entrepreneurial ecosystem. As the overall popularity of Chuangzhi Fang grows, commercial activity gradually spreads upward. Taking Plot 6-5 of Chuangzhi Fang as an example, every floor of the street-facing buildings has been fully transformed into four types of businesses: dining, retail, services, and culture. As a result, users from diverse backgrounds gather on the same street at different times of the day, with morning exercise, work lunches, afternoon shopping, and evening dining creating full-day usage coverage^[71].

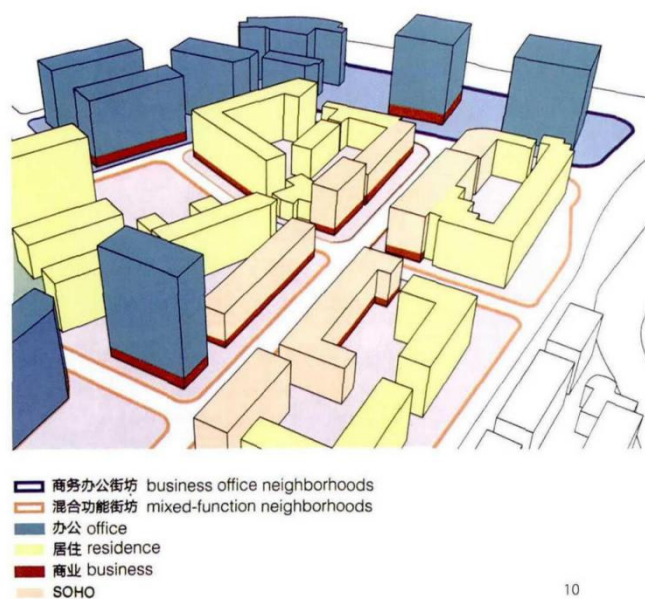


Figure 3- 37 Functional Analysis Diagram of Chuangzhi Fang
(Source: Reference^[71])

3.4.2.3 Collaborative Governance

(1) Connecting Diverse Communities and Collaborative Governance

The "Fasheng Convenience Store" serves as a typical spatial vehicle for multi-stakeholder collaborative governance on University Road. With a focus on non-profit activities, this space was co-developed by KIC in partnership with multiple social organizations and transformed into a non-profit public space, concurrently launching the "University Road Neighborhood Co-creation Initiative." During its operation, the space hosted over 100 events at an average frequency of five events per week, the vast majority of which were independently initiated by the neighborhood community, with some evolving into stable, recurring projects. Online, a diverse neighborhood community of over 350 people has formed, encompassing developers, local government officials, merchants, residents, white-collar workers, entrepreneurs, and faculty and students from nearby universities. With commercial logic set aside because of property ownership restrictions, multi-stakeholder collaboration has instead flourished organically within the same space, achieving a density and breadth of community connections that surpasses what purely commercial operations could ever achieve .



Figure 3- 38 : Photo of the Fasheng Convenience Store
(Source: Reference^[72])

(2) Structural Opportunities for Refining the Market-Led Approach

Collaborative governance on University Road centers on the KIC developer and operator, with institutional participation from the municipal government and universities showing potential for further expansion. Although the neighborhood is adjacent to several universities, and faculty and students regard University Road as a backstreet for daily life, opportunities exist to establish systematic industry-academia-research conversion platforms and two-way governance participation mechanisms between the district and the universities ^[73] . In essence, universities primarily contribute foot traffic and consumer demand, and efforts are underway to develop an institutional symbiotic relationship. Ongoing discussions regarding noise, cooking fumes, fire safety, and the renovation of commercial spaces on the second floor and above^[74] highlight opportunities to strengthen coordination in mixed-use districts when multi-stakeholder negotiation mechanisms are established . With a corresponding governance structure to underpin it, the relationship between the driving forces of symbiosis and the sources of conflict in a mixed-use environment can be effectively balanced. The Daxue Road case thus serves as counter-evidence to the aforementioned cases: the sustainability of University-City Symbiosis depends on the continuous alignment of multi-stakeholder objectives and the stable operation of institutional negotiation mechanisms, rather than being naturally sustained by spatial openness and market vitality alone.

3.5 Summary of This Chapter

This chapter examines four cases — Kendall Square, TU Delft, Tongji NICE2035, and Shanghai Daxue Road — which respectively represent four distinct implementation pathways: university-led TOD innovation districts, systematic campus opening and transformation, incremental acupuncture-style interventions, and market-driven spontaneous symbiosis. The analysis is conducted across three dimensions: spatial organisation, functional configuration, and collaborative governance.

At the level of spatial organisation, all four cases transform the passive spaces or infrastructure elements between the campus and the city into active connectivity structures: Kendall Square uses a transit station as an anchor to construct a concentric framework; TU Delft transforms a motorised arterial road into a linear park and systematically opens its boundaries; NICE2035 employs acupuncture-style interventions to activate the passive transitional zones along the perimeter walls; and Daxue Road constructs a slow-traffic priority environment through a dense street network and hard-surfaced plazas. While the approaches differ, the spatial logic of transforming fragmented elements into connecting interfaces remains consistent.

At the level of functional configuration, all four cases implant functionally mixed intermediate spaces between the campus and the city. The core mechanism lies not in the superimposition of functional types per se, but in the creation of daily encounters among users of diverse backgrounds through mixed use. Kendall Square's third-place spaces and symbiotic institutions, TU Delft's cluster units, NICE2035's hybrid composite spaces, and Daxue Road's vertical commercial proliferation — though diverse in form — all point toward the same objective: enabling researchers, students, residents, and entrepreneurs to meet naturally within the same spatial field.

At the level of collaborative governance, Kendall Square and TU Delft rely on explicit institutional arrangements to sustain multi-stakeholder collaboration; NICE2035's governance structure has evolved from externally driven to endogenously motivated; while Daxue Road, within its market-led framework, has exposed the structural problem of lacking institutional negotiation mechanisms. While the pathways and dominant mechanisms differ, institutional safeguards for multi-stakeholder collaboration constitute the common prerequisite for the sustainable operation of University-City Symbiosis. The common patterns identified across these three levels will be translated into a universally applicable Principles Framework in Chapter 4.

Chapter 4 Principles for University-City Symbiotic Regeneration

The effective establishment of University-City Symbiosis is not a naturally occurring spatial outcome, but rather relies on active construction grounded in specific theoretical logic and practical pathways. Section 2.4 of Chapter 2 has systematically elaborated on the conceptual connotations of University-City Symbiosis from four aspects: levels, mechanisms, objectives, and key elements. At the theoretical level, the theoretical framework established in Chapter 2 indicates that the realisation of symbiosis depends on three interrelated, progressively layered dimensions. First, Spatial Proximity and the active construction of Intermediate Domains constitute the geographical prerequisites and interface conditions for symbiosis to occur; second, functional configuration must simultaneously address the demand for Industry-Education Integration at the economic level and the demand for daily sharing at the social level, thereby forming the substantive foundation for meaningful interaction among heterogeneous actors; third, the synergistic operation of the three driving forces—knowledge production, technology transfer, and coordinated governance—under the Triple Helix Theory demonstrates that sustained and effective multi-stakeholder institutional arrangements are the fundamental guarantee for the maintenance and operation of the symbiotic system. These three dimensions are not independent of one another, but collectively serve the goal of Mutualistic Symbiosis. Only by simultaneously creating favourable conditions across the spatial, functional, and governance dimensions can both the university and the city achieve sustained, two-way gains through resource exchange.

At the practical level, the cross-regional analysis of four cases in Chapter 3 reveals significant cross-case patterns within the aforementioned theoretical framework. In the spatial dimension, Kendall Square employs porous boundaries and a pedestrian public network as its framework; TU Delft anchors its spatial structure through linear parks and transit nodes; and Tongji NICE2035 activates neighbourhood interfaces through acupuncture-style micro-interventions—all achieving spatial connectivity and openness between the university and the city through distinct pathways. In the functional dimension, all cases generally adopt strategies involving functionally mixed units and the implantation of symbiotic institutions, using mixed use to facilitate daily interactions among heterogeneous groups within the same spatial field. In the governance dimension, the cases generally exhibit a common pattern of multi-stakeholder coordination and mutual support among spatial carriers. The presence or

absence of institutional negotiation mechanisms directly influences whether symbiotic relationships can evolve from spontaneous contact into stable operation. The experience of Shanghai Daxue Road also indirectly confirms the indispensable nature of collaborative governance as an independent dimension.

Synthesising the aforementioned theoretical framework and case comparisons, this chapter derives universally applicable regeneration principles from three core dimensions—spatial, functional, and governance—namely: Spatial Connectivity and Openness, Functional Hybridity and Symbiosis, and Multi-stakeholder Co-governance and Activation. These three principles mutually reinforce one another, collectively forming the Principles Framework for University-City Symbiotic Regeneration of the SCUT-Tianhe Coach Terminal District, and will be translated into concrete design applications in conjunction with site-specific conditions in Chapter 6.

4.1 Spatial Connectivity and Openness

The spatial relationship between the university and the city can be improved; physical barriers and closed interfaces are opportunities for intervention that can enhance the emergence of University-City Symbiosis. Theoretically, while Spatial Proximity serves as the geographical prerequisite for knowledge spillover and informal exchange, Proximity itself does not equate to connectivity—the permeability of boundaries determines whether flows of people, information, and resources can freely cross system boundaries. Even when geographically adjacent, a closed spatial configuration will significantly diminish the advantages of Proximity due to insufficient permeability. The Intermediate Domain is not naturally generated but must be constructed through active spatial design intervention. In practice, the common starting point for the four case studies in terms of spatial organization is some form of spatial separation between campus and city—whether through road divisions, railway barriers, wall enclosures, or passive boundaries—and effective University-City Symbiosis practices invariably require breaking through such separations as a spatial prerequisite.

The campus-city boundary should be viewed as a transitional zone with transformative potential rather than as a definitive dividing line. The goal of connectivity is to reduce spatial friction in the interaction of heterogeneous entities, thereby creating the necessary physical conditions for the growth of the Intermediate Domain. Openness is not the dissolution of boundaries, but rather the replacement of closed enclosures with permeable, habitable interfaces, transforming border zones from passive backdrops into public spaces with

independent vitality.

4.1.1 Transit Node and Road Network Integration

Transportation accessibility is a fundamental condition for spatial connectivity between campuses and cities. While the physical distance between them is certainly important, what determines whether the two systems can form daily interactions is often not the straight-line distance, but the actual ease of access. When transportation systems are well organized, geographically adjacent campus and city spaces can achieve effective connection through smooth access. Therefore, interventions at the transportation level are a prerequisite for achieving spatial connectivity.

(1) Rail Node Anchoring

Existing rail transit nodes often occupy the most accessible geographic locations between the campus and the city, possessing the structural potential to serve as spatial anchors at the University-City Interface. Under normal circumstances, rail stations primarily function as single-purpose transfer points, and their surrounding areas have opportunities to develop greater functional density to support them, enabling the conversion of transfer passenger flows into sources of vitality within the region. An effective intervention strategy involves transforming rail nodes from purely transportation facilities into multifunctional urban interface nodes. By overlaying high-density functions to activate their surrounding areas, these nodes can serve as anchors to reorganize the spatial relationship between the campus and the city. Kendall Square uses the subway station as its structural core to form a tiered system, enabling a high concentration of innovative functions within walking distance; the Campus Station plan at TU Delft features a green plaza spanning both sides of the tracks, integrating the areas previously divided by the railway into a continuous University-City Interface, thereby transforming the transit node from a physical barrier into a spatial anchor connecting the campus and the city.

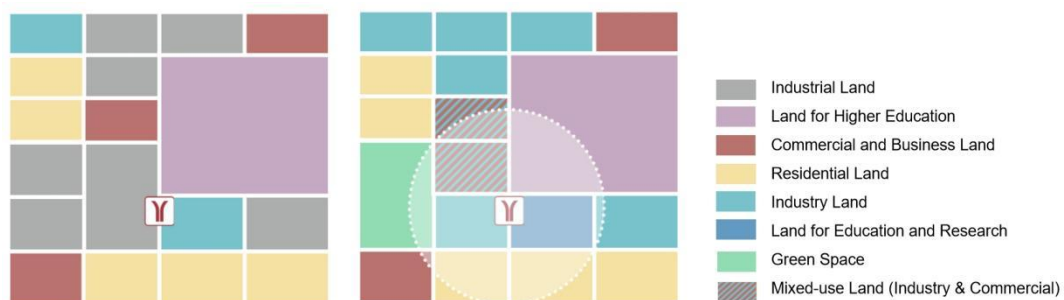


Figure 4- 1 : Schematic comparison of land use around the station before and after redevelopment

(Source: Drawn by the Author)

The above cases demonstrate a common Concentric Zoning logic, with rail stations at the core. Functional density and development intensity decrease with increasing distance from the station, and each concentric zone accommodates distinct functional types. Within a 400–500-meter radius of the station core, it is recommended to prioritize the concentrated placement of R&D institutions, commercial facilities, and public service functions. A relatively high development intensity should be maintained to create a central anchor point where innovation and R&D mutually support urban services; Within an 800-meter walking radius, priority should be given to supporting industries for R&D and residential service functions; residential functions catering to the innovation workforce may be moderately extended to a 1,600-meter radius to meet the basic spatial requirements for work-life balance^[76].

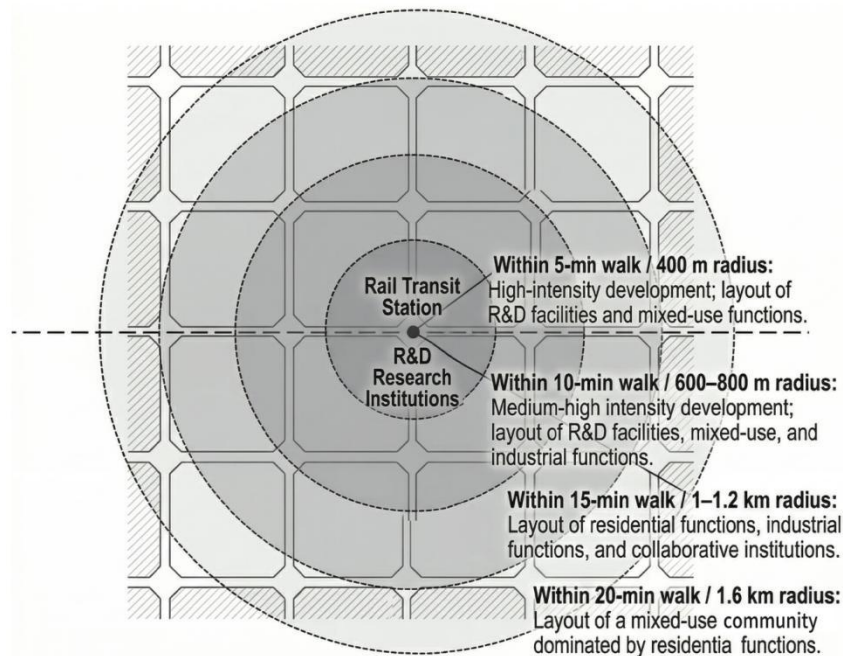


Figure 4- 2 Schematic of Concentric Zoning Around Rail Stations
(Source: Reference^[77])

(2) Prioritizing the Pedestrian and Bicycle Network

The continuity of the pedestrian and bicycle network directly determines the smooth flow of people and information between the campus and the city. The effective occurrence of knowledge spillover effects relies heavily on frequent interactions at the pedestrian scale; a network organization that prioritizes pedestrian and bicycle traffic is a critical intermediary step in transforming transportation accessibility into actual symbiotic interactions. Specifically, by increasing network density, reducing turning radii, and minimizing interference from through traffic, a continuous and safe pedestrian and bicycle access system between the campus and the city can be systematically established. Shanghai Daxue Road

combines a dense network structure with 217 intersections per square kilometer and tight turning radii of 3–5 meters, establishing a connectivity foundation for pedestrian and bicycle priority at the network level, while using a paved plaza at its eastern end to redirect through traffic; TU Delft, on the other hand, transformed a former motor vehicle arterial road into an 800-meter linear park, reorganizing pedestrian and bicycle flow patterns both on and off campus through a slow-traffic framework, thereby making walking and cycling the most natural modes of access between the campus and the city.

4.1.2 Construction of the Public Framework

The public space system serves as the spatial foundation through which the University-City Symbiosis is continuously manifested at the everyday scale; knowledge spillover, community connections, and cross-boundary encounters all hinge on people's willingness to linger within these spaces. In the University-City context, the public space system should form a continuous, permeable, and integrated spatial structure at key junctions, establishing a shared spatial framework between the University and the city through a combination of nodes and corridors. This study addresses two key aspects: the organization of the linear framework and the targeted revitalization of existing nodes.

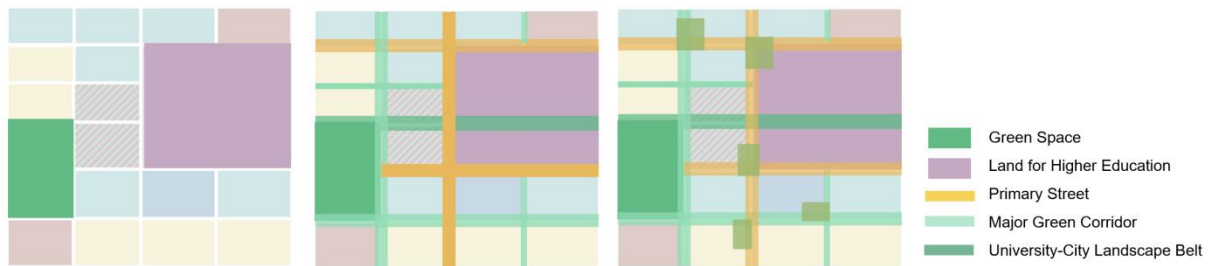


Figure 4- 3 Schematic of the Public Framework
(Source: Drawn by the Author)

(1) Linear Framework Connecting Nodes

Using linear public spaces as a framework to link functional nodes along the route is an effective organizational approach for constructing a continuous public space system. The linear framework integrates dispersed functional nodes into a cohesive public space system through recognizable spatial sequences, ensuring that users remain within the realm of public life throughout their movements. Kendall Square uses the main street as its core functional axis, arranging public space nodes along both sides of four major roads to form a continuous network radiating outward 500 meters from the transit station; TU Delft transformed Mekelweg into an 800-meter-long linear park, using a pedestrian and bicycle framework to connect eight major academic departments, and planned its extension toward the city's edge, ensuring a seamless connection between the campus landscape system and the city's public

green spaces.

(2) Point-to-area Catalysis for Activating Nodes

In existing built environments, comprehensive renewal is often subject to practical considerations such as complex property rights and limited funding. The Point-to-area Catalysis strategy identifies and activates key spatial nodes with demonstration potential; by leveraging the demonstration effect and guiding pedestrian flow, it gradually drives the overall transformation of surrounding areas. The successful activation of a single node can significantly facilitate subsequent interventions and continuously build a spatial foundation for the formation of the overall system. Tongji NICE2035 uses the Tongji University campus as a source of knowledge spillover, embedding functional nodes within the existing street fabric of Chifeng Road. By using single-point demonstrations to drive the overall transformation of the neighborhood, it establishes a typical pathway where key nodes drive comprehensive transformation.

4.1.3 Treatment of Boundary Interfaces

Boundary zones are where the contrasts between campus and urban spaces are most concentrated, yet they also hold the greatest potential for transformation. Effective boundary interventions transform interfaces that previously limited connectivity into transitional spaces with bidirectional permeability, shifting the boundary from a separator into an Intermediate Domain that facilitates encounters. This study proposes specific strategies at two levels: interface openness and Micro-interventions.

(1) Interface Opening and Sharing

The key to positively transforming campus boundaries lies in converting what were once closed, city-facing interfaces into shared zones open to both sides. This transformation does not require the elimination of the boundary itself, but rather, through the public provision of ground-level functions and the opening of the campus's high-quality resources to the outside, enables users on both sides of the boundary to perceive and access this transitional zone. MIT's East Campus maintains a high degree of public accessibility in the ground-floor spaces along the campus-city boundary, placing functions of the greatest public value on the most accessible ground level. Consequently, the boundary is transformed from a barrier into a vibrant interface that can be used by both parties. TU Delft's Botanical Garden has added entrances facing the city streets, opening up the campus's high-quality landscape resources to the public and allowing city residents to directly access the previously enclosed campus boundary area.

At the functional layout level, the openness of the boundary should also be reinforced through the proactive configuration of building functions. It is recommended that shared-use facilities—including libraries, exhibition spaces, maker spaces, dining venues, and public service facilities—be prioritized along the campus perimeter. The podium levels of buildings should be opened to the public, using the public nature of ground-floor functions to actively extend campus resources into the city, rather than relying on users to spontaneously cross boundaries. There are varying degrees of openness among different functional types. Functions such as innovation and R&D, daily living services, cultural and sports activities, and education and training—due to their strong public nature—are suitable for prioritized extension toward the urban interface; core teaching areas, however, should remain relatively independent to maintain necessary academic order^[78].

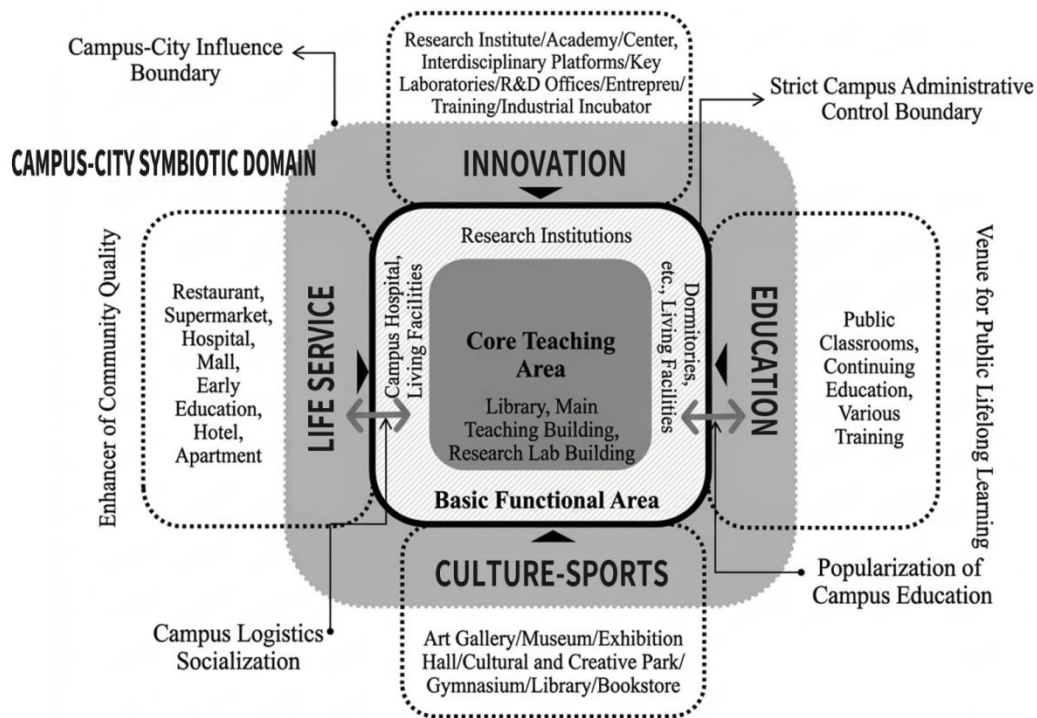


Figure 4- 4 Schematic of Functional Openness Levels at the University-City Boundary
(Source: Reference^[6])

(2) Micro-Interventions for Boundary Softening

In existing built environments, the physical conditions of boundary zones often limit the feasibility of large-scale restructuring; low-cost, high-frequency micro-intervention strategies offer a viable alternative. By densely embedding small-scale public installations, gathering spaces, and cultural elements along the boundary, it is possible to systematically enhance the character of the boundary while preserving the existing spatial layout, thereby creating a boundary activation interface that exhibits continuity both visually and functionally. The

Tongji NICE2035 project incorporates interactive walls, cultural graffiti walls, small stages integrated with greenery, and installations that incorporate historical memories along the perimeter wall of Tongji University's campus. These elements are organically combined with street-side seating and public gathering spaces, transforming the perimeter wall from a barrier into a continuous transitional interface through low-threshold cultural interventions.

4.2 Functional Hybridity and Symbiosis

Functional configuration serves as the core vehicle through which the University-City Symbiosis takes on substantive form in space. While spatial connectivity addresses the physical prerequisites for encounters between diverse groups, functional configuration determines what can occur following such encounters; it directly influences the likelihood and frequency of interactions, interactions, and engagements among users from different backgrounds within the same spatial context.

The interactive essence of University-City Symbiosis encompasses two interrelated dimensions: the economic dimension requires functional configuration to support the needs of knowledge production, technology transfer, and Industry-Education Integration; the social dimension requires functional configuration to simultaneously address the needs of daily life, shared spaces, and community integration. These two dimensions are mutually reinforcing—everyday social interactions create informal channels for knowledge spillovers at the economic level, while the functional content of Industry-Education Integration provides valuable common topics for interaction at the social level. A single-function zoning logic limits interaction between these two levels, whereas a multi-functional zoning logic creates the spatial conditions for their synergy. Based on the above analysis, this study summarizes the principles for updating functional zoning from three dimensions: the dual-track approach for the development of innovation and community functions, functional hybridity and symbiosis, and Symbiotic Implantation.

4.2.1 Parallel Development of Innovation Communities

The introduction of innovation-oriented functions tends to create a closed ecosystem primarily serving the knowledge elite, while the daily needs of existing community residents can be better addressed. The core premise of the Dual-track Approach is that innovation functions and daily community functions are not in opposition; rather, they can be configured simultaneously within the same spatial system and support one another—innovation functions bring knowledge spillovers and employment opportunities to the community, while daily community functions provide the innovation ecosystem with a round-the-clock base of human

activity and insights into local life^[79].

To achieve the Dual-track Approach, integrate innovation functions and daily community functions into a unified framework during the functional planning stage. TU Delft uses "clusters" as the basic unit of functional organization, integrating work, study, dining, leisure, and social facilities within walking distance. By deploying cluster nodes both on and off campus, innovation functions and daily life functions coexist within the same spatial unit; In Tongji NICE2035, while each functional node serves as a hub for knowledge spillover functions such as design creativity, urban science, and innovation incubation, it is simultaneously equipped with facilities like pocket gardens, neighborhood centers, and community labs. This approach continuously addresses the daily spatial needs of existing residents, ensuring that the growth of the innovation ecosystem can be balanced with the community's daily life.

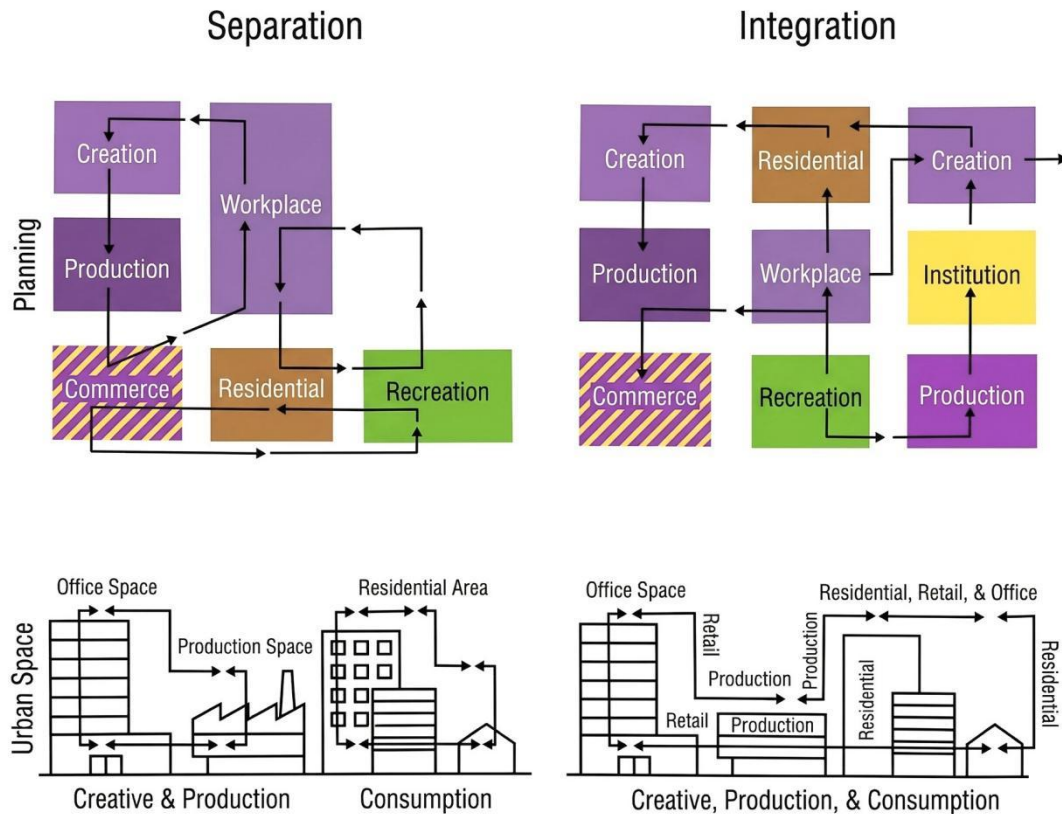


Figure 4- 5 Comparison of Functional Zoning and Integration Models
(Source: Reference^[79])

4.2.2 Multidimensional Functional Mixing

The spatial organization logic of single-function zoning aims for the purification of land use. While this enhances management efficiency, it also systematically eliminates the possibility of natural encounters between users from different backgrounds within the same

space. The core of the functional integration strategy lies in transforming limited spatial resources into conditions that continuously generate heterogeneous interactions through the overlapping of user groups. This study explores this approach from two dimensions: land use and architecture.

(1) Functional Mix at the Land-Use Level

At the land-use level, a small-plot development model juxtaposes diverse functions within walking distance, creating a horizontally mixed configuration of residential, office, commercial, cultural, and innovation functions at the neighborhood scale. This horizontal juxtaposition of functions compresses the spatial distance between different users, transforming daily movement itself into an opportunity for cross-sectoral interaction. Kendall Square integrates research institutions, enterprises, venture capital firms, retail businesses, and residential amenities into a continuous, perceptible urban corridor. The spatial distance between academia and industry is compressed to within walking distance, constituting a crucial physical prerequisite for the formation of knowledge spillover effects; Shanghai Daxue Road employs a small-plot development model to accommodate the symbiosis of various functions, resulting in round-the-clock usage overlaps among residents, students, entrepreneurs, and expatriates within the same street space.

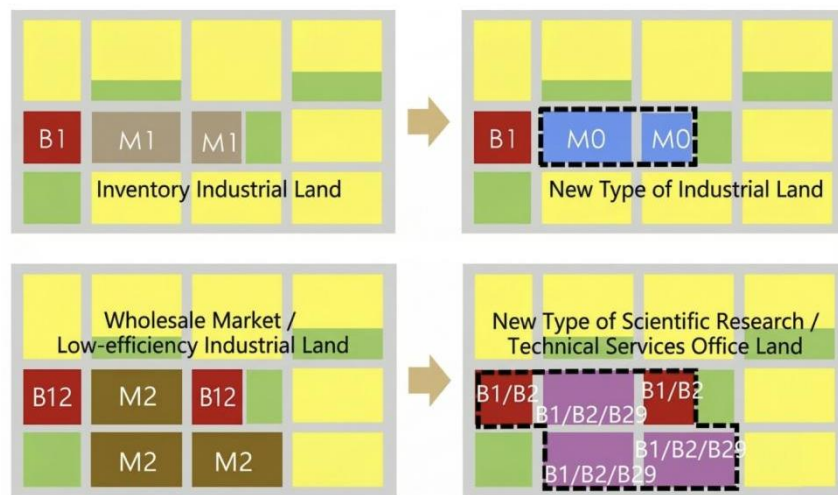


Figure 4- 6 Schematic of the functional transformation and upgrading model for existing land

(Source: Master Plan and Implementation Scheme for the "1+N" Renewal and Development of the Huanwushan Innovation Source Area)

(2) Functional Mix at the Building Level

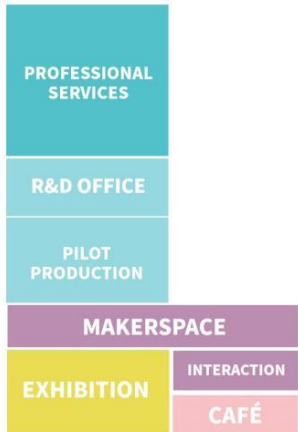
At the architectural level, guided by the principle of Ground-level Publicness, the most accessible ground level is allocated to functions with the highest public value, while functions requiring greater privacy are relocated to upper floors, creating a vertical functional gradient from public to private. The establishment of a continuous public interface at the ground floor

ensures that buildings actively engage in the generation of public life through their facades. Shanghai Daxue Road introduces a continuous commercial interface at the ground level; as overall foot traffic increases, commercial activities gradually permeate and spread upward, forming a spontaneous Vertical Programmatic Layering. The MIT East Campus also explicitly requires the ground floor to maintain a high degree of public openness, relocating research functions—which demand greater privacy—to upper floors or underground levels, thereby transforming the ground floor into a public living interface shared by the campus and the city.

Vertical Programmatic Layering represents an extension of the logic of land-use mixing into the vertical dimension. It is recommended to encourage individual buildings to stack differentiated functions vertically: ground-floor public services and commercial functions activate the street frontage; mid-level office, R&D, or educational functions support innovative activities; and upper-level residential or apartment functions supplement the supply of work-live spaces, creating a gradient distribution of functions across the building's cross-section. Under limited land conditions, this model can significantly increase functional density while enabling daily interactions among users from diverse backgrounds within the same building mass, providing a physical framework for unplanned encounters. Depending on the scale of the building, Vertical Programmatic Layering can take two typical forms: the high-rise model, which possesses ample vertical space and allows for the layered integration of rigid production, R&D offices, and flexible residential spaces; and the mid-to-low-rise model, which, under more compact floor-area constraints, prioritizes enhancing the openness of the ground-floor public interface and incorporating shared R&D spaces in the central zones.

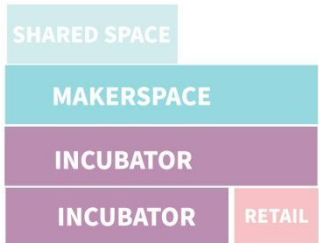
Table 4- 1 Vertical Integration in High-Rise Buildings

Schematic Diagram	Spatial Zoning	Primary Functions	Space Description
	Upper Zone		Targeting new media, technology services, and innovative talent, this zone features light-asset
	Flexible Services and Live-Work Spaces	Creative Offices, R&D Offices, Industry Services, Maker Apartments	offices, industrial services, and maker apartments (lofts), creating a flexible Innovation Space that integrates office, service, and residential functions.

	Central Zone	Pilot Testing, Prototype Manufacturing, Technical Testing, Small-Scale Prototyping	Creating an "urban Pilot Testing" floor zone, utilizing high ceilings and flexible layouts to accommodate heavy experimental equipment and flexible production lines, facilitating the transition from R&D to industrialization.
		Rigid Production	Designing open and shared R&D and experimental spaces to support research teams and small and micro-tech enterprises in conducting technological R&D, prototype development, and collaborative innovation.
	Lower Zone	General-purpose laboratories, shared laboratories, R&D spaces, maker spaces	Incorporate highly interactive and communicative public functions, emphasizing transparency and walkability to create an open, vibrant interface for innovation exchange and a highly dynamic social podium.
		Exhibition spaces, demo spaces, academic cafes, co-working spaces, ground-floor retail	
	Vibrant Public Base		

(Source: Drawn by the Author)

Table 4- 2 Vertical Composite for Low- and Mid-Rise Buildings

Schematic Diagram	Spatial Zoning	Primary Functions	Space Description
	Top Floor	Creative offices, design studios, and small tech company offices	Can be combined with the rooftop terrace to create a semi-outdoor shared space or maker apartments, fully utilizing the rare open views and ventilation conditions found in the densely built-up areas of Urban Villages
	Middle Zone	R&D Space, Shared Lab, Maker Space, Co-working Space	Establish open, shared Innovation Spaces to support R&D activities, product design, and team collaboration.
	Lower Zone	Retail, cafes, exhibition spaces, incubators, and demo spaces	Enhance the openness and accessibility of the street frontage, attract foot traffic through commercial, exhibition, and innovation activities, and create a vibrant public space in the Innovation District.

(Source: Drawn by the Author)

4.2.3 Symbiotic Space Implantation

Symbiotic spaces are a core strategy for translating the theory of the Intermediate Domain into spatial practice. By actively introducing space carriers with specific functional orientations in the transition zone between the campus and the city, they provide a physical medium for encounters and exchanges among diverse actors, transforming the Intermediate Domain from a passive buffer zone into an active symbiotic interface. The Triple Helix Theory further emphasizes that the formation of a regional innovation ecosystem relies on the synergistic coexistence of three heterogeneous spaces: Knowledge Spaces, Innovation Spaces,

and Consensus Space. These correspond respectively to the production of new knowledge, the transformation of innovation resources, and the coordinated governance of diverse stakeholders; the presence of all three categories is essential to maintain the integrity of the innovation ecosystem chain. Accordingly, this study categorizes the University-City Symbiosis space into three types: the Ubiquitous Knowledge Space, the Industry-Innovation Integration Space, and the Social Co-Governance Space. The Ubiquitous Knowledge Space serves as the knowledge engine of University-City Symbiosis; the Industry-Innovation Integration Space acts as the medium for the flow of innovation resources; and the Social Co-Governance Space constitutes the emotional foundation and institutional soil that sustain the long-term operation of the University-City Symbiosis relationship.

(1) Ubiquitous Knowledge Space

The core proposition of the Ubiquitous Knowledge Space lies in how the knowledge and technological resources accumulated by universities can transcend campus boundaries, permeate urban society through various spatial carriers, and form a two-way flow through feedback from the genuine needs of the community. The term "ubiquitous" highlights the core characteristic that distinguishes this type of space from traditional academic laboratories: knowledge is diffusely distributed between the university and the city through carriers of various types and scales, enabling users from diverse backgrounds to access knowledge and technological resources at any time during their daily movements and stays. As a result, the community transforms from the consumer end of the innovation chain into the genuine source of innovation demand.

In terms of carrier types, Ubiquitous Knowledge Spaces manifest in two distinct yet complementary forms: prototype laboratories, centered on knowledge transformation, feature flexible spatial requirements and can be directly embedded into the community fabric; open fabrication laboratories, centered on resource sharing, require the accommodation of digital fabrication equipment and have specific requirements for spatial load-bearing capacity and ceiling height. Together, these two types of carriers constitute a complete spillover pathway for knowledge, from production and transformation to technological dissemination.

Table 4- 3 Types of Ubiquitous Knowledge Space Venues

Facility Type	Typical Functions	Lead Entity	Spatial Requirements and Scale	Source of Platform
Prototype Lab	Interdisciplinary Research and Technology Transfer, University-Industry Collaborative Creative Workshops, Community Exhibitions and Open Seminars	University-led, with participation from industry and the community	Small–medium scale, with flexible spatial configurations	Conversion of ground-floor retail spaces or repurposing of former industrial buildings
Open Manufacturing Lab	Digital fabrication equipment open to the public, skills training, and maker project incubation	Primarily university-based, serving the general public	Medium scale; requires dedicated space to accommodate workshops and equipment, with specific requirements for load-bearing capacity, ceiling height, and ventilation	Renovation of existing 2–4-story buildings or new construction on existing sites

(Source: Drawn by the Author)

(2) Industry-Innovation Integration Spaces

The core concept of industry-innovation integration spaces lies in using commercial settings as the fundamental platform. Through mixed-use functions and collaborative operations among diverse stakeholders, these spaces elevate commercial environments into innovative "third spaces" that integrate consumption, interaction, and incubation, thereby facilitating the spontaneous flow of innovation resources among universities, enterprises, and communities. Unlike Ubiquitous Knowledge Spaces, which rely on institutional arrangements to drive directed knowledge flow, industry-innovation integration spaces leverage the natural crowd-gathering effect of commercial settings. This allows users from diverse backgrounds to naturally encounter one another through everyday consumption and interaction, with the university serving as a background knowledge field rather than a direct operator. The low-threshold nature of commercial settings allows ordinary community residents to enter naturally. The degree of functional mixing increases with the scale of the space, and the strategy of switching the dominant function of the same space at different times further enhances its vitality throughout the day.

Table 4- 4 Types of Industry-Innovation Integration Spaces

Vehicle Type	Typical Functions	Primary Operator	Spatial Requirements and Scale	Source of Venue
Small-scale innovative commercial interface	Coffee and dining serve as the foundation, layered with informal social spaces and lightweight workspaces, with dominant functions shifting throughout the day	Diverse stakeholders, high corporate engagement	Small scale, flexible spatial configurations	Conversion of individual or adjacent ground-floor retail units
Medium-scale innovative mixed-use interface	Building on the above, introduce co-working spaces, maker studios, and small exhibition or demo spaces, with multi-brand co-tenancy	Joint operation by diverse stakeholders	Medium scale, requiring a certain degree of spatial continuity	Conversion of multiple interconnected ground-floor retail units or integration of an entire floor

(Source: Drawn by the Author)

(3) Social Co-governance Spaces

Social co-governance spaces correspond to the "Consensus Space" in the Triple Helix Theory. Their core proposition is to foster a shared sense of place and social identity among people of diverse backgrounds and social strata through spatial design and sustained program operations, thereby weaving the previously fragmented campus community, urban residents, and migrant populations into a single social network. Led primarily by the community and government, with cultural resources supported by the university, these spaces serve as a safety net within the overall University-City Symbiosis ecosystem, extending the reach of this symbiotic relationship to ordinary community residents who are typically underserved within the innovation ecosystem.

Table 4- 5 Types of Social Co-governance Spaces

Vehicle Type	Typical Functions	Leading Entities	Spatial Requirements and Scale	Source of Platform
Community Public Lounge	Coffee shop, shared kitchen, multipurpose hall, and lightweight co-working space; frequent events to foster community engagement; integration of shared gardening or relaxation areas with unused outdoor spaces	Led by the community and government, with cultural resources provided by the university	Medium scale, emphasizing openness and visibility; indoor and outdoor spaces should seamlessly integrate	Renovation of ground-floor commercial or community support buildings

(Source: Drawn by the Author)

4.3 Multi-stakeholder Co-governance and Activation

The sustainable operation of the University-City Symbiosis cannot rely solely on the physical conditions created by spatial connectivity and Functional Hybridity; it also requires a

corresponding governance structure to underpin it. Interventions at the spatial and functional levels provide the physical prerequisites and content vehicles for the encounter of heterogeneous actors; yet, the transformation of such encounters into stable symbiotic relationships benefits from additional measures. Aligning the interests of various actors, coordinating resource allocation, and clarifying boundaries of authority and responsibility can all strengthen the driving force of symbiosis, which then becomes more likely to endure and thrive through institutional arrangements. The Triple Helix Theory identifies coordinated governance among diverse actors as one of the three core drivers of a regional innovation system, alongside knowledge production and technology transfer. Governance is not an external safeguard for the symbiotic system but an organic component of the symbiotic dynamic structure itself.

Effective collaborative governance must be constructed simultaneously on two levels: first, the spatial platform level, which uses specific venues for collaborative activities as a medium; through sustained operational activities and community organization, it transforms sporadic, heterogeneous interactions into a stable network of communities; second, the institutional mechanism level, which provides institutional safeguards for the long-term functioning of symbiotic relationships through multi-stakeholder negotiation, role division, and the gradual evolution of governance structures. The two reinforce each other: spatial carriers ensure that governance relationships are continuously activated in daily practice, while institutional mechanisms provide structural support for the stable operation of these spatial carriers. This study explores these two dimensions: the construction of co-governance spatial carriers and the establishment of multi-stakeholder negotiation mechanisms.

4.3.1 Construction of Co-governance Spatial Carriers

The core value of co-governance spatial carriers lies not in the material functions they provide, but in their operational logic as incubators for community ecosystems—through continuous event planning and community organization, they enable diverse groups of people who were originally strangers to gradually form cohesive communities through repeated encounters, transforming sporadic spatial interactions into stable social networks.

Hao Commune integrates functions such as a café, shared kitchen, shared multipurpose hall, and lightweight co-working space within a roughly 300-square-meter space. Its true value lies not in these functions themselves, but in the community ecosystem that continuously grows around this space—a dedicated operations team uses high-frequency events as a bond to continuously attract people from diverse backgrounds to gather here,

transforming the space into a self-sustaining community incubator; When property regulations prompted the withdrawal of commercial operations, the Fasheng Convenience Store on Shanghai Daxue Road was transformed into a nonprofit public space through multi-stakeholder collaboration. Hosting over 100 community-driven events—an average of five per week—and gathering a diverse neighborhood community of more than 350 people online, the withdrawal of commercial logic actually allowed multi-stakeholder collaboration to emerge spontaneously within the same space. This demonstrates that once a community is formed, it possesses an endogenous momentum that transcends the functional purpose of the space itself.

4.3.2 Establishment of Deliberative Mechanisms

Co-governance spaces provide the physical conditions for multi-stakeholders to meet, while negotiation mechanisms offer institutional safeguards for their sustained cooperation. Symbiotic relationships benefit from institutionalized negotiation mechanisms, which help stakeholders maintain harmony when interests diverge; the ongoing interaction between residents and businesses on Shanghai Daxue Road demonstrates the value of such mechanisms. An effective multi-stakeholder negotiation mechanism must encompass three dimensions—information exchange, interest coordination, and the evolution of governance structures—and continuously adapt as the symbiotic relationship deepens. This study explores these dimensions through the lenses of institutionalized information exchange and the incremental evolution of co-governance structures.

(1) Institutional Information Exchange and Interest Coordination

The prerequisites for multi-stakeholder consultation are the transparent flow of information and institutional channels for expressing interests. Multi-stakeholder relationships that establish information-sharing mechanisms can avoid deadlocks, enabling parties to collaborate and voice their concerns. Kendall Square requires MIT to submit an annual "Town-Gown Report" to the City of Cambridge, covering issues directly related to community quality of life—such as housing supply, climate resilience, and transportation emissions reduction—using an institutionalized annual reporting mechanism to ensure regular information exchange between the university and the city; Meanwhile, the City of Cambridge mandates through planning regulations that new large-scale commercial developments allocate 5%–10% of their floor area to Innovation Spaces, with at least 25% of these spaces provided to community organizations and nonprofit institutions at below-market rents, thereby achieving structural coordination of diverse stakeholders' interests through

institutionalized space allocation. TU Delft has established a Campus Liaison Center to hold regular consultation meetings with nearby residents, integrating community concerns into the routine decision-making process for campus planning.

(2) The Evolution of Incremental Co-governance Structures

A collaborative governance structure evolves gradually through long-term coordination among multiple stakeholders. The three-stage collaborative evolution of the Tongji NICE2035 Chifeng Road Block clearly illustrates this process: In the initial phase, the basic framework was characterized by street-level leadership, university implementation, and resident participation that was primarily observational. The core task was to complete foundational spatial renovations and build community trust; In the intermediate phase, social resources were systematically introduced. The street office established a community public welfare fund to open up diverse funding channels and created a consultation mechanism combining a core members' joint conference with an expanded joint conference, shifting collaboration from reliance on ad hoc initiatives to institutional arrangements; In the deepening phase, a qualitative transformation occurred as the university and the community moved from project-based collaboration to substantive integration. A stable symbiotic structure emerged among the subdistrict office, the university, and community residents, characterized by intertwined interests and complementary resources. Consequently, the university-city collaboration mechanism evolved from a governance tool into an endogenous driving force for the neighborhood's sustained renewal.

4.4 Summary of This Chapter

Based on the University-City Symbiosis theoretical framework established in Chapter 2 and the cross-regional empirical analysis of four cases in Chapter 3, universally applicable regeneration principles are derived from three dimensions — spatial, functional, and governance—forming the core methodological framework of this study.

In the spatial dimension, the principle of Spatial Connectivity and Openness proposes strategic pathways for reducing spatial friction between the university and the city and transforming passive boundaries into permeable Intermediate Domains, addressing three levels: transportation accessibility, the public space system, and boundary activation. In the functional dimension, the principle of Functional Hybridity and Symbiosis proposes a strategy framework for functional configuration that simultaneously supports symbiotic interactions at both economic and social levels, addressing three levels: the Dual-track Approach, mixed use, and symbiotic space implantation. In the governance dimension, the principle of

Multi-stakeholder Co-governance and Activation proposes a strategic logic for ensuring the long-term functioning of symbiotic relationships through the construction of co-governance spatial carriers and multi-stakeholder negotiation mechanisms, sustained by a combination of community operations and institutional arrangements. These three principles mutually reinforce one another and are indispensable: spatial connectivity provides the physical prerequisite for functional symbiosis; functional hybridity provides the substantive foundation for governance synergy; and collaborative governance provides the institutional safeguards for the sustained operation of the first two.

The regeneration principles summarised in this chapter are universally applicable rather than site-specific; they constitute a methodological framework derived from theoretical deduction and case-based induction, and have not yet been integrated with specific site conditions. Chapter 5 will conduct a systematic site analysis of the SCUT-Tianhe Coach Terminal District, identifying actual challenges and latent resources across the three dimensions of space, function, and governance; Chapter 6 will, on the basis of this site understanding, translate the three regeneration principles outlined in this chapter into design applications tailored to the specific site, and in this process of translation the framework itself will be tested and refined.

Chapter 5 Site Analysis of the SCUT-Tianhe Coach Terminal District

5.1 Site Overview and Resource Conditions

5.1.1 Site Development History

The SCUT-Tianhe Coach Terminal District is located in the core zone of the Huanwushan Innovation Hub in Tianhe District, Guangzhou, adjacent to the SCUT North Campus, and occupies a strategic position for the district's science and technology innovation development. In 2024, Guangzhou officially adopted the "1+N" Master Plan and Implementation Scheme for the Renewal and Development of the Huanwushan Innovation Source Area, positioning the area as the "Intellectual Core of South China and Flagship of Science and Technology Innovation" and the "Source of Tianhe's Science and Technology Innovation," thereby entrusting it with the vital strategic role of leading Guangzhou's high-quality development. Within this planning framework, Tianhe Coach Terminal is explicitly designated as the TOD Innovation Service Hub, occupying a central position within the overall development structure of the Wushan Innovation Hub.

Currently, the SCUT-Tianhe Coach Terminal District possesses favorable land reserves and a solid rail transit infrastructure, indicating significant development potential; there is room for aligning its current functional composition with its designated development role. The area features a high proportion of spontaneous development; aside from some state-owned former industrial sites, most land consists of village collective land, resulting in a mixed-use landscape and a fragmented spatial fabric that presents opportunities for integrated planning. Surrounding land uses include auto parts markets, logistics warehouses, urban villages, and commercial centers, among others, and the overall environmental quality can be enhanced through future development.

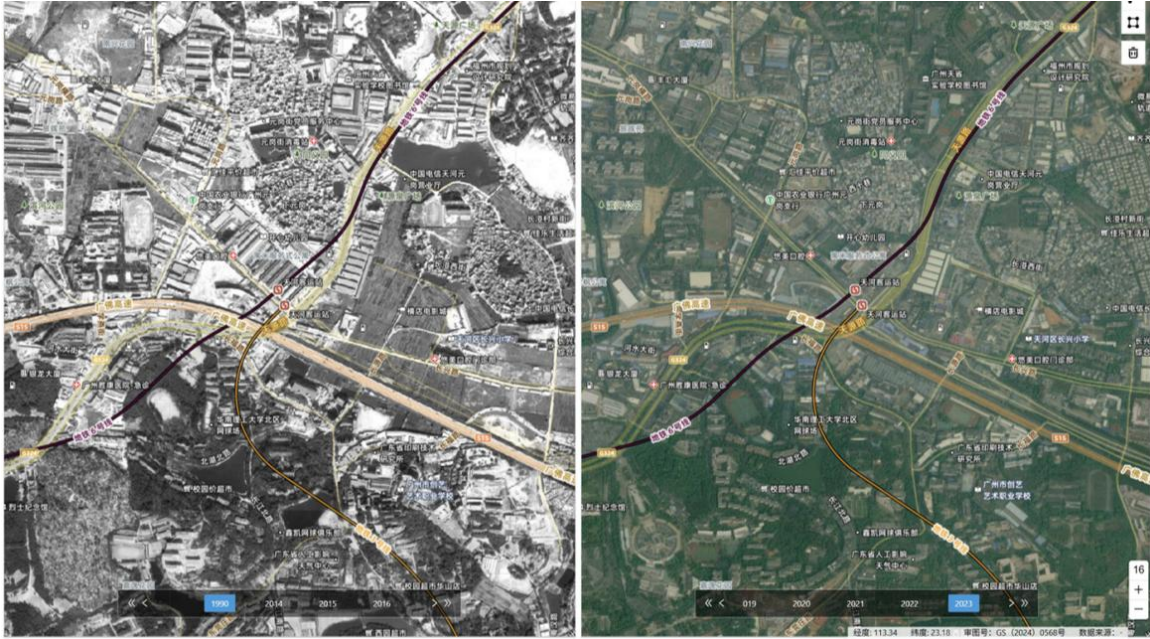


Figure 5- 1 Comparison of Site in 1990 and 2023

(Source: Tianditu)

5.1.1.1 Development of Tianhe Coach Terminal

Tianhe Coach Terminal is Guangzhou's first multifunctional comprehensive bus terminal, completed and put into operation in 1997. In its early years, it offered routes to more than 20 provinces, municipalities, and autonomous regions across the country, serving as a vital gateway for migrant workers from other provinces and residents of Eastern, Western, and Northern Guangdong entering Guangzhou. The station boasts a substantial scale, with a main parking lot covering over 20,000 square meters. It features more than 70 departure bays and can accommodate over 200 buses waiting to depart simultaneously. With over 1,500 buses in operation, the station handled a peak daily passenger volume of up to 100,000, making it one of the core hubs for Guangzhou's external passenger transport at the time.

With the rapid expansion of the high-speed rail network and the rise of new transportation modes such as ride-hailing and on-demand buses, the competitive edge of long-distance coach services has steadily eroded, and passenger volume at Tianhe Coach Terminal has shown a year-on-year decline. In terms of sentimental value, Tianhe Coach Terminal holds collective memories for countless urban migrants and students—the long queues at the ticket counters and the surging crowds entering the station represent a shared experience of Guangzhou's transient population from an era before high-speed rail and subways became widespread. Today, the station's main building has largely transitioned away from passenger operations, retaining only limited waiting areas; some areas have been converted into bus parking lots, while other buildings have been repurposed as business

centers and freight facilities. Overall, the site presents opportunities for systematic functional reallocation and spatial renewal.

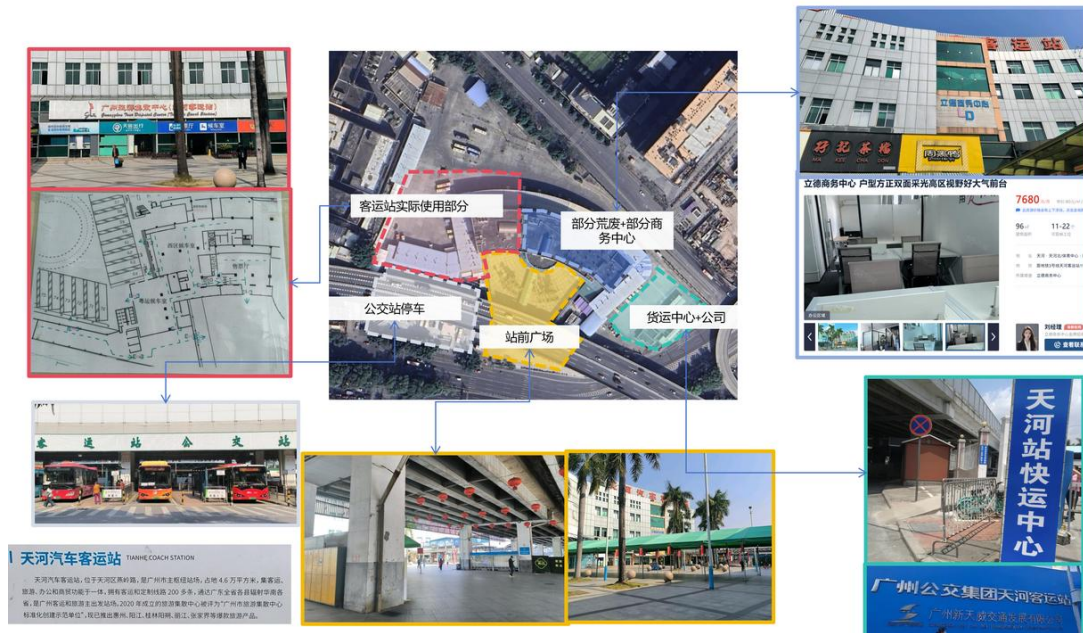


Figure 5-2 : Current State of Tianhe Coach Terminal
(Source: Drawn by the Author)



Figure 5-3 Current State of Tianhe Coach Terminal
(Source: Drawn by the Author)

5.1.1.2 Development of the North Campus of South China University of Technology

Large-scale development of the SCUT North Campus began in the 1990s. Initially focused on the construction of faculty apartments and student dormitories, it served primarily as a residential support area for the main campus. As the university's enrollment continued to expand, the functions of the SCUT North Campus gradually diversified. Teaching buildings,

key laboratories, the university science and technology park, and research institutes were successively relocated there, transforming it from a single residential support zone into a functional "satellite district" closely integrated with the main campus^[80]. From the developmental trajectory of the North Campus, it has possessed the inherent capacity to support student practical activities since its early construction phase. It has long played a significant role in industry-academia-research collaboration, laying the functional foundation for the subsequent University-City Symbiosis.

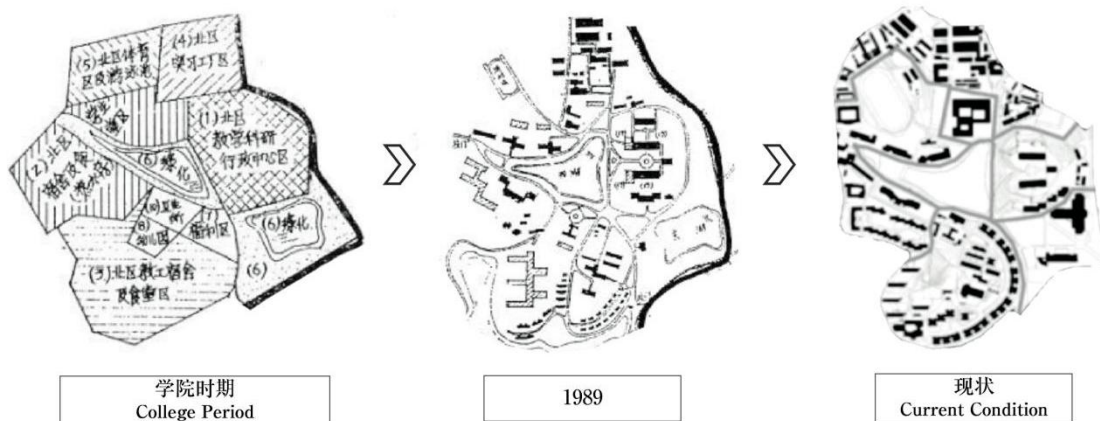


Figure 5- 4 Development of the North Campus of Huazhong University of Science and Technology

(Source: Drawn by the Author based on *University Infrastructure*)

5.1.2 Current Site Configuration

The SCUT-Tianhe Coach Terminal District enjoys superior transportation and geographical conditions. At the surface road level, the area is situated at the intersection of Guangshan Road, Tianyuan Road, and Yuangang Heng Road, directly connecting to Tianhe District's major urban thoroughfares and offering strong external accessibility. In terms of rail transit, Metro Lines 3 and 6 intersect within the area, forming a dual-line transfer hub that brings a steady flow of regional passengers to the area, constituting a vital transportation foundation for driving functional renewal.

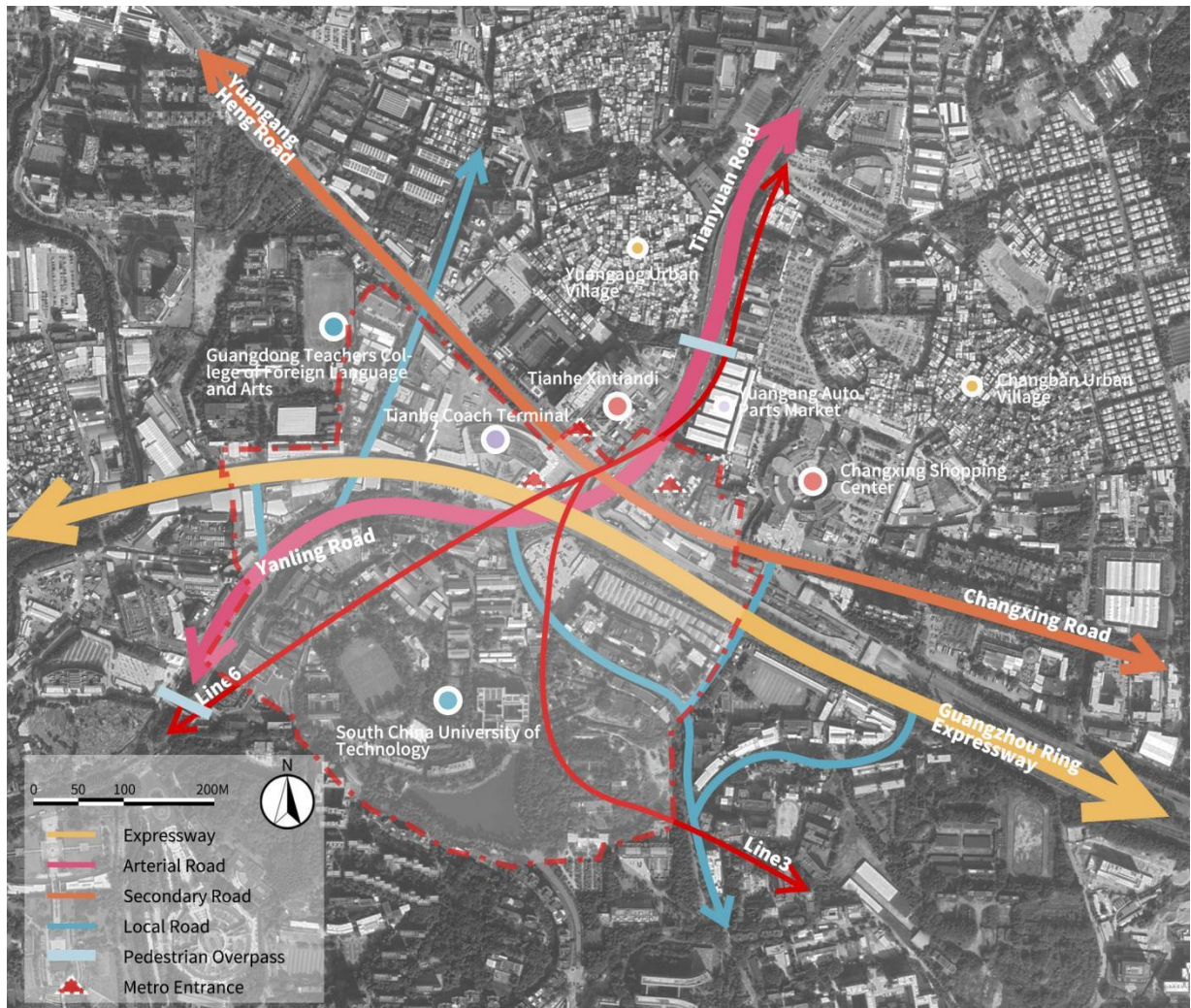


Figure 5- 5 : Site Transportation
(Source: Drawn by the Author)

The current land use in the area is characterized by traditional business formats and a concentration of emerging industries. The economic efficiency of land use presents an opportunity for enhancement, aligning with the development 定位 of the "Huanwushan Innovation Hub." The area features a high proportion of self-initiated construction and a complex ownership structure. Aside from some state-owned former factory sites, a large portion of the land is collectively owned by villages. This diverse ownership structure offers opportunities for coordinated renewal and redevelopment efforts.

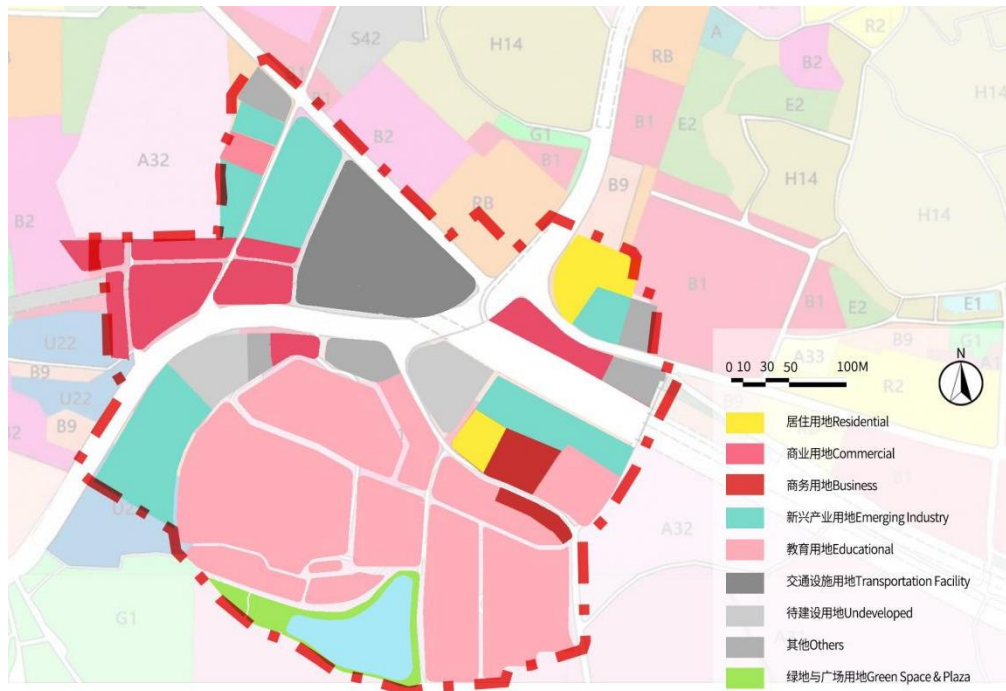


Figure 5- 6 : Current Land Use
(Source: Reference)



Figure 5- 7 : Current Land Ownership Map
(Source: Author's own compilation based on Reference)

In terms of industrial structure, the district encompasses functional clusters such as the Industrial Innovation Service Cluster, the Scientific Research and Commercialization Cluster, and the Tianhe Coach Terminal Science and Technology Innovation Service TOD (High-Level Innovation Exchange Zone) within the overall Ring Wushan Master Plan, and is situated within the core influence zone of the Ring Wushan university cluster. In terms of

industrial guidance, the core industrial positioning of the Ring Wushan area is defined by a "2+4+N" framework. The district covers sectors such as next-generation information technology, intelligent manufacturing, new materials, new energy, and agricultural technology. Leverage the architectural discipline strengths of South China University of Technology (SCUT) by incorporating architectural design and innovation services into the industrial guidance framework as a complementary element. Regarding the blue-green ecological framework, the area connects to the ecological penetration axis running northward from Longyandong to the South China Botanical Garden and Changban Park, providing the spatial conditions necessary to establish a north-south green corridor. Regarding skyline management, the master plan requires that, within height restrictions, the design respect the height relationships of the surrounding mountains. By integrating the TOD nodes at Tianhe Coach Terminal and Changban Station, the plan aims to create compact, moderately-heighted regional landmarks, forming a modern, cohesive skyline characteristic for the SCUT-Tianhe Coach Terminal District.



Figure 5- 8 Planning documents related to the SCUT-Tianhe Coach Terminal District
(Source: "1+N" Overall Planning and Implementation Plan for the Huanwushan Innovation Source Area)

5.1.3 Site Regeneration Resource Conditions

5.1.3.1 Policy Advantages

The district's renewal is supported by clear overarching policies. In 2024, Guangzhou City formally adopted the "1+N" Master Plan and Implementation Scheme for the Renewal and Development of the Huanwushan Innovation Source Area^[82], positioning the Huanwushan Innovation Source Area as the "Intellectual Core of South China · Flagship of Science and Technology Innovation" and assigning it the strategic role of leading Guangzhou's science and technology innovation. In May 2025, the "Control Detailed Plans for the First-Phase Projects of Changban Village and Yuangang Village, as well as the Shàngyuángǎng Plot in the Huanwushan Innovation Source Area of Tiánhé District" were successively approved^[81], further clarifying the area's near-term construction direction and functional positioning. As the primary concentration of existing land and a key development area within the Wushan Innovation Hub, the SCUT-Tianhe Coach Terminal District has received clear development authorization and planning guidance at the policy level, providing institutional safeguards for systematic renewal. Meanwhile, SCUT is gradually relocating its university-affiliated enterprises to surrounding urban areas. This trend helps channel on-campus innovation resources into the city, further stimulating the flow of resources between the university and the city.

Laboratory of Advanced Papermaking and Paper-based Materials, and the State Key Laboratory of Luminescent Materials and Devices, providing a solid academic foundation to support the integrated development of industry, academia, and research in the area. The orderly opening of university resources and the sharing of physical spaces are the core resources underpinning the transformation toward University-City Symbiosis.

华南理工大学国家级科研机构总览		
National-Level Research Platforms — South China University of Technology		
国家重点实验室 · 国家工程技术研究中心 · 国家工程研究中心		
State Key Laboratory · National Engineering Technology Research Center · National Engineering Research Center		
亚热带建筑与城市科学全国重点实验室 State Key Laboratory of Subtropical Building and Urban Science	国家人体组织功能重建工程技术研究中心 National Engineering Technology Research Center for Tissue Restoration and Reconstruction	聚合物新型成型装备国家工程研究中心 National Engineering Research Center of Novel Equipment for Polymer Processing
先进造纸与纸基材料全国重点实验室 State Key Laboratory of Advanced Papermaking and Paper-Based Materials	国家金属材料近净成形工程技术研究中心 National Engineering Technology Research Center for Near-Net-Shape Forming for Metallic Materials	造纸与污染控制国家工程研究中心 National Engineering Research Center of Papermaking and Pollution Control
发光材料与器件全国重点实验室 State Key Laboratory of Luminescent Materials and Devices	国家移动超声探测工程技术研究中心 National Engineering Technology Research Center for Mobile Ultrasonic Detection	
国家（地方联合）工程实验室		
National (Local Joint) Engineering Laboratories		
挥发性有机污染治理技术与装备国家工程实验室 National Engineering Laboratory for Volatile Organic Compounds Pollution Control Technology and Equipment	小麦和玉米深加工国家工程实验室（共建） National Engineering Laboratory for Wheat and Corn Further Processing (joint)	
汽车零部件技术国家地方联合工程实验室 National and Local Joint Engineering Laboratory for Automotive Parts Technology	医用植入器械国家工程实验室（共建） National Engineering Laboratory for Medical Implant Devices (joint)	
风电控制与并网技术国家地方联合工程实验室 National and Local Joint Engineering Laboratory for Wind Power Control and Grid Integration Technology	TFT-LCD工艺技术国家工程实验室（共建） National Engineering Laboratory for TFT-LCD Process Technology (joint)	
农田土壤污染防治与修复技术国家工程实验室（共建） National Engineering Laboratory for Prevention, Control and Remediation of Farmland Soil Pollution (joint)	塑料改性加工国家工程实验室（共建） National Engineering Laboratory for Plastic Modification and Processing (joint)	
AMOLED工艺技术国家工程实验室（共建） National Engineering Laboratory for AMOLED Process Technology (joint)		
国家国际科技合作基地	国家地方联合工程研究中心	
National International Science and Technology Cooperation Base	National (Local Joint) Engineering Research Center	
国家热带特色健康食品示范型国际科技合作基地 National Demonstration Base for International Science and Technology Cooperation on Tropical Characteristic Health Food	半导体显示与光通信器件发展国家地方联合工程研究中心 National and Local Joint Engineering Research Center for Semiconductor Display and Optical Communication Devices	
State Key Lab x3 · Eng. Technology Research Center x3 · Eng. Research Center x2 · (Local Joint) Eng. Lab x9 · Intl. S&T Cooperation Base x1 · (Local Joint) Eng. Research Center x1		
国家重点实验室×3 · 工程技术研究中心×3 · 工程研究中心×2 · 联合工程实验室×9 · 国际科技合作基地×1 · 地方联合工程研究中心×1		

Figure 5- 10 : National Key Laboratories at South China University of Technology (SCUT)
 (Source: Drawn by the Author based on <https://www2.scut.edu.cn/ist/zlcg/list.htm>)

5.1.3.3 Innovation Industry Foundation

A relatively dense cluster of innovation industrial parks has formed around the SCUT-Tianhe Coach Terminal District. Within the study area and its immediate vicinity, there are currently ten identifiable innovation industrial parks, covering a variety of business formats such as technology incubation, cultural creativity, co-working spaces, education and training, and business services. This has laid the initial spatial foundation for the aggregation of creative talent and the cultivation of an innovative atmosphere.



Figure 5- 11 : Distribution of Innovation Industries

(Source: Drawn by the Author)

In terms of park types, the aforementioned parks can be broadly categorized into three models. The first is the incubation-service-oriented model, represented by the Chuangxinggang Changban University Hall Innovation Park and Tianhui LOFT Creative Park. These parks specifically target startup teams and small and medium-sized enterprises (SMEs), offering low-threshold entry requirements alongside professional services such as funding connections, legal consultation, and marketing support. Some parks have already established spontaneous activities, such as regular creative markets, and have developed a certain degree of community cohesion. The second is the full-chain comprehensive service model, represented by HI MONDAY Industrial Park and Zhihui Park Zhaolian Yuangang Creative Industrial Park. These parks provide an integrated support system encompassing "space + community + finance + data + services," and are equipped with facilities such as multifunctional conference halls, art galleries, and business apartments, forming a relatively complete closed-loop industrial ecosystem. The third category is the specialized cultural and creative-oriented model, exemplified by the Nanyue SYNT Park. These parks focus on emerging cultural and technological fields such as performing arts production, immersive theaters, and virtual studios (VP and XR), exhibiting strong differentiation in their functional positioning.

In terms of business structure, most parks have spontaneously adopted a vertical mixed-use model characterized by "retail activation at the base level and creative office

production at the upper levels." Lifestyle amenities such as dining, social commerce, and fitness and entertainment are generally embedded on the ground floor, forming a complementary relationship with creative office functions in daily operations. This self-organizing structure aligns closely with the logic of functional mixing advocated by this study, indicating that the district possesses relatively mature market-driven conditions for functional integration.

Existing parks currently exhibit a relatively dispersed, point-like spatial distribution, and opportunities exist to strengthen pedestrian connections and functional linkage mechanisms between parks to further facilitate the cross-park flow of innovation elements and resulting synergies. The revitalization of the SCUT-Tianhe Coach Terminal District can leverage its core locational advantages to integrate resources from surrounding parks, serving as a spatial anchor to activate these dispersed innovative energies and driving the district's systemic leap from single-point incubation toward a networked innovation ecosystem.

5.1.3.4 Potential of the Site's User Base

Under current conditions, the diverse groups active within the district generally face a structural mismatch between spatial supply and actual demand, and this mismatch itself constitutes a potential space for renewal intervention. Through a systematic analysis of the site's primary user groups, it can be observed that these groups exhibit significant differences and complementarities in behavioral characteristics, current pain points, and renewal needs, collectively forming the demographic foundation for generating the district's diverse vitality.

The emerging industries and creative communities within the district—including creative entrepreneurs and corporate R&D personnel—are the core driving force behind the district's transition toward an innovation-oriented model. This group has a clear demand for high-quality social commercial spaces (such as cafes and co-working spaces), shared housing for young people, and convenient pedestrian and cycling environments. The current supply in the district is limited in these areas, and the creative population is therefore distributed across multiple locations, presenting an opportunity to achieve spatial clustering effects. Once the relevant spatial conditions are improved, the clustering of this group will bring sustained new consumer vitality and cultural innovation momentum to the district.

Traditional migrant workers and service personnel form a stable backbone that supports the district's daily commercial operations and basic services. They value improved basic infrastructure, enhanced pedestrian and cycling environments, and optimized public transportation connections. This group has long faced the spatial challenge of the dualistic

development between the city and Urban Villages, leaving significant room for improvement in their quality of life; addressing their needs will help enhance the social inclusivity of the district's renewal.

Local community residents, particularly long-residing elderly and children, consistently value high-quality open spaces, accessible facilities, and organized community activities; they have a limited range of movement and rely heavily on public spaces. Young and middle-aged native residents, meanwhile, have strong expectations for high-quality commercial environments and open streets conducive to organized activities. They also possess a proactive willingness to participate in community co-governance and provide local commercial services, making them potential key participants in driving the operation of social co-creation spaces.

University faculty and students, whose daily movement is largely contained within the boundaries of Danwei compounds, demonstrate inward-oriented routines; however, their demand for shared experimental platforms, joint R&D spaces, and diverse lifestyle amenities remains untapped. Undergraduate, master's, and doctoral students possess vigorous social and innovative vitality, making them core potential users of Ubiquitous Knowledge Spaces and Hybrid Innovation Spaces; faculty and faculty advisors are key actors in driving industry-academia-research collaboration and activating joint laboratories. If district renewal can effectively break down the barriers between campus and city and provide corresponding spatial carriers, the behavioral potential of these groups to expand into the urban side will be significantly unleashed.

Transient and hub-based populations generate massive daily passenger flows through subway stations and bus terminals. The core hub area presents opportunities to introduce effective spaces for people to linger and commercial interfaces to accommodate them, thereby converting this substantial transit traffic into economic vitality for the district. This group has clear demands for improved wayfinding systems, public restrooms, and a range of dining and rest facilities. Unlocking their consumption potential depends on systematic improvements to the quality of public spaces and commercial interfaces surrounding the hubs.

Overall, the differentiated needs of these five groups are highly complementary at the spatial level—the creative community brings vitality and consumption, service personnel support basic operations, local residents provide on-site engagement, the student and faculty groups contribute knowledge and innovation, and the transit hub users contribute traffic and consumption potential. One of the core tasks of the district's renewal is to provide differentiated yet mutually compatible spatial carriers for these groups, enabling the daily

activities of diverse populations to form a positive, complementary relationship within the same district.

5.2 Challenges Facing University-City Symbiosis

On the basis of understanding the site's basic layout and resource conditions, this section provides a systematic analysis of the current problems in the SCUT-Tianhe Coach Terminal District, with a focus on identifying the four principal barriers constraining the formation of University-City Symbiosis.

5.2.1 Fractured Spatial Connectivity

5.2.1.1 Elevated Bridges and Major Arterial Roads

The Guangzhou Ring Expressway (Guangshan Road), Tianyuan Road, and Yuangang Heng Road intersect within the district to form an elevated highway network, causing severe physical severance of north-south spatial connectivity. Visually, the massive elevated structures form a continuous horizontal barrier across the site, while the district lacks iconic buildings or landscape nodes capable of counteracting this visual rupture, resulting in insufficient spatial legibility on both the northern and southern sides. In terms of pedestrian connectivity, along Tianyuan Road, pedestrians must walk 540 metres north or 780 metres south (near the Yuangang Archway) to cross via a pedestrian overpass; there is only one at-grade crossing within the district. Although the Tianhe Coach Terminal metro station has an underground passage, it does not function as a dedicated pedestrian crossing, rendering north-south connectivity extremely inefficient in practice.

The passive condition of the spaces beneath the elevated structures further compounds the obstructive effect of the highway network. Owing to the absence of coordinated lighting design and daily management, these under-bridge spaces are characterised by poor perceived safety and disordered environments; their current functions — primarily parking, municipal facilities, and temporary waste storage — bear almost no relation to the daily needs of surrounding residents, producing a large-scale passive "grey zone" that generates a significant psychological barrier to pedestrian movement.



Figure 5- 12 Barriers Created by Elevated Highways
(Source: Drawn by the Author)

5.2.1.2 Enclosed Danwei Compounds

The area is surrounded by numerous Danwei Compounds, primarily universities and research institutes, whose spatial form perpetuates the fundamental characteristics of the closed compound model from the planned economy era: walls delineate clear property boundaries, interior and exterior spaces are sharply separated, and pathways for public resources to spill over into the urban side are completely blocked. As the largest Danwei Compound in the area, SCUT North Campus presents no permeable interface or transitional space of any kind along the boundary between the campus and the surrounding urban fabric; a large volume of high-quality educational, landscape, and public facility resources is enclosed within the campus walls and is unable to participate in the construction of a city-level public space system. This closed model not only restricts the permeation of people and activities between the university and the city, but also physically reinforces the sense of spatial severance between them.

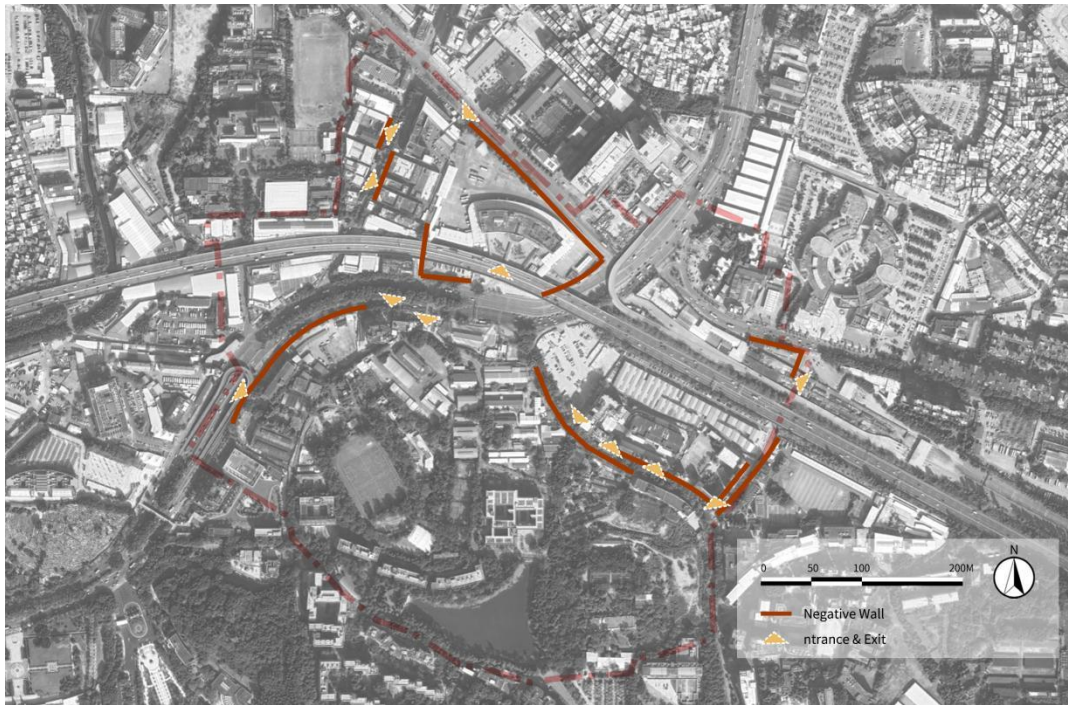


Figure 5- 13 Interface Impacted by Danwei Compounds
(Source: Drawn by the Author)

5.2.1.3 Juxtaposed Urban Fabrics



Figure 5- 14 Site Texture
(Source: Drawn by the Author)

Three types of spatial fabric coexist within the district in marked contrast. The Sparse Compound Fabric, represented by universities, research institutes, and the coach terminal, exhibits low building coverage and wide spacing; individual buildings are large in scale, and

open spaces such as plazas and internal roads account for a significant proportion of the figure-ground relationship. The Compact Block Fabric, represented by surrounding industrial parks and general commercial areas, features buildings arranged along street frontages with a balanced figure-ground ratio and relatively high land utilisation. The High-density Indigenous Fabric, exemplified by Yuangang Village and Changban Village, exhibits extremely high building density, prominent "handshake buildings," highly compressed public spaces, and a road network as intricate as a capillary system.

These three fabric types are directly juxtaposed within the district without intermediate-scale transitional forms as buffers, and no organic interlocking relationship has been formed between them. The elevated highway network comprising the Guangzhou Ring Expressway and Tianyuan Road physically severs the continuity of the architectural fabric on both the northern and southern sides, producing a wide ribbon-like void that renders the urban spatial structure in a state of enforced rupture. The extreme contrast in fabric scale, compounded by the deficiency of north-south connectivity, further reinforces the overall perception of spatial fragmentation within the district.

5.2.2 Deficit in Spatial Vitality and Quality

5.2.2.1 Relatively Insufficient Development Intensity

The study area of the SCUT-Tianhe Coach Terminal District covers approximately 59 hectares, with an overall floor area ratio (FAR) of approximately 1.16; within a 100-metre radius of the terminal, the FAR is approximately 1.2, indicating that the overall development intensity is relatively low^[83]. Drawing on development experience at urban rail transit station areas both domestically and internationally, the FAR in the core zones of urban TOD typically ranges from 4.0 to 5.5, while peripheral areas generally maintain levels between 2.5 and 4.0; the development potential of land surrounding transit stations diminishes with increasing distance, and the 200-metre and 500-metre scales serve as the primary control references based on walkability^[84]. As a dual-line transfer hub for Metro Lines 3 and 6, Tianhe Coach Terminal constitutes an urban TOD station with strong agglomeration capacity; its current level of development, relative to comparable stations, still has considerable room for improvement, and the locational value and passenger flow advantages brought by rail transit have not been effectively translated into corresponding land development intensity.

5.2.2.2 Low-end and Disorderly Business Mix

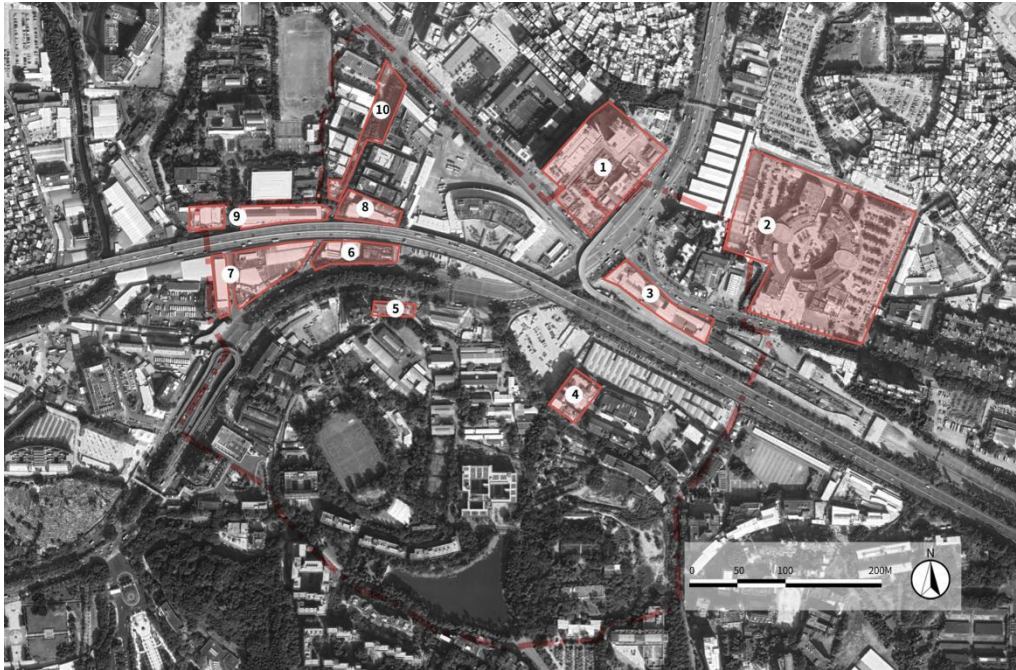


Figure 5- 15 : Current Commercial Status of the Site
(Source: Drawn by the Author)

Table 5- 1 : Current Commercial Status of the Site

No.	Current Status Map	Primary Business Type	Business Type	Operational Status
C1		Shopping, Dining, Entertainment, Lodging, and Office Complex	Mixed-Use Commercial	Open for Business
C2		Department Stores · Supermarkets · Children's Entertainment · Dining · Sports (Badminton Courts, Gyms) · Movie Theaters	Mixed-Use Commercial	Open for Business
C3		Auto Parts (Primarily for Private Vehicles) · Traditional Chinese Medicine Clinic · BYD Showroom · Educational Field Trip Base · Media Company · Martial Arts Association · Combat Sports · Fitness · Educational Training · Piano	Automotive Services	Open for Business
C4		Hotel Accommodations	Lifestyle Services	Open for Business
C5		Dining, Hotels, and Convenience Services	Lifestyle Services	Open for Business
C6		Primarily Food and Lodging	Lifestyle Services	Open for Business
C7		Auto Parts, Funeral Services, Logistics	Funeral and Auto Parts Services	Open for Business
C8		Dining, Accommodation, and some office spaces; logistics and warehousing near the elevated highway; renovated apartments near Huitong Industrial Plaza	Lifestyle Services	Open for business

No.	Current Status Map	Primary Business Type	Business Type	Operational Status
C9		Located near Guangwai Arts University, with many dining options and daily necessities	Daily Services	Open for Business
C10		Primarily restaurants and lodging	Daily Services	Some space is available.

(Source: Compiled and drawn by the Author)

The commercial landscape of the district exhibits a distinct polarisation. The two major commercial hubs centred around Utopia and Tianhe New World are relatively well-developed, while the remaining commercial sites are scattered and generally of lower quality, dominated by small retail stores, convenience stores, and wholesale goods. At the same time, a significant proportion of the area's land is occupied by service-oriented businesses such as auto parts, funeral services, and logistics, or is disorderly mixed with other commercial functions, resulting in low-quality street frontages and a passive commercial atmosphere.

In terms of business mix, there is a marked misalignment between the district's existing commercial offerings and the needs of the university population concentrated at SCUT North Campus. Social-oriented commercial spaces catering to young consumers — such as cafés, casual dining, cultural and creative retail, and co-working spaces — are extremely scarce; only scattered businesses of this type are in a nascent state, and no economies of scale have yet been achieved. The accommodation sector is dominated by budget hotels, with a notable absence of quality short-term rental or youth apartment products suited to faculty, students, and visitors.

Overall, the district's existing commercial system has failed to adequately activate the foot traffic advantages generated by Tianhe Coach Terminal as a transit interchange hub, or the consumer potential represented by SCUT North Campus. Both the TOD locational value and the demographic dividend from the university population remain in a state of low-efficiency utilisation.

5.2.2.3 Deficiency of Public Space

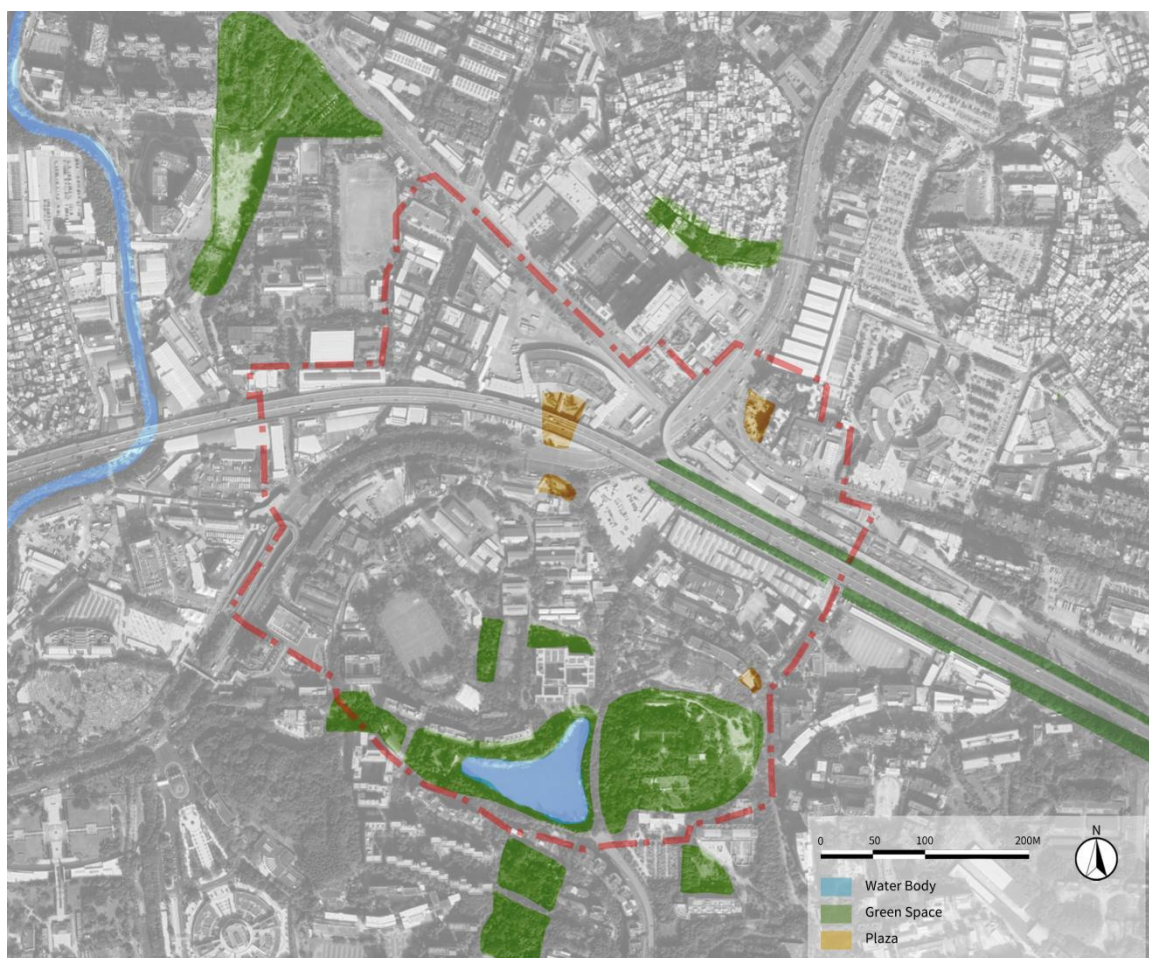


Figure 5- 16 Current Status of Public Green Spaces
(Source: Drawn by the Author)

The district lacks concentrated urban public green spaces; existing green spaces are scattered, and the larger plaza-style green areas are mostly located within university campuses, with limited accessibility to the general public. At the level of urban open interfaces, the Tianhe Coach Terminal Plaza is the only large-scale public space in the district. The Guangzhou Ring Expressway provides protective green belts along its eastern section within the area, while its western section passes directly through the interior of the neighbourhood, generating a negative impact on the surrounding environment; the continuity and accessibility of public spaces are both constrained as a result.

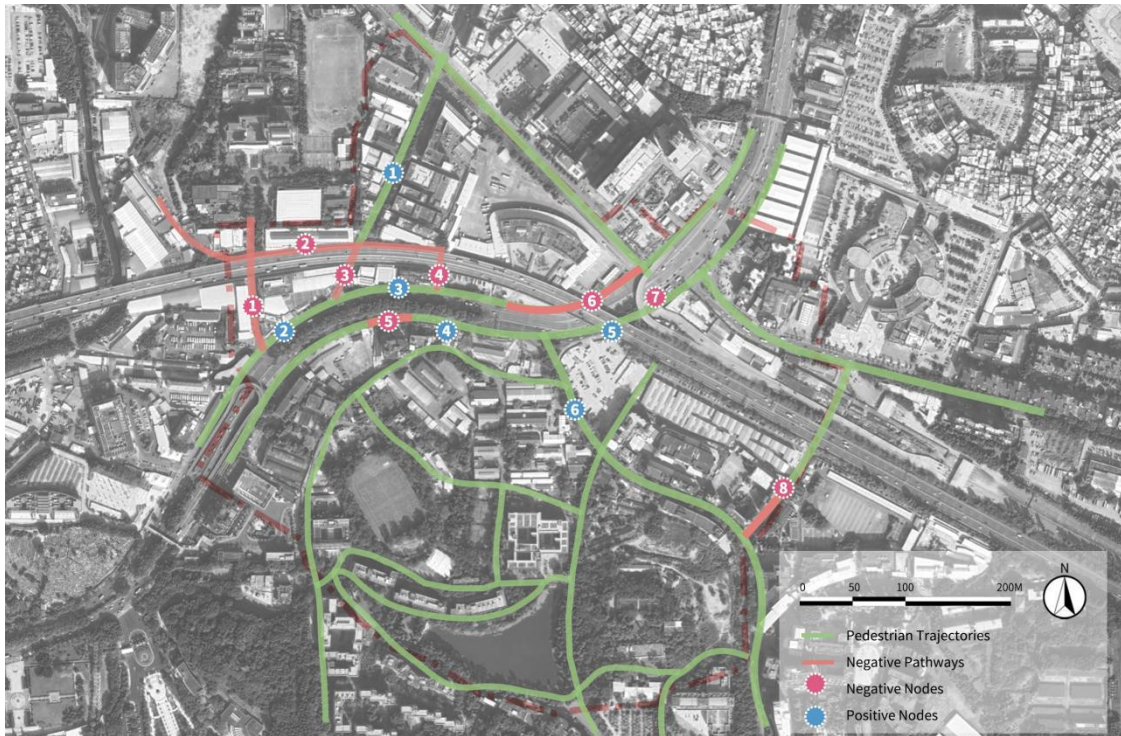


Figure 5- 17 Current Status of Pedestrian Streets
(Source: Drawn by the Author)

Table 5- 2 Road Junctions with Development Potential

No.	Actual Photo	Measured Distance	Existing Condition Assessment
1		/	Primarily utilized by shop extensions and vehicles
2		3 m	Originally quite wide, a significant portion is used for outdoor seating from Yuan Gang Food Street
3		Varies between 2 and 3 meters (Irregular)	The pedestrian walkway was originally somewhat narrow, and some shops have extended their structures outward, which has further reduced its width.
4		/	The lighting is soft and intimate.

No.	Actual Photo	Measured Distance	Existing Condition Assessment
5		3.8 m	Due to the high perimeter wall of the police station, the pedestrian walkway appears narrow
6		/	Occupied by a sanitation rest station and vehicles
7		4.8 m	The path is wide overall, but electric scooters are parked on both sides, which limits the clear space for walking.
8		/	There is only a roadway; a separate pedestrian area is yet to be designated.

(Source: Compiled and drawn by the Author)

Table 5- 3 Active Road Junctions

No.	Actual Photo	Measured Distance	Existing Condition Assessment
1		9.5	Fairly wide
2		8 m	Wider
3		4.5 m	Wider
4		15 m	Wider
5		9 m	Wider
6		5.3 m	Fairly comfortable

(Source: Compiled and drawn by the Author)

In terms of the pedestrian environment, the overall walking experience in the district is poor, with problems concentrated in the following aspects: sidewalk widths in some sections are insufficient, and the absence of designated non-motorised vehicle lanes results in widespread pedestrian-vehicle conflict; shop encroachments and the disorderly parking of motor vehicles and electric bikes have led to large-scale occupation of sidewalks, further compressing available passage space; north-south pedestrian connectivity is poor, as major arterial roads sever the surrounding space and crossing points are severely inadequate; parking demand is high and management is disordered, with a severe shortage of electric vehicle parking spaces and the absence of systematic planning for motor vehicles, coaches,

and trucks, producing widespread illegal parking that further compounds the disorder of the public realm.

5.2.2.4 Weak Place Identity

The district as a whole lacks distinctive spatial imagery and place identifiers, making it difficult for users to develop a sense of familiarity with or belonging to the area. At the university interface level, the boundary zone between SCUT North Campus and the district is devoid of any landmark architecture, landscape nodes, or wayfinding elements; looking toward the campus from the district's main roads, the view consists solely of perimeter walls and low-quality commercial frontages along the street. The academic atmosphere and cultural ambiance that a key university should project are entirely absorbed into the urban fabric, and a pedestrian without navigational assistance is almost entirely unable to perceive the presence of a major research university. This stands in marked contrast to the Ambience Spillover effect that is commonly observed at university boundaries in both domestic and international case studies. At the district-wide level, the site lacks spatial sequence and visual focal points; individual plots are separated by walls, viaduct piers, and passive setback spaces, and no continuous or legible public space system has been formed. Users moving through the district experience poor spatial orientation and weak destination awareness, making the establishment of place identity difficult.

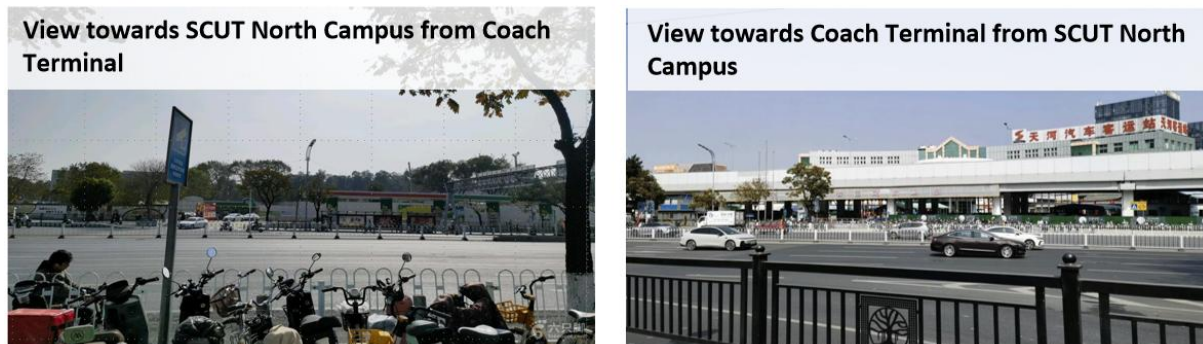


Figure 5- 18 : Current Site Conditions
(Source: Drawn by the Author)

5.2.3 Fractured Industry-Innovation Ecosystem

5.2.3.1 Low Alignment between Industry and University Disciplines

The district's existing industries are predominantly concentrated in low value-added segments at the downstream end of the production chain, centred on traditional service sectors such as auto parts, logistics, and low-end wholesale. The alignment between these industries and the priority disciplinary strengths of the adjacent South China University of Technology

and surrounding research institutes is extremely low. This structural mismatch means that, despite a high degree of physical proximity between "industry" and "research," no effective functional coupling mechanism exists: research outcomes cannot find corresponding industrial recipients locally, and industrial development is unable to draw on technological supply from the university resources immediately adjacent to it. The spatial proximity of supply and demand has failed to translate into substantive innovation collaboration, and knowledge spillover effects have remained in a state of low efficiency over an extended period, making it difficult for an Industry-Research Conversion Loop to form within the district.

5.2.3.2 Insufficient Innovation Carrying Capacity

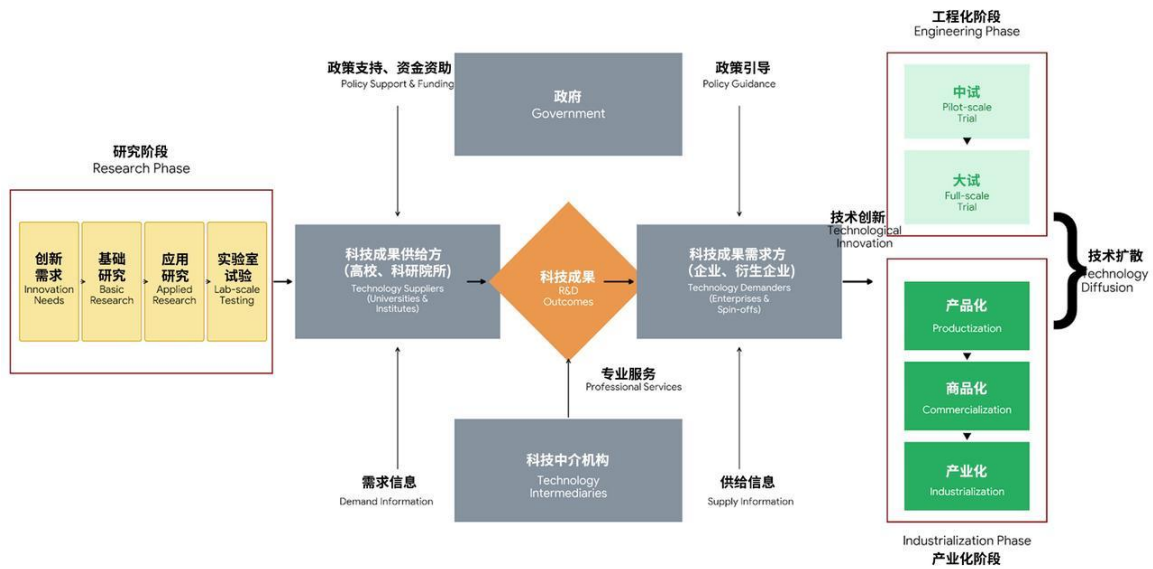


Figure 5- 19 Innovation Chain

(Source: Author's adaptation from reference materials)

A structural misalignment exists at the supply-demand interface. Research institutions focus predominantly on basic research, producing a large volume of outputs in the form of papers and reports, while outputs related to industrial technology application and practice are comparatively limited; scientific and technological achievements and market demand are thus in a state of disconnection, requiring industrial platform intermediaries to provide directional guidance. With regard to the alignment between achievements and the market, the prevailing evaluation system of "prioritising academia over the market" has resulted in research output being oriented primarily toward academic publication, with market-facing applied research outputs remaining limited owing to considerations of scale and impact. Supply-demand matching mechanisms are also in need of strengthening: enterprises generally lack specialised departments for identifying and evaluating research outcomes, while the technology transfer

departments of universities and research institutes have limited service capacity and rely on conventional methods of external promotion, making it difficult to efficiently match scientific and technological achievements with suitable industrial recipients; technology transfer itself involves complex dimensions including legal matters, policies, intellectual property, and business models, all of which require targeted, end-to-end support from specialised institutions. The weakness of the engineering phase constitutes a critical bottleneck constraining the extension of the transfer chain: moving toward industrialisation requires comprehensive consideration of engineering factors such as cost, output, yield, and process equipment, and transfer outcomes are subject to considerable uncertainty, depending on the collaborative effort of engineers and scientists; however, the capacity of most enterprises to absorb scientific and technological achievements is insufficient, Pilot Testing equipment is largely concentrated in large enterprises and not open to external parties, universities and research institutes have limited pilot testing facilities, and small and medium-sized enterprises lack the capacity to establish their own pilot testing facilities, leaving the implementation conditions for the engineering phase severely deficient.



Figure 5- 20 Feedback from Relevant Stakeholders
(Source: Author's adaptation from reference materials)

The incompleteness of the science and technology service support system further constrains the efficiency of technology transfer. The level of specialisation in intellectual property (IP) services is an important factor influencing technology transfer; the district's existing IP service provision is insufficient to ensure timely and effective protection of innovative achievements or to provide stakeholders with comprehensive coverage of IP information in relevant fields. With regard to technology intermediary services, against the backdrop of highly specialised industries, demand for third-party independent testing and inspection services continues to rise; such services help reduce hardware barriers and promote

industrial technology iteration, yet the supply of these services within the district is markedly inadequate. In terms of technology promotion services, the dissemination, exchange, transfer, and application of scientific and technological achievements all depend on corresponding promotion service support; existing mechanisms remain incomplete, constraining the full realisation of the utility of science and technology.

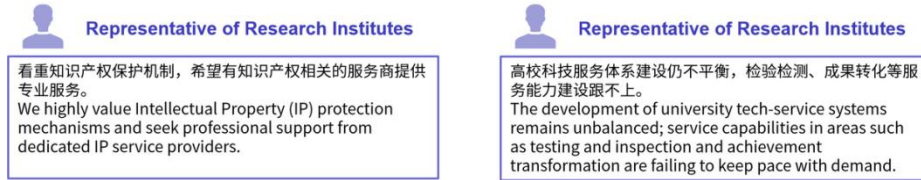


Figure 5- 21 Feedback from Relevant Stakeholders
(Source: Author's adaptation from reference materials)

The absence of science and technology innovation spaces constitutes a direct physical obstacle to the implementation of innovation activities. The Huanwushan area faces a significant shortage of research facilities and supporting spaces. In terms of R&D and production spaces, there are evident gaps in office space for research institutions and partner enterprises, laboratories for core technology and product development, and Pilot Testing spaces for scaling up experimental production, all of which require urgent expansion to support the enhancement of regional innovation capacity. In terms of functional support facilities, industrial support spaces for hosting academic conferences, results exchanges, and exhibition and matchmaking events are severely lacking, as are living support spaces providing talent apartments and commercial amenities; the practical concerns of research personnel remain inadequately addressed, further weakening the district's capacity to accommodate and attract innovation actors.



Figure 5- 22 : Feedback from Relevant Stakeholders
(Source: Author's adaptation from reference materials)

5.2.4 Absence of Multi-stakeholder Coordination Mechanisms

The regeneration of the SCUT-Tianhe Coach Terminal District involves diverse stakeholders, including the government, universities, village collectives, state-owned

enterprises, private business owners, and community residents. However, no formal collaborative governance framework covering these stakeholders has yet been established within the district; interactions among these entities have long remained informal and infrequent, making it difficult to generate the collective momentum needed to drive systematic regeneration.

In terms of property rights structure, the area features a coexistence of state-owned land, village collective land, and privately owned land; property rights relationships are complex and interest boundaries are ill-defined, such that in the absence of an institutionalised negotiation platform, any regeneration initiative involving multiple property rights holders incurs significant coordination costs. The relationship between universities and the city similarly perpetuates the self-contained logic of the Danwei Compound era: no regular communication or cooperation mechanism has been established between the university administration, local government, and surrounding communities, and the opening and sharing of campus resources lacks institutional safeguards. Industry-university-research collaboration between enterprises and universities is primarily project-based and ad hoc, lacking a stable institutionalised engagement platform; mechanisms for knowledge transfer and benefit distribution remain unclear, making it difficult to translate collaborative intent into sustained coordinated action. These deficiencies at the institutional level have left the district's spatial resources and innovation factors in a prolonged state of dispersal and closure; the multi-stakeholder collaborative ecosystem required for University-City Symbiosis has yet to take shape.

5.2.5 Integrated Problem Assessment

Based on the analysis of the four levels above, the intrinsic structure of the district's challenges may be assessed. From the perspective of University-City Symbiosis, the SCUT-Tianhe Coach Terminal District inherently possesses the locational conditions to serve as an Intermediate Domain between the university and the city — Metro Lines 3 and 6 converge here to form a transfer hub, and the site's northern boundary directly adjoins SCUT North Campus. However, the physical severance caused by elevated highways and major thoroughfares, the enclosing logic of Danwei Compound walls, and the fragmentation of Juxtaposed Urban Fabrics together produce an interface obstruction at the spatial level; at the same time, the prolonged absence of institutional negotiation channels among multiple stakeholders has left resource flows between the university and the city without structural support. Structural barriers at both the spatial and institutional levels have jointly caused the

persistent dysfunction of a University-City Interface that should, by virtue of its location, be highly interactive.

Against this backdrop of structural dysfunction, the deficiency of spatial vitality and the Fractured Industry-Innovation Ecosystem are symptomatic manifestations at the level of university-city interaction. Where pedestrian flows cannot effectively reach the interface zone, vitality cannot accumulate there; where a functional interface between the university and enterprises is absent, knowledge transformation lacks spatial support. In terms of their underlying causes, both issues are also shaped by factors such as historical land use and regional industrial structure, and are not solely attributable to interface dysfunction; however, from the perspective of University-City Symbiosis analysis, repairing the structural barriers at the spatial and institutional levels is the priority prerequisite for addressing these two categories of problems.

5.3 Summary of This Chapter

This chapter provides a systematic analysis of the SCUT-Tianhe Coach Terminal District from two perspectives: site overview and resource conditions, and diagnosis of current issues. The former traces the developmental trajectory of the coach terminal and SCUT North Campus, their current layout, and the resources available for regeneration—including policy, university, industry, and demographic conditions; the latter identifies four core issues: Fractured Spatial Connectivity, deficiency of vitality and quality, a Fractured Industry-Innovation Ecosystem, and the absence of collaborative mechanisms. Through integrated assessment, the underlying structural causes are revealed: Dual Obstruction at the spatial and institutional levels has led to the persistent dysfunction of the University-City Interface, from which functional deterioration has been derived.

When the three regeneration principles distilled in Chapter 4 are examined within the context of this district, it becomes evident that they share an inherent Precondition Structure for implementation: Spatial Connectivity and Openness serves as the physical prerequisite for the realisation of both Functional Hybridity and Symbiotic Implantation and Multi-stakeholder Co-governance and Activation. If the physical separation of the University-City Interface is not repaired, both functional symbiosis and collaborative governance will lack the basic spatial carriers upon which to operate. The conclusions revealed by this site analysis will be specifically addressed in the design proposals and guidelines framework presented in Chapter 6.

Chapter 6 Regeneration Design for the SCUT-Tianhe Coach Terminal District

Guided by the principles distilled from the aforementioned theoretical framework and case studies, this chapter combines the current conditions and identified issues of the SCUT-Tianhe Coach Terminal District to propose systematic regeneration strategies across three levels: spatial, functional, and institutional.

In terms of objectives, the proposal establishes the direction of regeneration at both the macro and meso-micro levels. At the macro level, as a key node within the Huanwushan Innovation Source Area and adjacent to the SCUT North Campus, the district bears the spatial responsibility of transmitting university innovation resources to the city and strengthening the functions of the regional science and technology innovation center; the regeneration design must effectively respond to this planning orientation. At the meso- and micro-levels, the proposal aims to transform the currently fragmented and inefficient university-city interface zone into a symbiotic zone where knowledge, innovation, and public life elements flow continuously, enabling the spatial resources and human activities of both the university and the city to interpenetrate and mutually activate one another, propelling the site's transformation from a transit node into a diverse and multifunctional destination for innovative living.

In terms of strategic composition, this chapter unfolds around three progressively layered design strategies. Spatial connectivity and interface restoration addresses the most pressing physical barriers in the district, focusing on issues such as the elevated road network that severs north-south connections, campus walls that enclose the university-city interface, and the lack of organisation in the public space system; the primary task is to establish a continuous and accessible spatial framework. Functional hybridity and symbiotic space implantation intervenes upon this spatial framework, responding to the functional problems of a fragmented industry-innovation ecosystem and insufficient vitality by systematically implanting innovation carriers, mixed-use programmes, and three types of symbiotic spaces into the site. Multi-stakeholder co-governance and activation operates at the institutional and operational level, addressing the root barrier of a long-absent multi-stakeholder coordination mechanism by constructing a system of place identity and governance that supports the sustainable operation of symbiotic relationships. These three strategies progress sequentially from the physical to the functional and from the functional to the institutional, collectively

forming the overall intervention framework for the district's regeneration.

In terms of design basis, the proposal draws upon the "1+N" Master Plan and Implementation Plan for the Huanwushan Innovation Source Area and the Regulatory Detailed Plan for the First-Phase Projects of Yuangang Village and Changban Village, and the Shangyuangang Plot in the Huanwushan Innovation Source Area of Tianhe District as background references, adopting differentiated approaches for the various plots within the study area. For plots with approved regulatory detailed plans that have entered the implementation phase, the approved plan layout is incorporated into the design as the existing condition; these include the SCUT Wushan Campus, North District Student Dormitory and Science and Technology Innovation Building Project (Plot 1) and the Phase I Project of Changban Village in the Huanwushan Innovation Source Area (Plot 2). The functional positioning and spatial layout of the aforementioned plots are based on the approved regulatory plan schemes, and the proposal comprehensively considers their connectivity with surrounding regeneration plots on this basis. For plots covered by the medium- to long-term planning for Yuangang – Changban, the actual site conditions serve as the subject of study, with the functional positioning of higher-level plans used as a reference background; the design process proceeds without presetting spatial conditions from approved schemes, ensuring that the design conclusions directly address real-world issues.

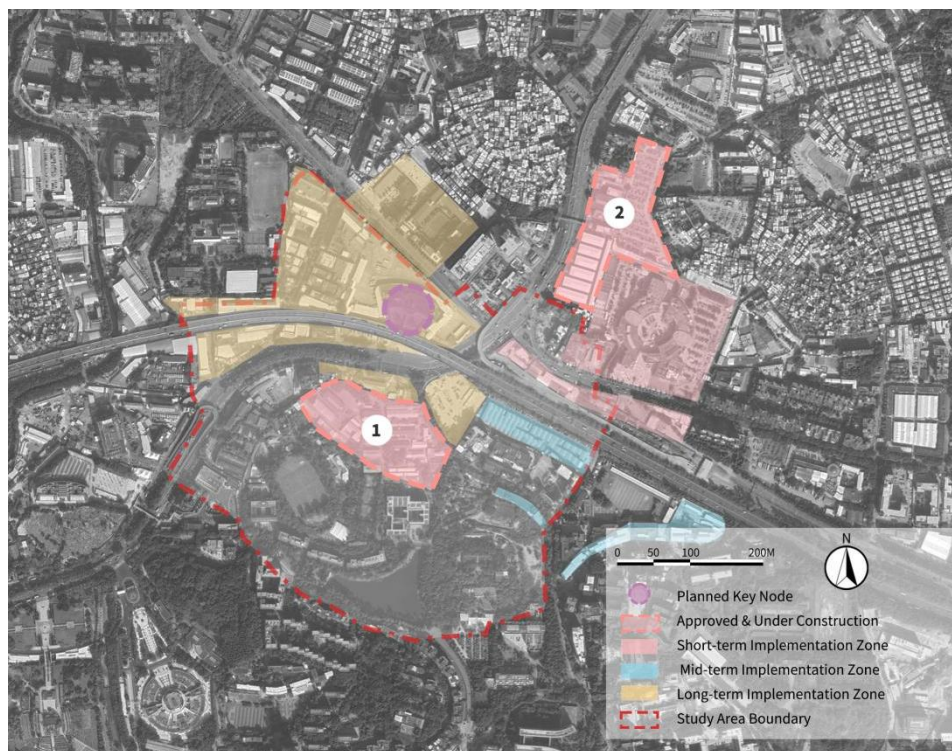


Figure 6- 1 Schematic of the Study Area and Phased Implementation of Surrounding Plans
(Source: Drawn by the Author)



Figure 6- 2 : Proposed Plan for Near-Term Construction Sites

(Source: Master Plan and Implementation Scheme for the "1+N" Renewal and Development of the Huanwushan Innovation Source Area)

6.1 Three-Dimensional Stitching and Boundary Permeation

Spatial connectivity and interface restoration constitute the highest-priority intervention level among the three strategies of the proposal. To address the structural barriers of the elevated road network severing north-south slow-traffic connections, the lack of systematic organisation in the public space system, and the long-term enclosure of the university-city interface, this section proposes design guidelines across three areas: north-south three-dimensional connectivity, construction of a public space sequence, and boundary softening and interface permeation. The aim is to establish a spatial framework that is continuously accessible and capable of sustaining vitality, thereby providing the physical foundation for subsequent functional implantation and co-governance activation.

6.1.1 North-South Three-Dimensional Connectivity

Strategy 1: Connecting the North-South Slow-traffic Network via the Guangshan Road Underground Passage

To address the severance of the north-south slow-traffic system caused by the elevated road network, a comprehensive approach combining overpasses and underground passages may be adopted to ensure the continuity of slow-traffic routes between SCUT North Campus and the SCUT-Tianhe Coach Terminal District. In sections where overhead bridge clearance is insufficient to accommodate pedestrian overpasses, priority may be given to establishing underground passages in coordination with existing metro stations and sunken plazas, leveraging the passenger concentration effect of transit nodes to enhance the accessibility and sense of security of underground spaces, so as to avoid the formation of isolated and underutilised underground pedestrian segments.

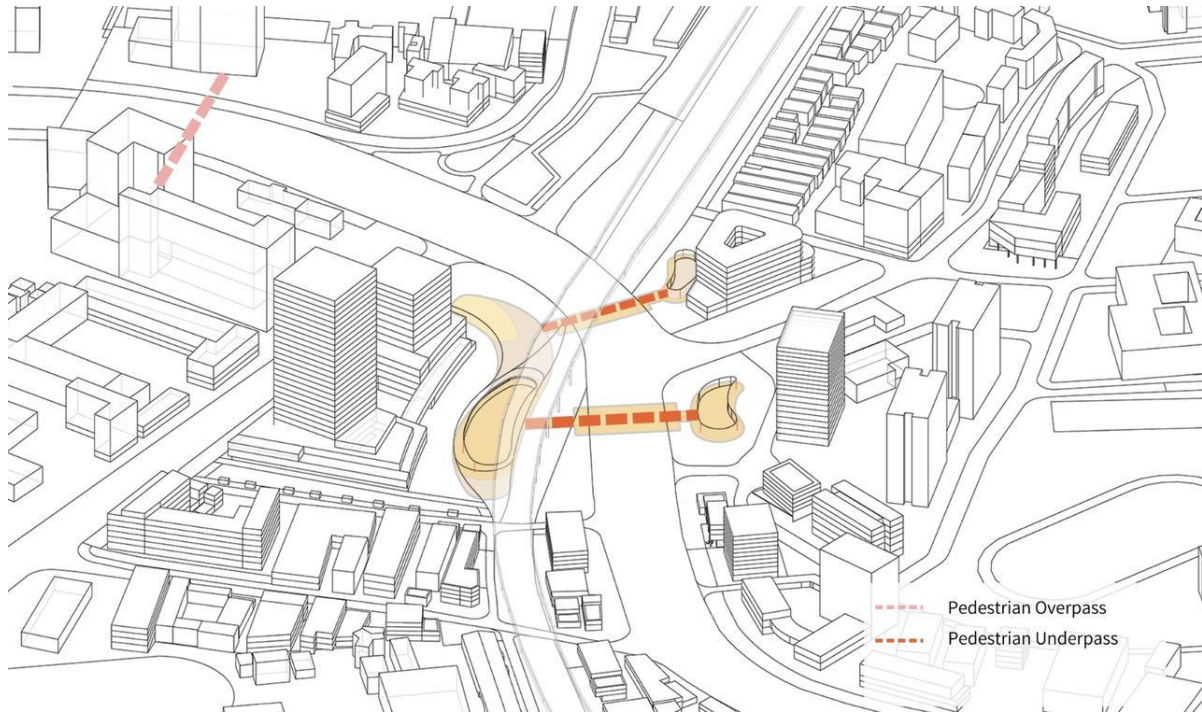


Figure 6- 3 : Underground Passage Connecting North and South
(Source: Drawn by the Author)

Strategy 2: Parkification of the Space beneath the Ring Expressway Viaduct

The space beneath the viaduct has long remained in a negative condition due to shading, noise, and inadequate management, creating a psychological barrier to north - south pedestrian connectivity. Given the persistent environmental constraints of noise exposure, insufficient daylighting, and exhaust accumulation, functional programming beneath the viaduct may be guided by activity types suited to its micro-environmental characteristics. Priority may be given to non-motorised vehicle parking areas, cycling corridors, fitness equipment, and dynamic recreational facilities such as skateboard areas, as these functions impose low demands on acoustic comfort and are thus compatible with the sound environment beneath the structure. Short-stay seating and shelter facilities may be integrated at corridor nodes to accommodate the transient dwell needs of passing pedestrians. Micro-service stations may also be introduced at suitable locations to serve both the daily needs of nearby residents and the operational requirements of municipal maintenance. In terms of planting, shade-tolerant and pollution-resistant native species are recommended, with multi-layered planting compositions to achieve noise buffering and air purification effects, thereby progressively improving both the viaduct's micro-environment and the ambient air quality of the surrounding area. On this basis, artistic intervention may be employed to enhance spatial legibility, transforming a negative void into an active interface that accommodates through-movement, dynamic activities, and short-stay uses — integrated

with the landscape corridors on both sides to form a coherent slow-traffic experiential sequence.

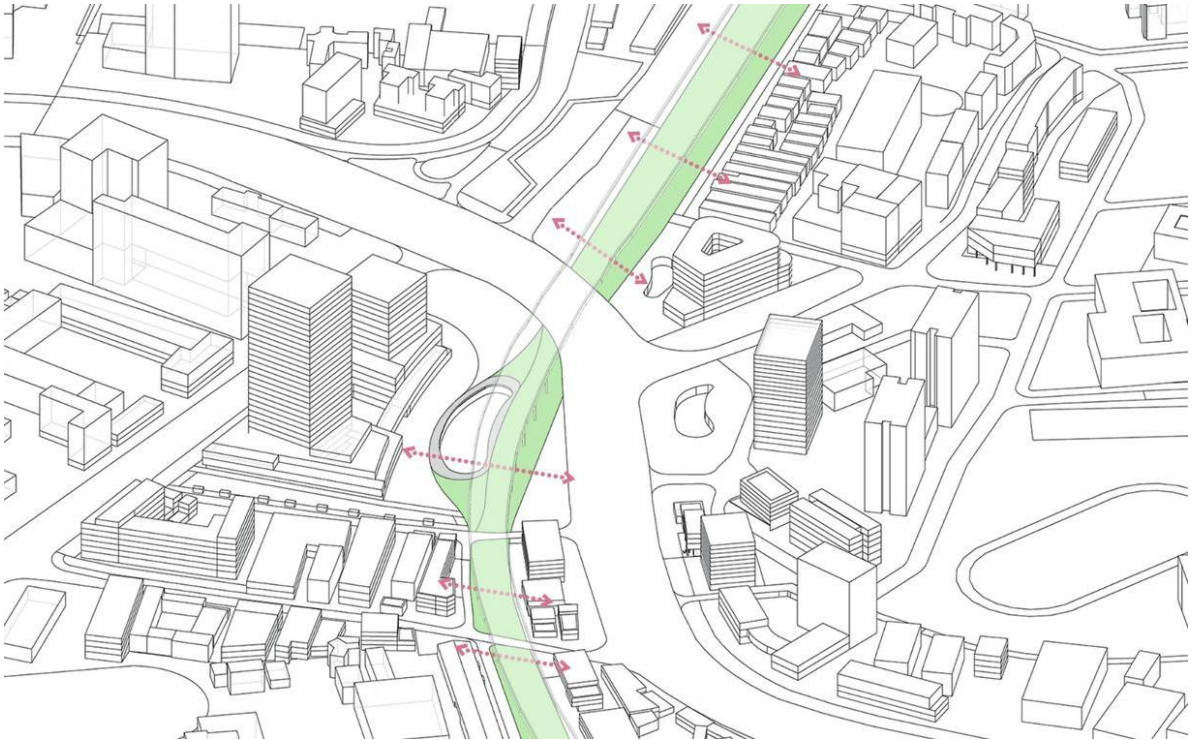


Figure 6- 4 : The Underbridge Park Bridging North and South

(Source: Drawn by the Author)



a) Before Renovation



b) Renewal Strategy



c) Post-renovation rendering



d) Post-renovation rendering

Figure 6-5 Rendering of the park under the

(Source: Drawn by the Author)

6.1.2 Construction of Public Sequences

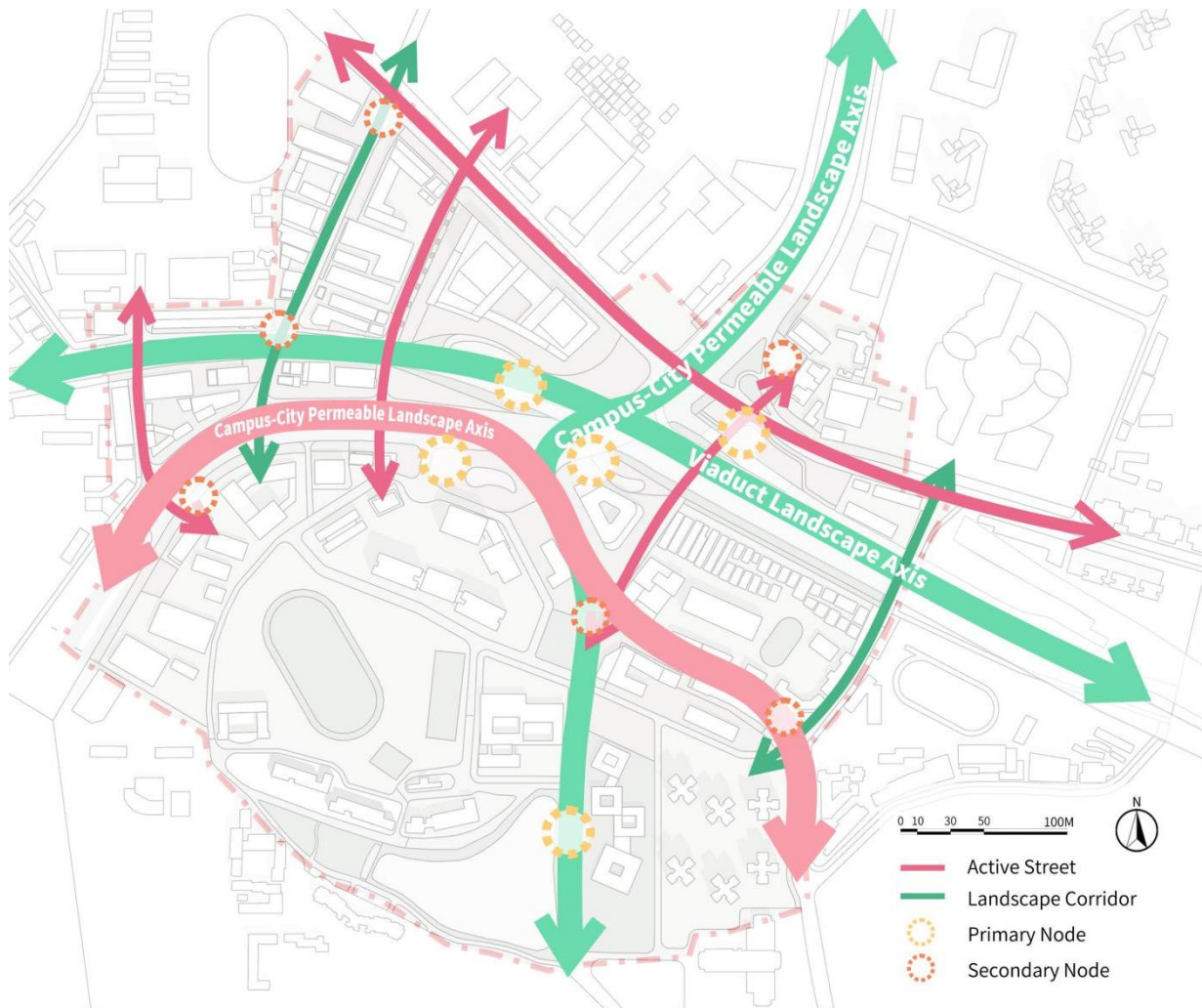


Figure 6- 6 : Public Space Sequence Diagram
(Source: Drawn by the Author)

Strategy 1: Categorized Activation of Active Street Corridors and Landscape Corridors

Drawing on the two structural frameworks of the district—active street corridors and landscape corridors—differentiated activity programmes and facility configurations are implanted accordingly. Active street corridors emphasise small-scale functional interventions; outdoor commercial setups, flexible activity spaces, and temporary exhibition frontages may be introduced along the street edge, and ground-floor functions may extend outward to activate the transitional grey zones between buildings and streets, forming a continuous and vibrant street interface. Landscape corridors emphasise the integration of natural scenery and recreational functions; multi-layered vegetation may be used to establish an ecological canopy base, public seating and small-scale landscape amenities may be systematically arranged, and sunken rest areas or elevated platforms may be introduced at suitable locations in response to topographical variations, thereby enriching the spatial layering.

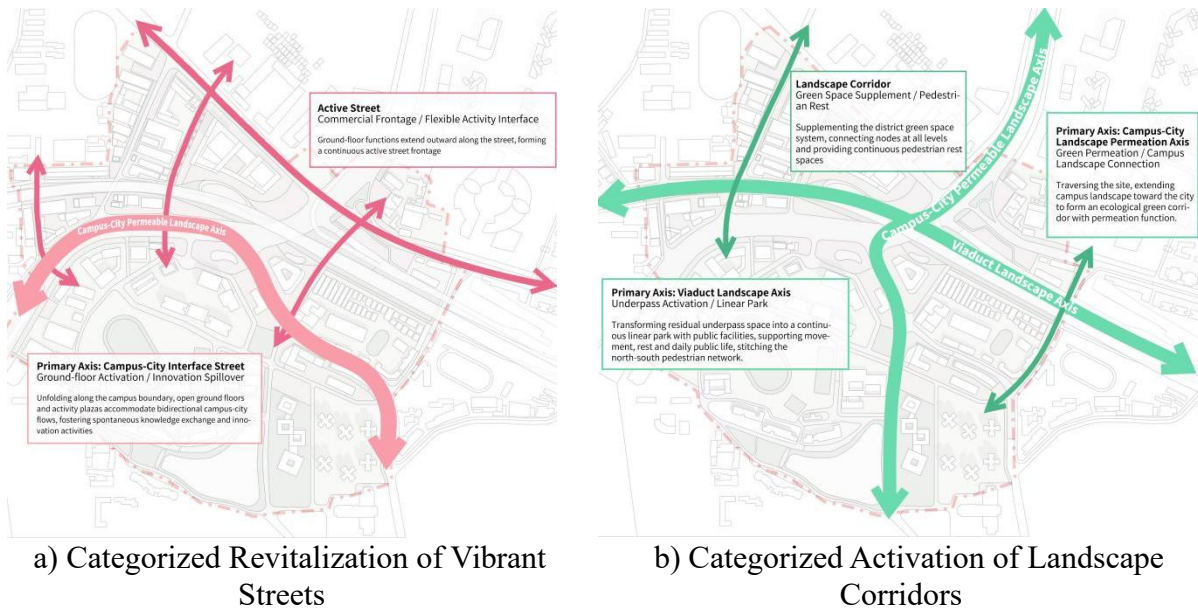


Figure 6- 7 Schematic Diagram of Categorized Activation of Active Street Corridors and Landscape Corridors
(Source: Drawn by the Author)

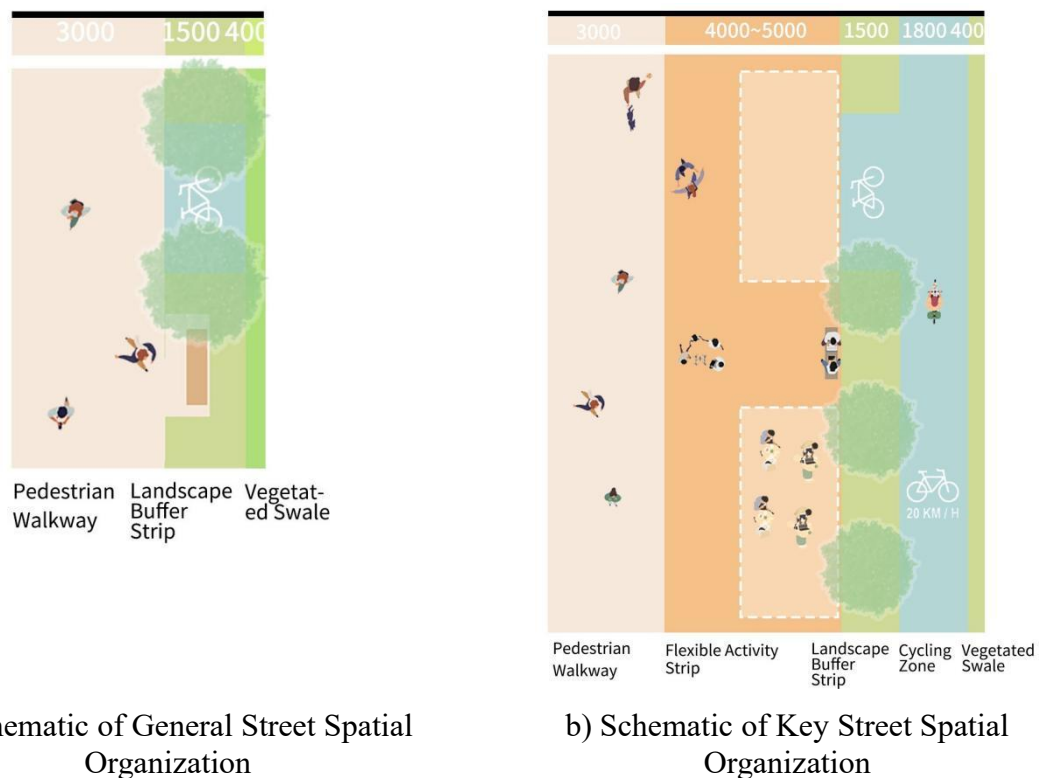


Figure 6- 8 Schematic of Street Spatial Organization
(Source: Drawn by the Author)

Strategy 2: Hierarchical Configuration of Public Nodes

Based on the hierarchical classification of primary and secondary nodes within the public space structure, differentiated spatial scales and facility configurations are prescribed for each node. Primary nodes may reserve flexible spaces capable of hosting collective activities such as gatherings, performances, and markets, with necessary basic service facilities provided

accordingly. Secondary nodes may focus on small-scale lingering functions, equipped with modular seating, small-scale display installations, and shelter facilities to accommodate daily brief stays and informal interactions.

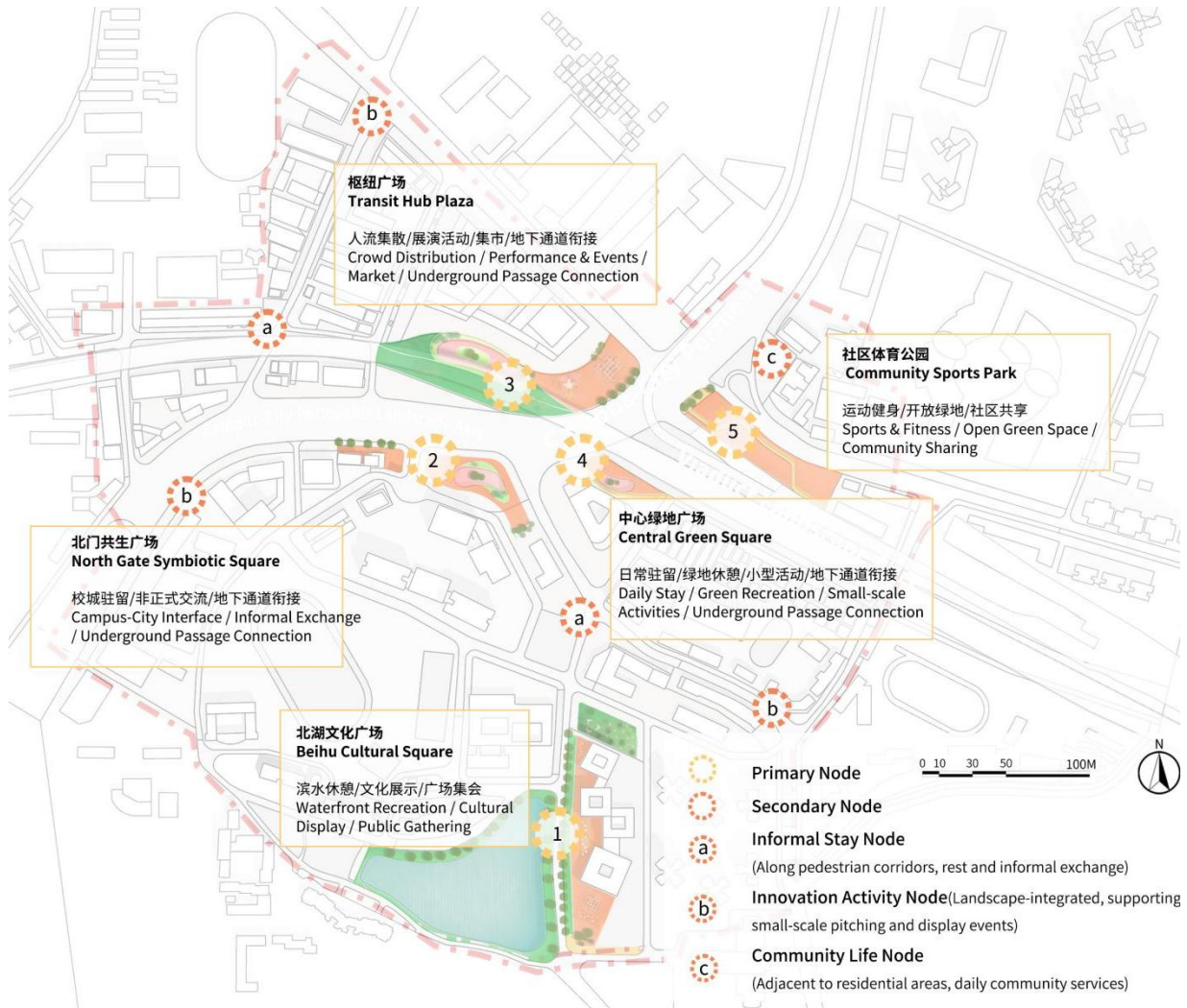


Figure 6- 9 : Schematic Diagram of Hierarchical Configuration of Public Nodes
(Source: Drawn by the Author)

Strategy 3: Narrative Landscaping of Coach Terminal and Campus Memory

Narrative landscape strategies may be incorporated into the design of the public space sequence, using the transportation history of Tianhe Coach Terminal and the academic development trajectory of SCUT as narrative threads, and embedding site memories into everyday, tangible public spaces through landscape installations, paving textures, and information signage systems, thereby strengthening the area's sense of place and distinctiveness.



Figure 6- 10 : Architectural Development History of South China University of Technology
(Source: Compiled by the author based on available materials)



Figure 6- 11 Related Online Comments
(Source: Compiled from website comment sections)

6.1.3 Boundary Softening and Permeation

Strategy 1: Phased Softening of the Northern Campus Boundary Wall and Interface Permeation

The softening of the boundary wall involves questions of jurisdictional management and security maintenance along the campus perimeter. It is therefore advisable to proceed on the prerequisite that an agreement between the municipal authority and the university has been reached regarding boundary ownership adjustment and security responsibilities, adopting a phased and incremental implementation approach. Priority may be given to sections around campus entrances and those already possessing a degree of openness, as these locations present relatively lower negotiation resistance and carry stronger demonstration value — helping to accumulate collaborative experience among all stakeholders and establishing a

foundation for the softening of subsequent sections.

In terms of spatial treatment, green buffer planting may replace the more rigid segments of the physical wall, while interactive functional facilities and node-scale landscapes may be introduced around campus entrances, transforming the previously enclosed boundary into a permeable, dwellable university – city symbiotic interface. The degree of boundary softening may be calibrated to match the openness of adjacent campus functions, ensuring the relative independence of the campus core while enabling the orderly overflow of spatial resources towards the urban side.

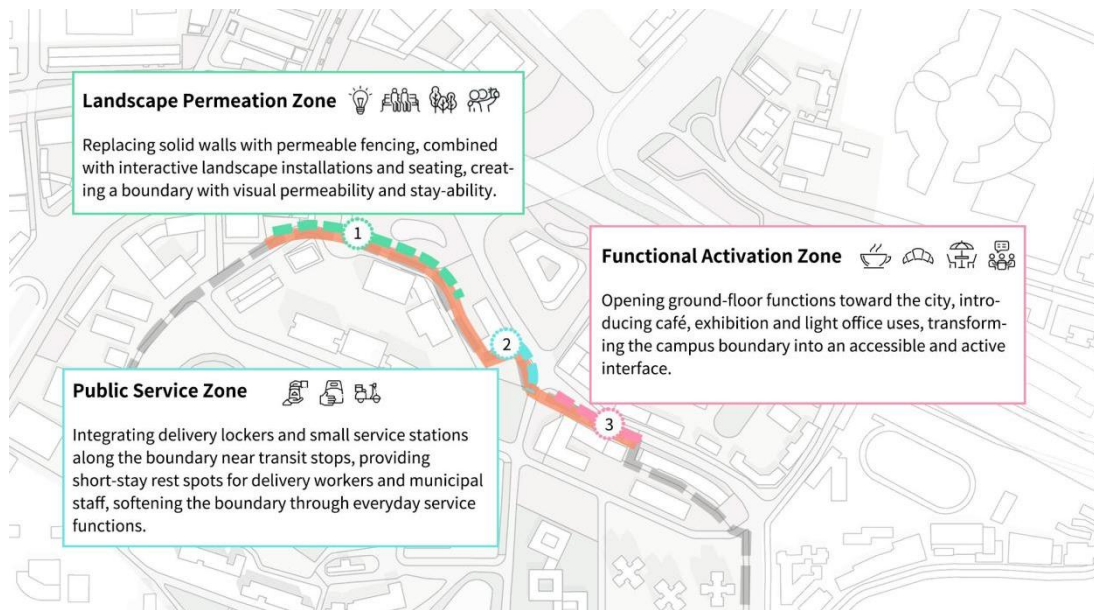


Figure 6- 12 Boundary Softening
(Source: Drawn by the Author)

Strategy 2: Anchor-point Implantation of Spillover Functions around Campus Gates

In areas adjacent to urban thoroughfares or main entrances along the campus boundary, priority may be given to positioning facilities with strong spillover attributes, including platforms for industry-academia-research collaboration, continuing education institutions, and campus cultural exhibition spaces, so that these may serve as public anchor points for campus-city interaction, leveraging their interface effect to facilitate the permeation of knowledge and activities toward the urban side. At the same time, existing campus resources such as libraries, gymnasiums, and landscaped spaces may be opened to the public on a time-slot basis when conditions permit; by leveraging university-city symbiosis circulation routes, urban visitors may be guided in an orderly manner into shared functional areas on campus, thereby achieving resource sharing while maintaining normal order in teaching and research zones.

For new buildings, architectural designs that engage in visual dialogue with adjacent

historic structures may be adopted, echoing the university's architecture in terms of formal details, facade texture, and colour palette. Along the campus boundary, stepped setbacks or height restrictions may be applied to preserve the visual openness of key internal campus view corridors, thereby creating a natural visual transition zone where campus space extends into the city.

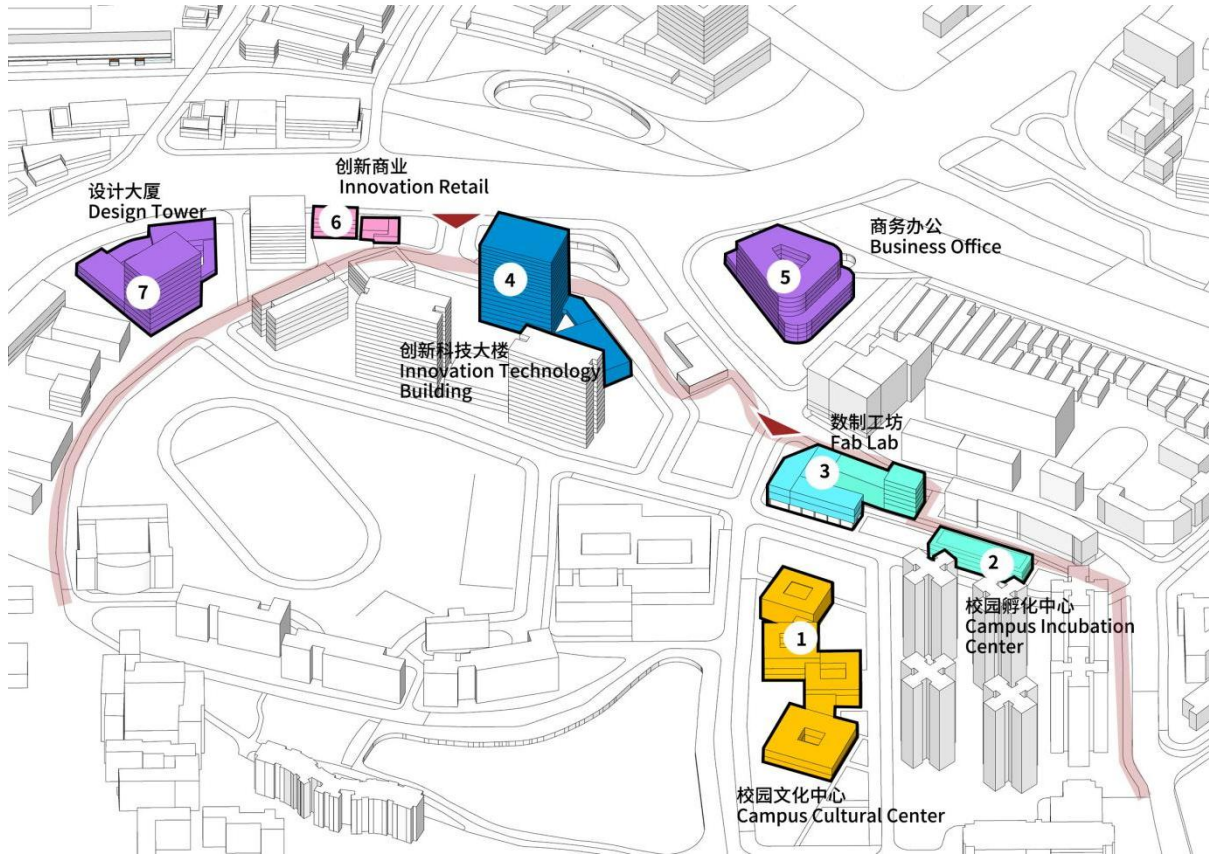


Figure 6- 13 Functional Layout at the Campus Interface
(Source: Drawn by the Author)

6.2 Hybrid Coordination and Symbiotic Implantation

Building upon the established spatial framework, this section proposes guidelines for functional hybridity and symbiotic space implantation across three aspects: the spatial framework of functional layout, spatial synergy within the innovation chain, and the implantation of three types of symbiotic spaces. The aim is to transform the district's locational advantages and university resources into a sustainable innovation functional system, addressing the functional problems of a fragmented industry-innovation ecosystem and insufficient spatial vitality.

6.2.1 Mixed-Use Configuration

Strategy 1: Functional Mix at the Land Use Level

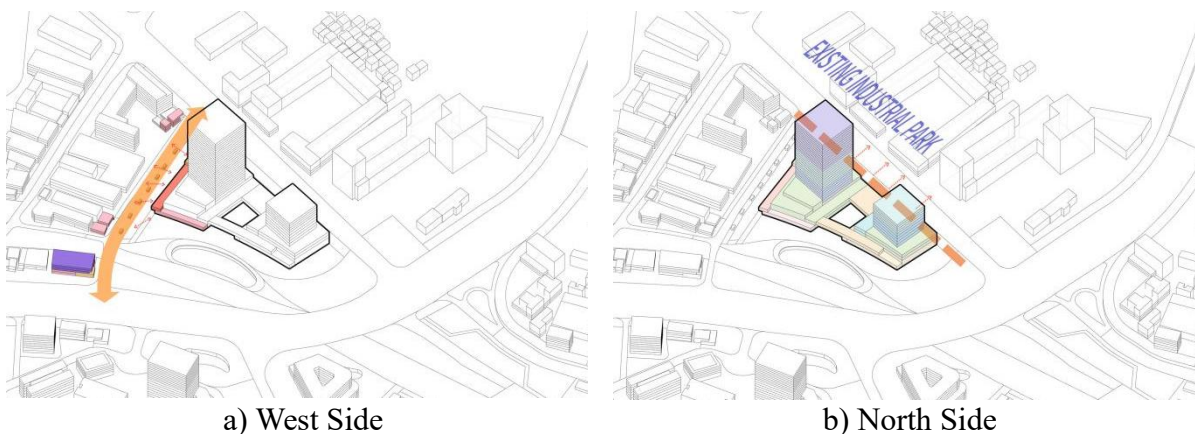
The district's regeneration may be guided by functional integration, avoiding the

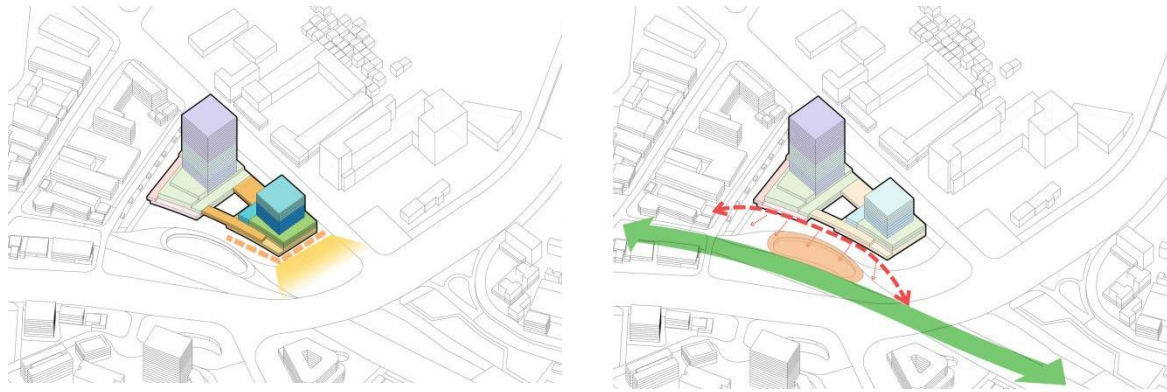
large-scale concentration of single-function land uses. In terms of land allocation, the proportion of commercial, business, sci-tech innovation, and mixed-use land may be moderately increased to promote the spatial proximity of residential, employment, and innovation functions. Drawing on the experience of innovation districts, the proportion of innovation spaces may be no less than 15% of the total floor area, and no less than 75% of ground-floor facades may be allocated to commercial and public service functions to ensure street vitality and public accessibility. The overall layout may be intensive and compact, prioritising the integration of functions within existing land parcels rather than relying on outward expansion.

Strategy 2: Layout of Core Functional Anchor Points for the Tianhe Coach Terminal TOD

By fully leveraging the rail transit advantages created by the intersection of Metro Lines 3 and 6, hierarchical functional influence zones may be defined radiating outward from the core area of Tianhe Coach Terminal. Within a 5-minute walk (approximately 400-metre radius), high-density development may be pursued, with R&D facilities, core nodes of symbiotic interfaces, and mixed-use complexes prioritised, transforming rail passenger flow into a source of sustained vitality for the SCUT-Tianhe Coach Terminal District.

The Tianhe Coach Terminal itself may be regenerated as the district's Innovation Service Hub, forming differentiated functional transition interfaces in four directions: the west side may be dominated by commercial interfaces, incorporating flexible market spaces integrated with street plazas; the north side may focus on industrial services and informal innovation exchanges, featuring business support facilities, small-scale demo spaces, and salon areas; the east side may serve as the core exhibition and exchange interface for sci-tech innovation, featuring large-scale display installations and a sci-tech innovation-themed plaza; the south side may connect with open public spaces, a linear park, and a sunken plaza, creating a permeable transition from urban public spaces to the station core.





c) East Side

d) South

Figure 6- 14 Innovative TOD Integration of Tianhe Coach Terminal with the Surrounding Area

(Source: Drawn by the Author)

Strategy 3: Vertical Functional Zoning of High-rise and Mid-low-rise Levels

For different types of buildings within the district, a differentiated vertical functional zoning strategy may be adopted. For high-rise buildings, such as the twin-tower complex, the vertical logic of "public openness at the lower levels, rigid production at the middle levels, and flexible services at the upper levels" may be followed: the podium and ground floor may accommodate highly public functions such as conferences, dining, and exhibitions; the middle levels may accommodate R&D offices and industrial service organisations; the upper levels may accommodate flexible work-and-live functions such as hotels and serviced apartments, creating a 24-hour mixed-use condition. For mid-to-low-rise buildings, such as sci-tech innovation incubators, the logic of ground-floor activation and upper-level flexible adaptation may be followed: the ground floor may accommodate open classrooms, cafés, and temporary exhibition spaces; the upper levels may primarily accommodate incubation offices and open research laboratories; and the top floor or end sections may incorporate exhibition spaces that serve both public display and internal use.

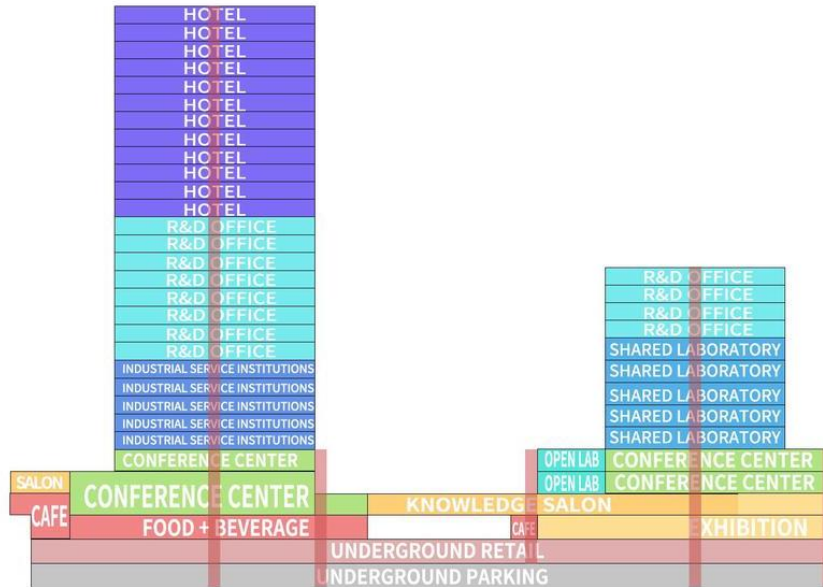


Figure 6- 15 Tianhe Coach Terminal Innovative TOD Vertical Zoning
(Source: Drawn by the Author)



Figure 6- 16 Fablab Vertical Partition
(Source: Drawn by the Author)

6.2.2 Synergy in the Innovation Chain

Strategy 1: Positioning and Synergy of Front-End Functions in the District's Innovation Chain

The implantation of innovation functions within the district may actively align with the regional innovation chain, with its role within the chain's division of labour clearly defined. The innovation chain typically encompasses three stages: research, technology transfer, and industrialisation. The district's core functions may focus on the mid-to-front end of the chain, prioritising basic and applied research, early-stage technology transfer, and comprehensive supporting services. Moving north along Tianyuan Road, functional connections with existing headquarters and business centres may be established to address the needs for technology commercialisation and capital matching at the back end of the chain. Extending outward along Yuangang Road and Changfu Road, collaboration with surrounding innovation parks may be pursued to build a network of innovation incubation bases, jointly supporting the scaled acceleration functions at the mid-stage of the chain.

Regarding the development of innovation facilities within the site, a Dual-track supply

mechanism involving both universities and the government may be established. Universities may focus on creating open innovation facilities geared toward multidisciplinary applications, including open micro-manufacturing labs, living labs, and university-industry joint experimental platforms; collaboration among students, faculty, and corporate R&D personnel within the same space may thus be fostered. The government, in conjunction with the Innovation Service Hub, may provide Pilot Testing platforms, shared laboratories, and supporting entrepreneurial services, made available to social entrepreneurs and small and medium-sized sci-tech enterprises. These two types of platforms complement each other's functions, together forming a complete innovation support chain spanning from basic research to Pilot Testing.

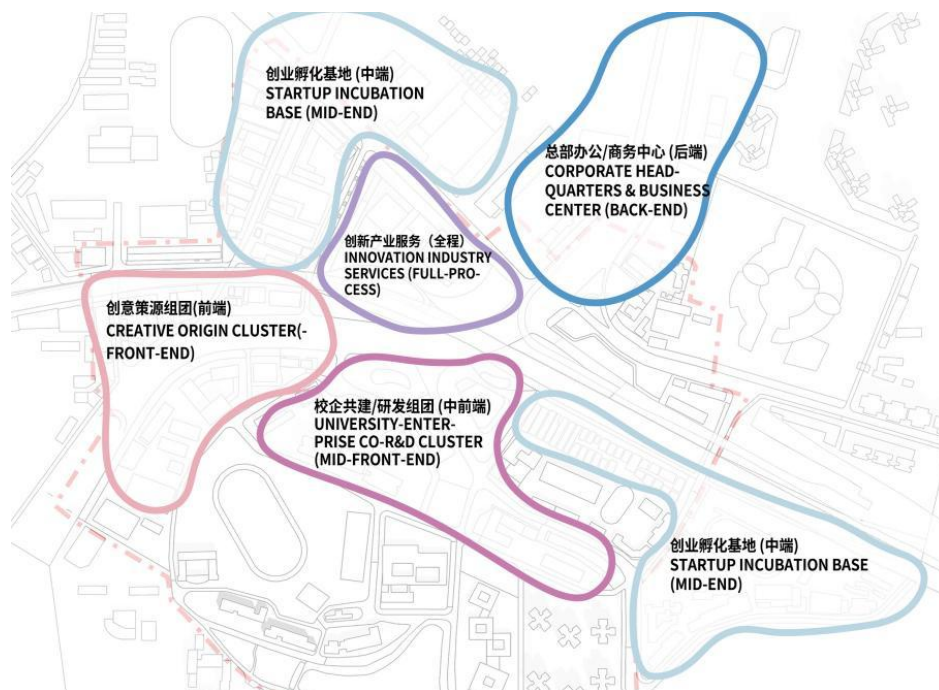


Figure 6- 17 Synergy of the Innovation Chain in the SCUT-Tianhe Coach Terminal District
(Source: Drawn by the Author)

6.2.3 Symbiotic Space Implantation

Building upon the established functional layout framework and innovation chain synergy, three types of symbiotic spaces intervene as catalysts. Through the realisation of specific spatial prototypes, they activate knowledge flow, innovation convergence, and community co-creation between the university and the city.

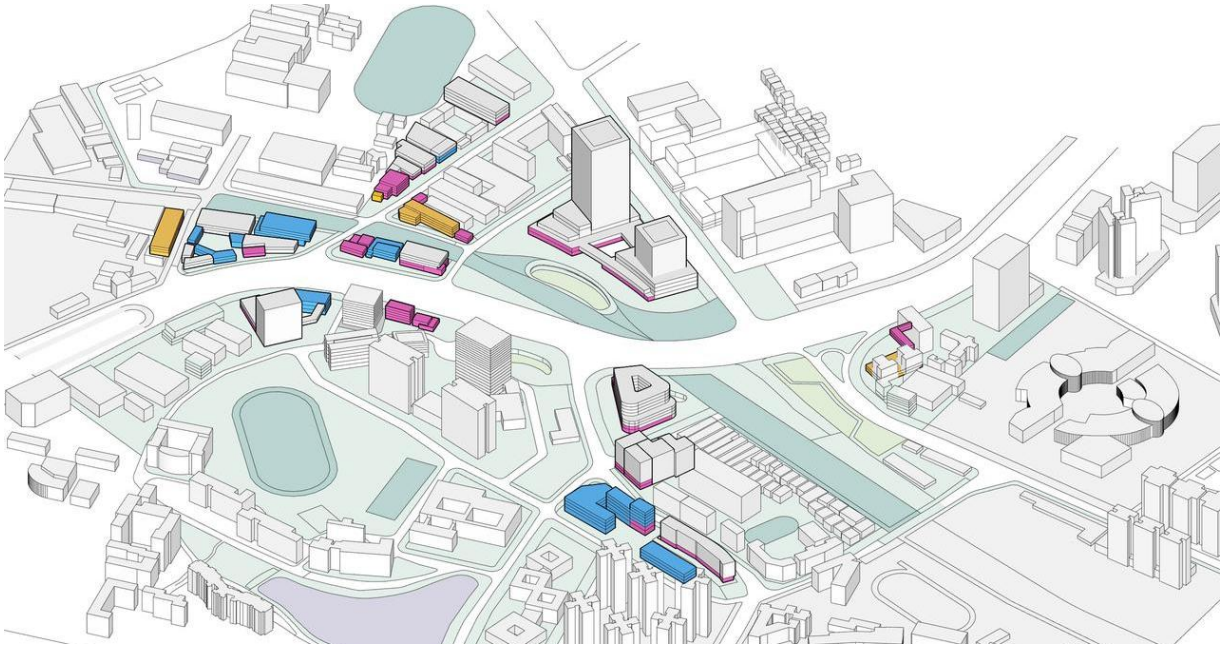


Figure 6- 18 Distribution of Symbiotic Spaces
(Source: Drawn by the Author)

Ubiquitous Knowledge Space

With knowledge spillover and two-way flow as core objectives, these spaces are tiered based on scale and functional intensity. Medium-scale interventions, represented by multidisciplinary open laboratories, integrate interdisciplinary tools and resources and are open to both on-campus and off-campus users; collaborative research spaces may be introduced within newly constructed design-oriented facilities in the district, providing a physical platform for the intersection of design practice and scientific research. Small-scale interventions primarily take the form of living labs, distributed throughout the district according to specific industrial sectors to form a network of knowledge catalysts, thereby activating informal learning and R&D exchanges within everyday spaces.

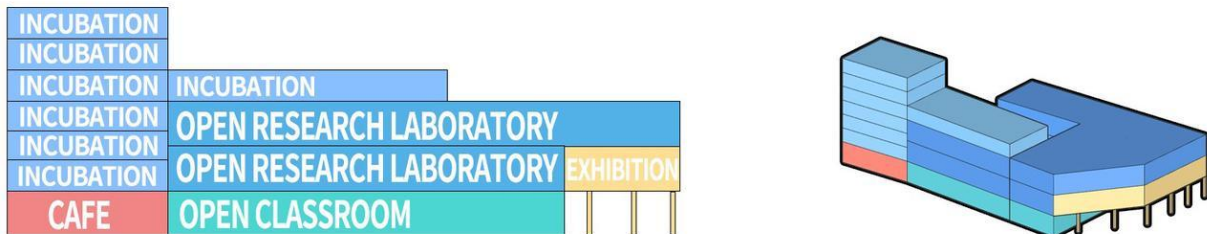


Figure 6- 19 : Schematic of a Single Building in the Ubiquitous Knowledge Space
(Source: Drawn by the Author)

Hybrid Innovation Space

Aiming to facilitate the spontaneous gathering of diverse stakeholders and resource integration, these spaces transform commercial interfaces into catalysts for innovation

spillover. Ground-floor spaces may extensively incorporate low-threshold daily consumer functions, using high foot traffic to activate the interactive interface between buildings and streets, thereby providing a spatial foundation for informal exchanges. On this basis, brand operators may be encouraged to participate in the operation of co-creation spaces, producing joint commercial spaces that integrate brand exploration, creative incubation, and co-creation office functions; these spaces may be equipped with small presentation stages, exhibition areas, and flexibly partitioned light-office units, allowing commercial consumption and innovative exchange to permeate one another within the same space.

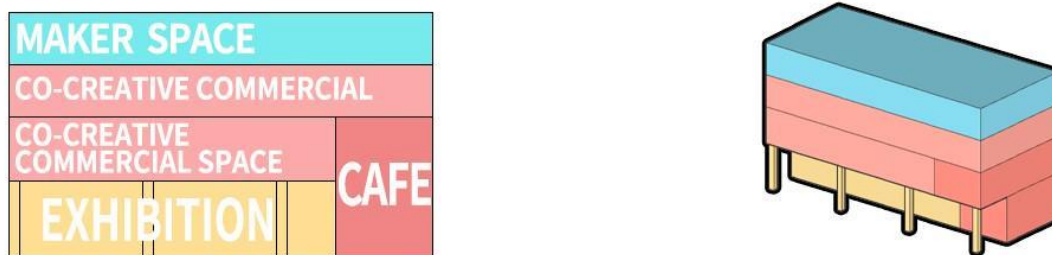


Figure 6- 20 : Schematic of a Hybrid Innovation Space Building
(Source: Drawn by the Author)

Civic Commons Space

Centred on fostering shared use and a sense of belonging, these spaces may be implemented through a joint initiative led by the government and universities. The core facility is the Community Living Room, which integrates diverse functions such as a community library, affordable maker spaces, event organisation, and information dissemination, serving as a public anchor point for daily interactions among residents, students, and entrepreneurs. The distribution of civic commons spaces may be integrated with district-level public green corridors and community living zones, to avoid the accessibility imbalances caused by concentrated distribution, ensuring that users from diverse backgrounds may easily access these spaces and develop stable usage habits. These spaces also serve as physical platforms for subsequent multi-stakeholder deliberative mechanisms; their operational logic is further elaborated in Section 6.3.

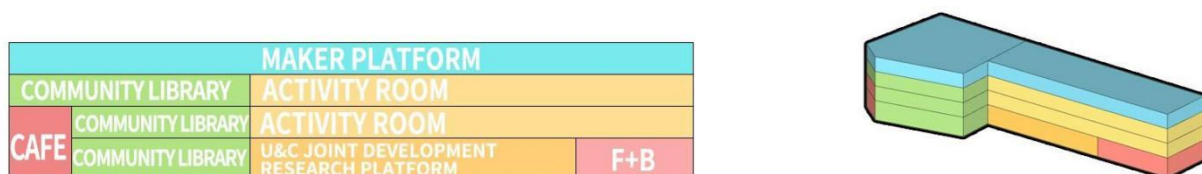


Figure 6- 21 Schematic of a Civic Commons Space Building
(Source: Drawn by the Author)

6.3 Spatial Carrier Construction and Incremental Institutionalisation

6.3.1 Construction of Co-governance Spaces

Strategy 1: Spatial Support for Scenarios Where Diverse Actors Converge

The core value of civic commons spaces lies in providing the spatial conditions for users from diverse backgrounds to encounter one another naturally within the same venue. Such encounters depend not on institutional arrangements, but on the openness, visibility, and degree of functional integration inherent in the space itself. The spatial organisation of a Community Living Room may break away from the logic of single-function zoning, juxtaposing a coffee area, light-office units, a community reading corner, and a multi-purpose activity zone within a single continuous space, enabling users with different purposes to engage in spontaneous visual contact and informal interaction, forming a daily foundation for cross-group convergence.

The integration of indoor and outdoor spaces is a key means of activating multi-stakeholder convergence. The siting of civic commons spaces may be integrated with the district's public green corridors and key plaza nodes, allowing indoor activities to extend naturally outdoors. Plazas and green corridor areas may reserve flexible activity spaces to support spontaneously organised gatherings by diverse actors—such as community markets, startup pitch events, and workshops—thereby reinforcing the interplay between daily indoor presence and event-driven outdoor gatherings, collectively fostering an atmosphere of sustained multi-stakeholder co-governance.

Strategy 2: Spatial Integration of the University-City Forum

A University-City Forum may be embedded within the Community Living Room to serve as a spatial venue for daily multi-stakeholder consultation. Rather than functioning as an independent institution, the Forum operates as an integral component of the Community Living Room's functional system, coexisting within the same continuous space alongside the coffee area, reading corner, and light-office units. Under normal circumstances, this area serves as an open, informal gathering space accessible to all; when needed, the space may be flexibly transformed into a deliberation venue where representatives from government, universities, and enterprises participate alongside community residents, allowing institutional deliberation to occur within the context of daily life rather than in a closed institutional space detached from ordinary users. The design of the deliberation hall may emphasise spatial visibility and an inclusive atmosphere, avoiding the enclosed layout of formal meeting rooms; fixed partitions may be replaced with open table and chair arrangements and flexible spatial

dividers, ensuring that any stakeholder may naturally enter and participate.

6.3.2 Establishment of Collaborative Mechanisms

Strategy 1: Constructing an Incremental Co-governance Framework for Government, Universities, Enterprises, and Communities

Multi-stakeholder collaboration mechanisms may be established by drawing on existing practices of university-city co-governance and adopting a gradual, phased approach. In the initial phase, led by the government and universities, multi-stakeholder dialogue may be initiated through civic commons spaces and joint university-city research platforms, building a foundation for cooperation through spatial operations. In the intermediate phase, building on initial cooperative experience, enterprise representatives and community residents may be gradually introduced to expand the scope of stakeholders in the consultation process, driving the consultation mechanism toward formalisation and clarifying the boundaries of each party's responsibilities regarding spatial ownership, revenue distribution, and maintenance. In the long term, the focus may shift to fostering a self-sustaining, dynamically adaptive co-governance ecosystem among all stakeholders, enabling the symbiotic relationship to continuously evolve in response to changes in site conditions and the policy environment, rather than relying on the sustained drive of a single actor.

Strategy 2: Collaborative Creation of a Soft Environment for Attracting Innovative Talent

Beyond the formal governance framework, diverse stakeholders may collaborate to foster an environment conducive to attracting innovative talent. For innovative enterprises, governments and universities may jointly provide professional services such as policy consultation, intellectual property protection, and technology transfer support, establishing a comprehensive support system covering the entire entrepreneurial lifecycle. For innovative talent, the district may offer diverse live-work support services and facilities and community interaction spaces to reduce the cost of retention. University-industry matchmaking events, startup pitch sessions, and cross-sector exchange forums may be regularly organised; through such events, the daily use of symbiotic spaces may be continuously revitalised, ensuring that the institutional co-governance framework and vibrant informal innovation exchanges mutually reinforce one another, together forming the operational foundation of the University-City Symbiosis ecosystem.

6.4 Integrated Design

6.4.1 Overall Scheme



- | | |
|---------------------------------|--|
| 1-Campus Cultural & Arts Center | 10-Community Fab Lab |
| 2-Campus Fab Lab | 11-Yuangang Food Hall Upgrade |
| 3-Campus Incubator | 12-Short-stay Apartments |
| 4-Business Office Center | 13-Tianhe Coach Terminal Innovation TOD |
| 5-Sunken Plaza | 14-Viaduct Underside Park |
| 6-Hybrid Innovation Space | 15-Sports Park |
| 7-Design Tower | 16-Innovation & Technology Building with Dormitories |
| 8-Social Inclusion Space | 17-North Lake |
| 9-Community Living Lab | |

Figure 6- 22 Master Plan of the SCUT-Tianhe Coach Terminal District
(Source: Drawn by the Author)



Figure 6- 23 Axonometric Diagram of the SCUT-Tianhe Coach Terminal District
(Source: Drawn by the Author)

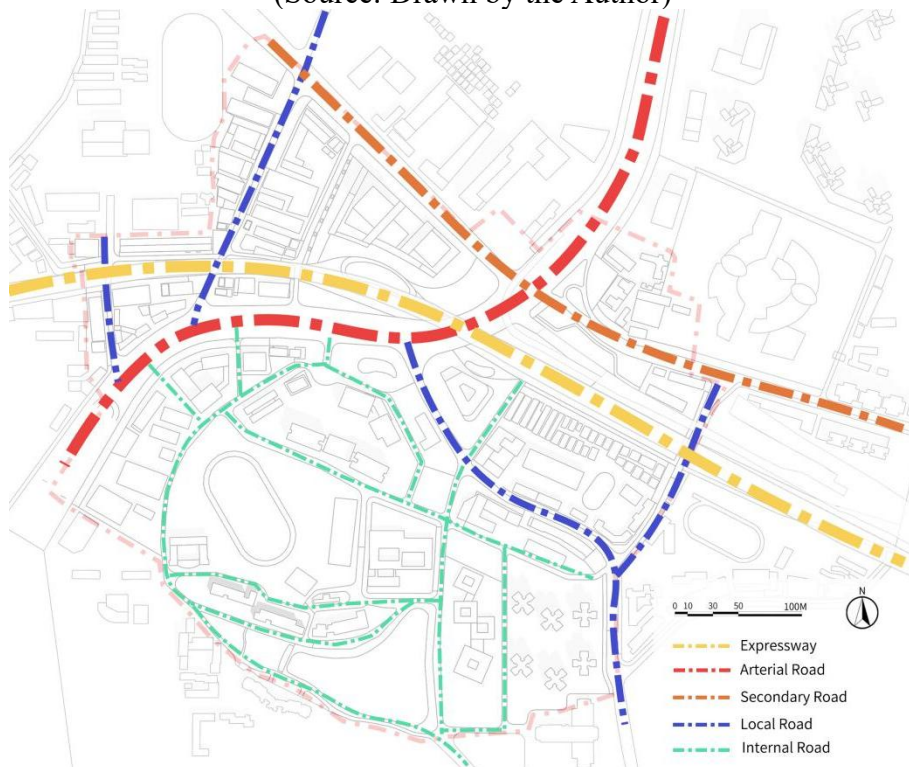
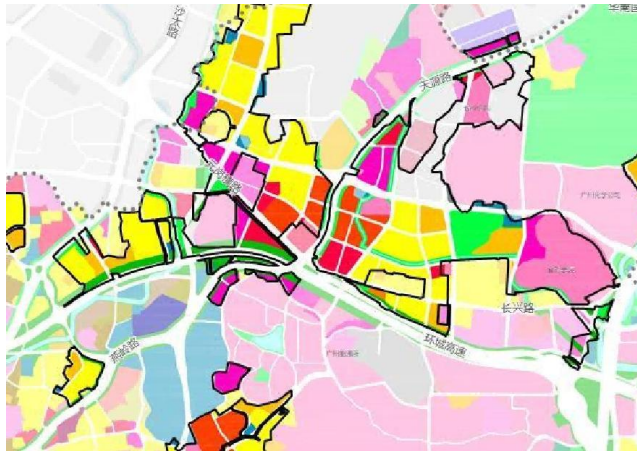


Figure 6- 24 : Road Traffic Diagram of the SCUT-Tianhe Coach Terminal District
(Source: Drawn by the Author)

In accordance with the planning coordination principles outlined in the introduction of this chapter, the proposed scheme maintains continuity with the overall framework of the upper-level planning in terms of functional positioning. The Master Plan and Implementation Scheme for the "1+N" Renewal and Development of the Wushan Innovation Source Area designates the SCUT-Tianhe Coach Terminal District as one of the "three sci-tech innovation service cores" within the region, classified as a "primary industrial service center," undertaking the composite functions of sci-tech innovation services, industrial coordination, and transportation hub. The Land Use Scheme for Urban Villages in the Changban-Yuangang District (Preliminary Draft) provides preliminary arrangements for the land use properties of certain parcels within the district. As this document remains in the preparation stage, covers a relatively large area, and addresses the district primarily at the level of overall structure — with parcel-level land use arrangements remaining framework-level guidance — and given that the research scope of this study spans multiple official planning units including Changban Village and Yuangang Village and does not fully coincide with any existing statutory planning unit, the upper-level planning has not yet provided detailed specifications for land use functions within the scope of this study.

Against this background, the proposed scheme aligns with the upper-level planning in terms of overall functional direction, sustaining the core identity of the "sci-tech innovation service core," reinforcing the composite functions of industry, education, and business, and preserving the existing capacity of the transportation hub. In terms of specific land use strategies, the scheme draws on the campus-city symbiosis perspective to elaborate the internal land use functions of the district, proposing two categories of mixed-use land — "Business & Sci-Tech Innovation Mixed Use" and "Commercial & Sci-Tech Innovation Mixed Use" — as a refined response to the upper-level positioning of "industrial service," while also offering renewal suggestions for undeveloped land and informal spaces. The proposed scheme constitutes a research-based planning suggestion, intended as a reference for subsequent planning formulation and design practice.



a) Land Use Scheme for Urban Villages in the Changban-Yuangang District (Preliminary Draft)



b) Research Scope Portion

Figure6- 25 Land Use Scheme of the Research Scope in the Upper-Level Planning
(Source: Master Plan and Implementation Scheme for the "1+N" Renewal and Development of the Huanwushan Innovation Source Area)

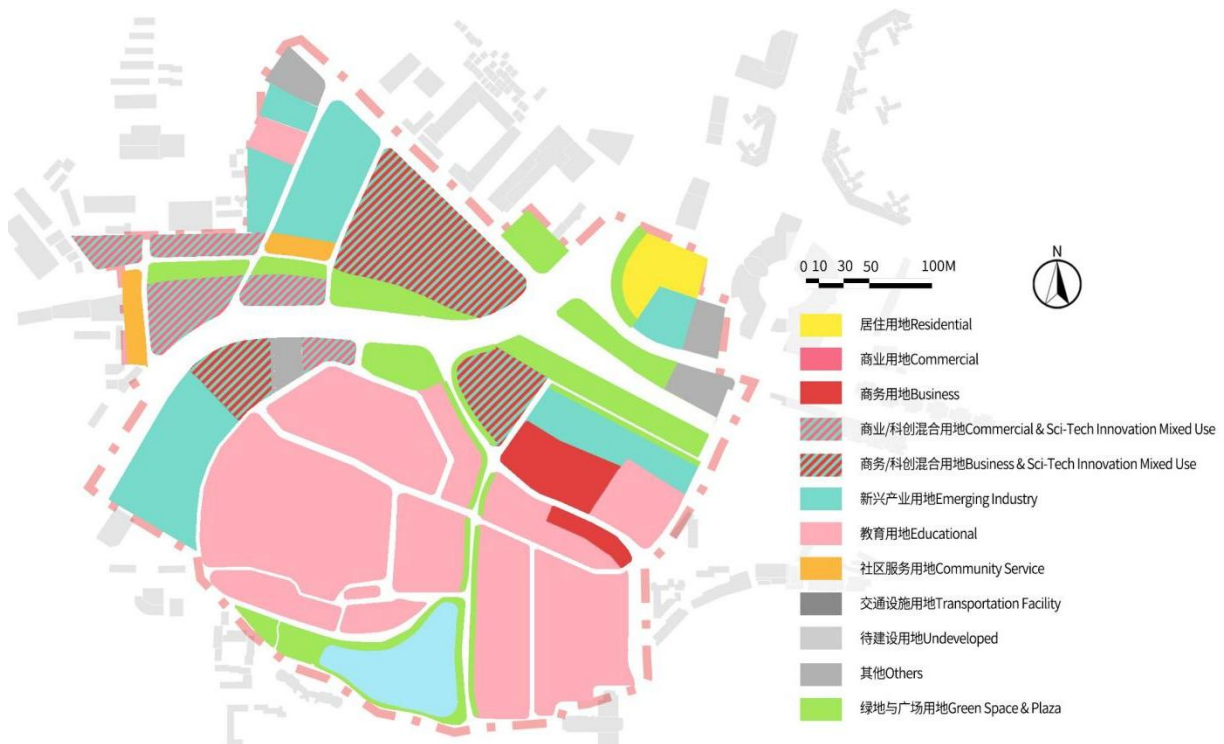


Figure 6- 26 Land Use Planning Map for the SCUT-Tianhe Coach Terminal District
(Source: Drawn by the Author)

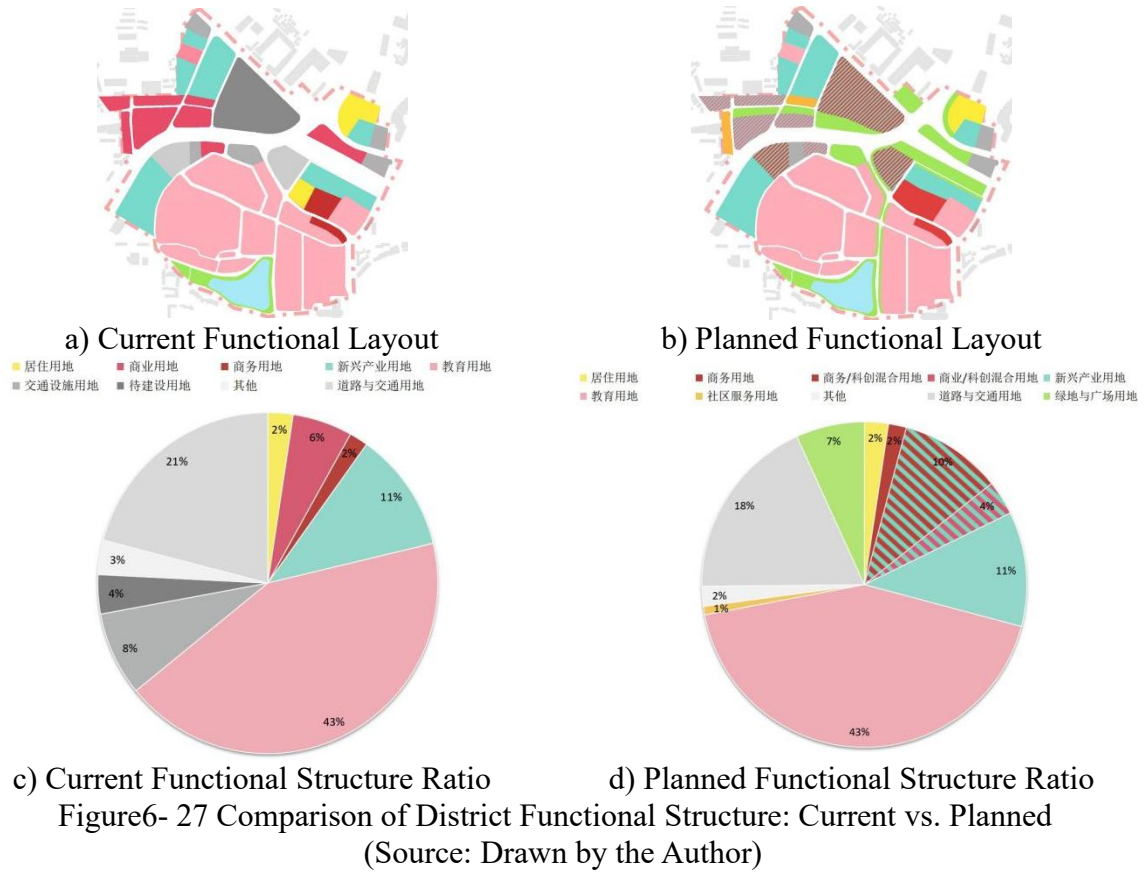
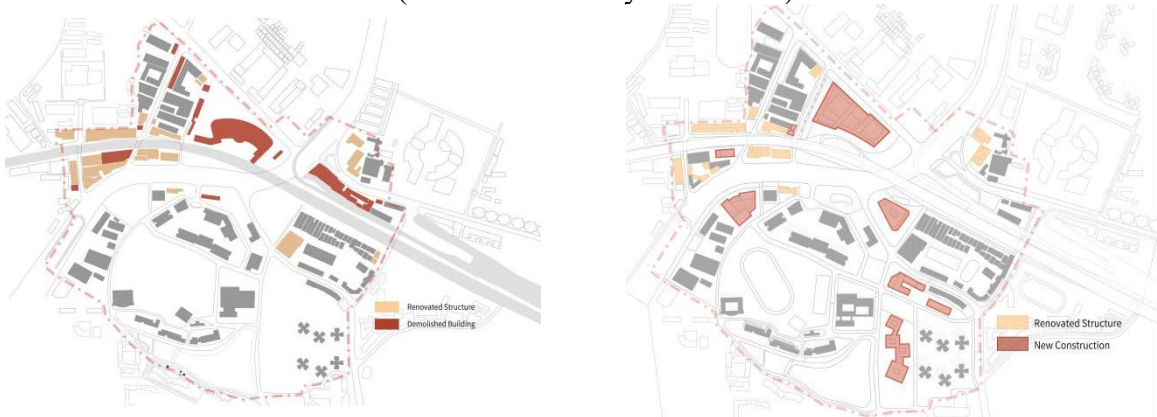


Table6- 1Land Use Function Balance Table

用地类别 LandUseCategory	现状 Current		规划 Planned		增减(ha) Change(ha)
	面积(ha) Area(ha)	占比(%) Ratio(%)	面积(ha) Area(ha)	占比(%) Ratio(%)	
居住用地 Residential	1.41	2.4	1.41	2.4	-
商业用地 Commercial	3.36	5.7	0.00	0.0	-3.36
商务用地 Business	1.05	1.8	1.05	1.8	-
商务/科创混合用地 Business & Sci-Tech Innovation Mixed Use	0.00	0.0	5.99	10.2	+5.99
商业/科创混合用地 Commercial & Sci-Tech Innovation Mixed Use	0.00	0.0	2.02	3.4	+2.02
新兴产业用地 Emerging Industry	6.72	11.4	6.72	11.4	-
教育用地 Educational	25.29	42.9	25.29	42.9	-
社区服务用地 Community Service	0.00	0.0	0.50	0.8	+0.50
交通设施用地 Transportation Facility	4.70	8.0	0.00	0.0	-4.70

用地类别 LandUseCategory	现状 Current		规划 Planned		增减(ha) Change(ha)
	面积(ha) Area(ha)	占比(%) Ratio(%)	面积(ha) Area(ha)	占比(%) Ratio(%)	
待建设用地 Undeveloped	2.19	3.7	0.00	0.0	-2.19
其他 Others	1.93	3.3	1.17	2.0	-0.76
道路与交通用地 Road & Transportation	12.24	20.8	10.72	18.2	-1.52
绿地与广场用地 Green Space & Plaza	0.00	0.0	4.02	6.8	+4.02
合计 Total	58.9	100	58.9	100	-

(Source: Drawn by the Author)



a) Proposed Demolition and Renovation

b) Proposed New Construction and Renovation

Figure 6- 28 Building Renewal Strategy Diagram

(Source: Drawn by the Author)

6.4.2 Node Design

NODE 1: Creative District along the Elevated Road

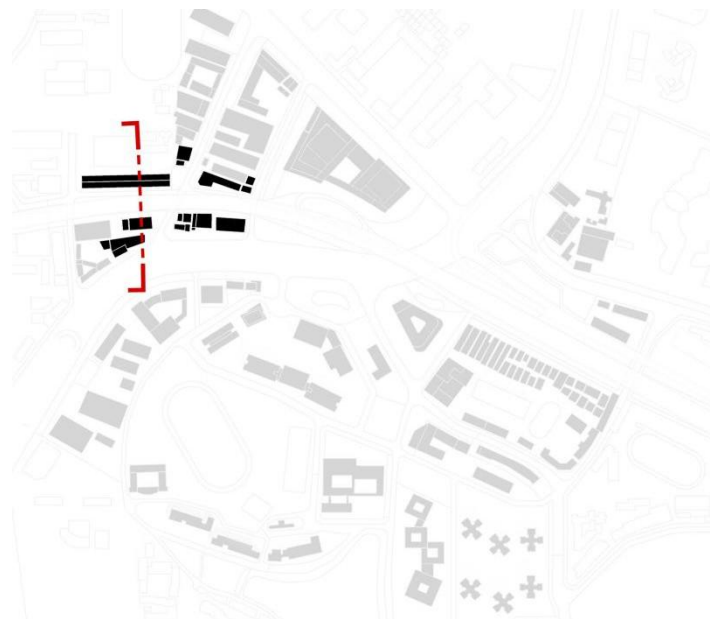


Figure 6-29 : Schematic of Node 1 Location

(Source: Drawn by the Author)

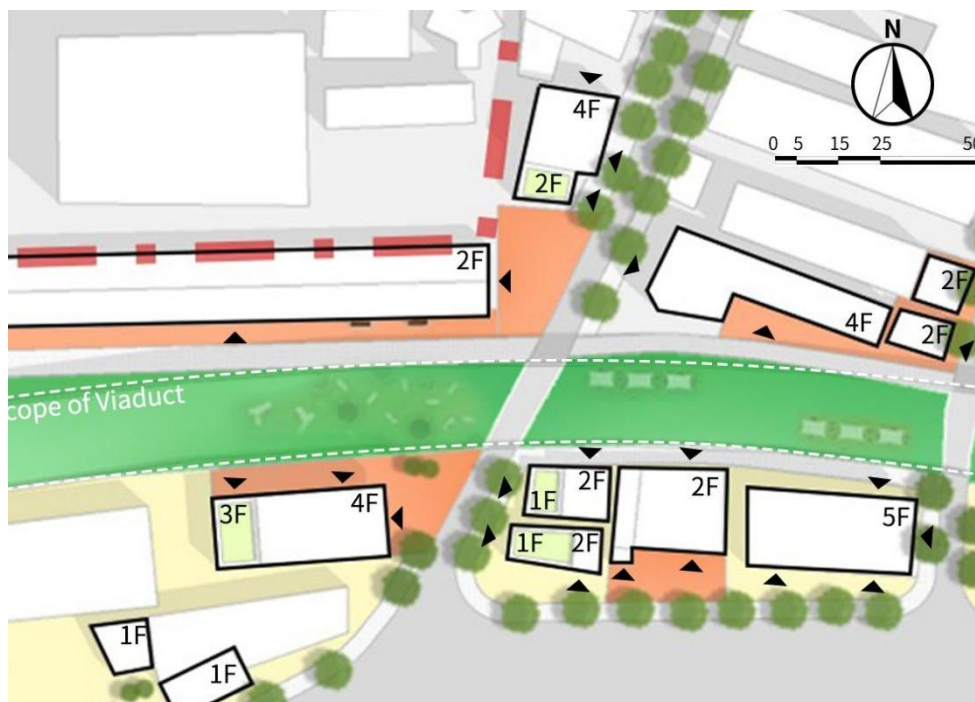


Figure 6- 30 : Plan View of Node 1
(Source: Drawn by the Author)

Node 1 is located in the commercial district of an urban village along the elevated road. Existing issues are concentrated in illegal structures and street-encroaching constructions, underutilised under-bridge spaces, and overall low environmental quality; the small-scale street fabric and low-rent business formats, however, constitute significant local resources. A built-environment regeneration approach is adopted, proceeding on the premise of removing illegal structures and street-encroaching constructions while preserving the original small-scale spatial layout. Low-cost renovation is prioritised over complete demolition, maintaining the affordability and accessibility of the space while creating conditions for the spontaneous growth of diverse business formats.

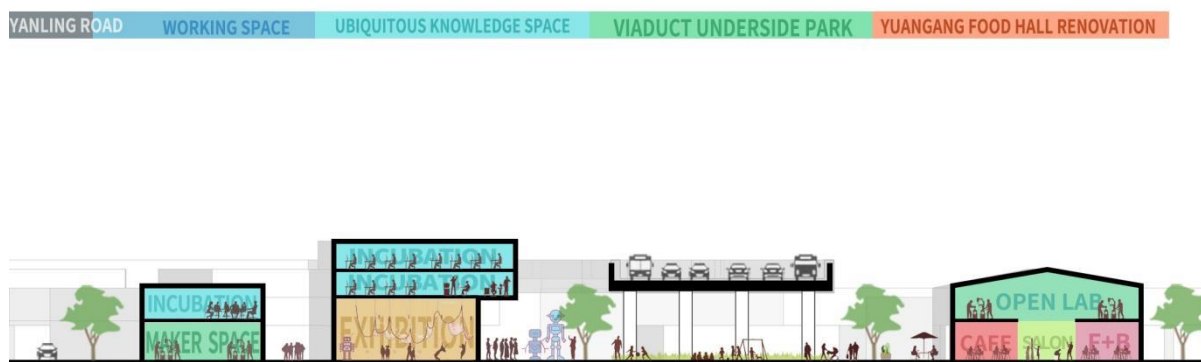


Figure 6-31 Section of Node 1
(Source: Drawn by the Author)

Buildings along the route may be regenerated into Ubiquitous Knowledge Space prototypes, including incubator offices, maker spaces, and open laboratories; strip parks may

be established in the shaded areas beneath the elevated bridge, using landscape and recreational functions to revitalise what were once passive grey spaces, thereby transforming the elevated bridge from a psychological barrier into a public gathering place connecting both sides; the existing Yuangang Food Court may be revitalised by introducing social-oriented businesses—such as cafés and salons—as well as office spaces, while preserving its local character and everyday vitality; community libraries, affordable office spaces, and activity rooms may be distributed throughout various sections, linked by continuous slow-traffic paths, allowing knowledge exchange, daily consumption, and public recreation to coexist naturally within the same area.

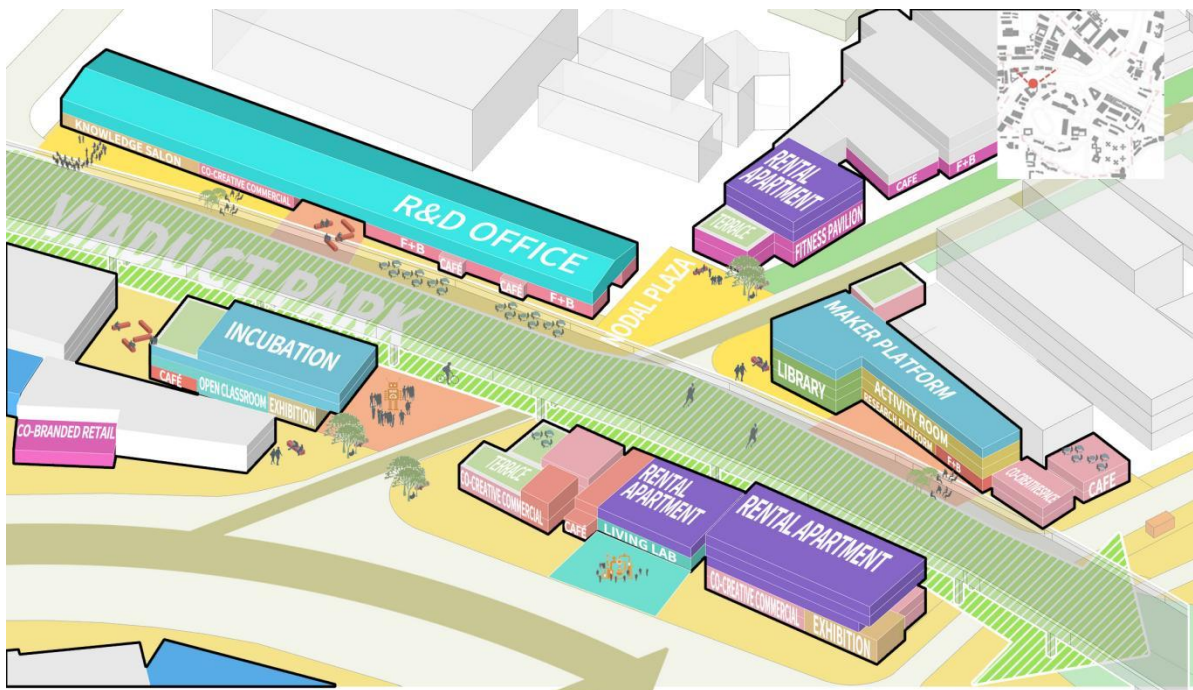
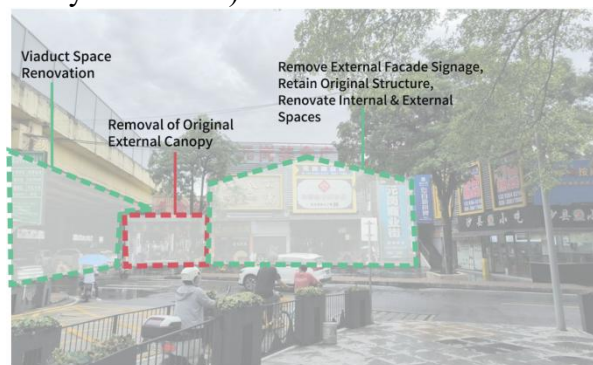


Figure 6-32 Node 1 Functional Axonometric Diagram
(Image source: Drawn by the Author)



a) Before Renovation



b) Renewal Strategy



c) Street-level view beneath the elevated road



d) Street-level view of the creative district



e) Perspective view of the creative district

Figure 6- 33 Rendered Views of Node 1

(Image source: Drawn by the Author)

NODE 2: Transit Hub Innovation Service Core



Figure 6- 34 Schematic of Node 2 Location
(Source: Drawn by the Author)

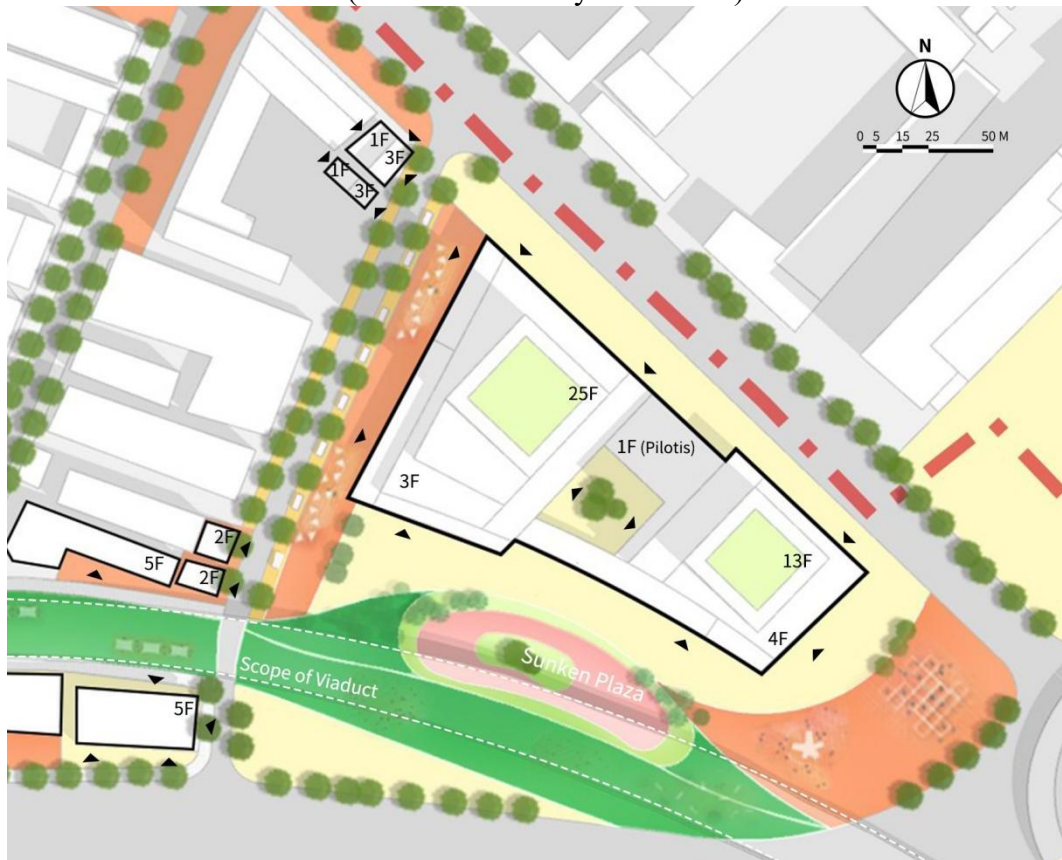


Figure 6- 35 Floor Plan of Node 2
(Source: Drawn by the Author)

Node 2 focuses on the Tianhe Coach Terminal Innovation Service Hub and its surrounding urban space. It is the core area within the district with the highest functional intensity and the greatest potential for pedestrian concentration. Existing issues are concentrated at two levels: first, as a transfer hub for two metro lines, the massive transit passenger flow lacks an effective spatial interface, and the flow advantage has long failed to translate into district vitality; second, high-density development and the surrounding small-scale neighbourhoods lack a scale transition, resulting in a pronounced sense of spatial discontinuity. The core design rationale is that the Innovation Service Hub may not function as an isolated functional entity, but rather as a dual anchor point for both public life and innovative activities within the district, serving as a structural complement to urban public space while supporting industrial functions.

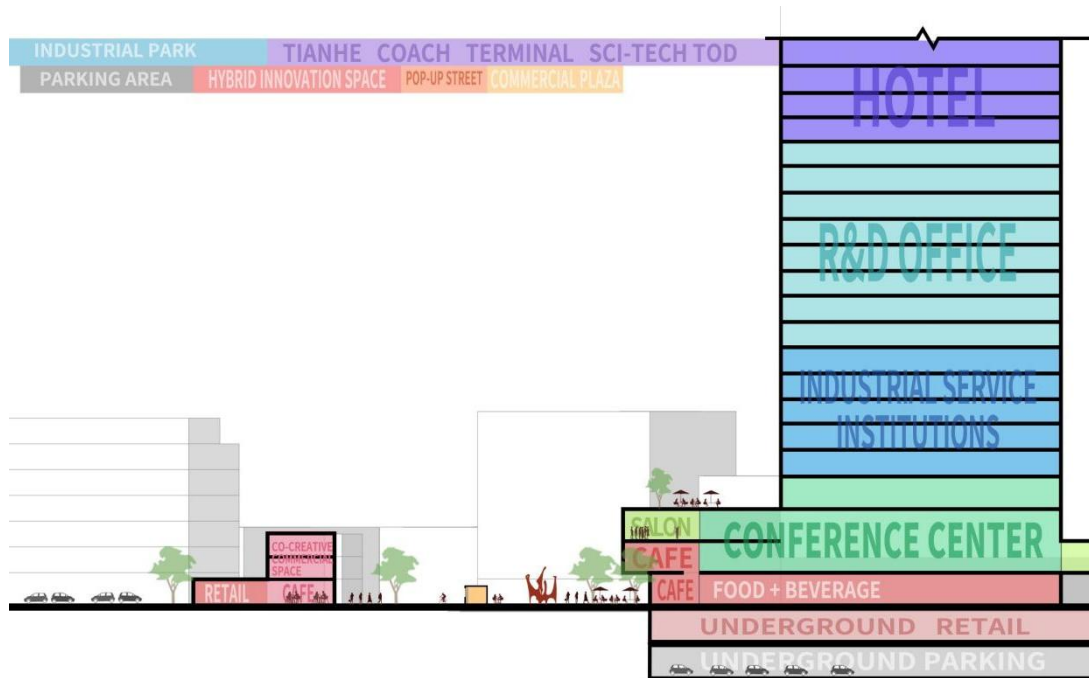


Figure 6- 36 Node 2 Cross-Section
(Source: Drawn by the Author)

The podium may employ a staggered, stepped design, allowing the building mass to gradually taper toward the surrounding blocks, creating a progressive scale transition at street level and alleviating the pressure exerted by the large-scale building on the surrounding small-scale fabric. A sunken plaza may be situated in front of the main building, serving as an open public space to accommodate passengers exiting the metro; it extends underground to connect with north-south underground passageways, guiding hub traffic in an orderly manner toward SCUT North Gate, thereby establishing the node as a ground-level anchor point within the north-south three-dimensional connectivity system. The ground level of the plaza may remain highly open, filling the structural gap in the surrounding public open space with a

public activity area, thereby endowing the Innovation Service Hub with the functional attributes of an urban living room during normal operations. Vertically, the podium transitions from open-plan retail and dining spaces at the ground level upward to a conference centre, industrial service facilities, and R&D offices, with a hotel at the top, creating a mixed-use condition operating around the clock and ensuring the node maintains continuous vitality on both weekdays and weekends, as well as during the day and at night.

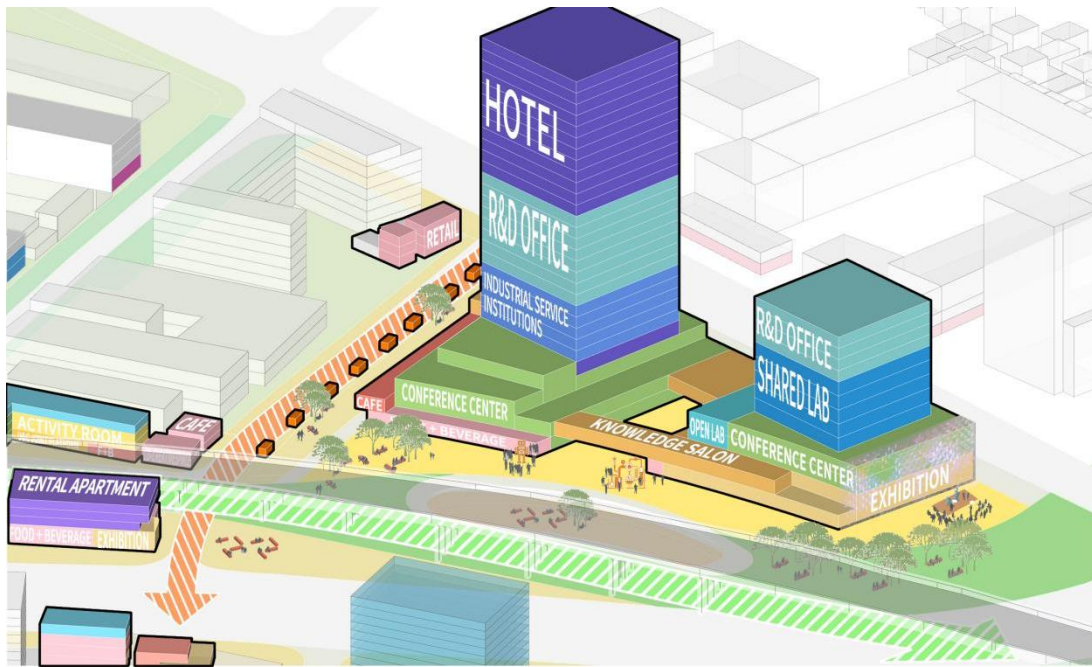


Figure 6- 37 Node 2 Functional Axonometric Diagram

(Source: Drawn by the Author)



a) Before Renovation



b) Renewal Strategy



c) Bird's-eye view of the transit hub innovation service core



d) Street-level view of the neighbourhoods surrounding the transit hub



e) Bird's-eye view of the plaza

Figure 6- 38 Rendered Views of Node 2

(Source: Drawn by the Author)

NODE 3: University-City Symbiotic Transition Zone

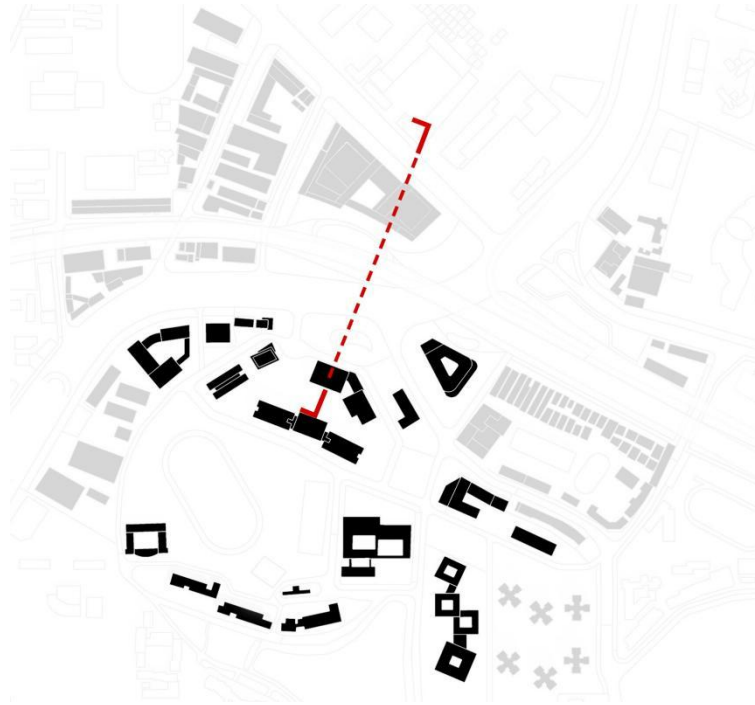


Figure 6- 39 Schematic of Node 3 Location
(Source: Drawn by the Author)

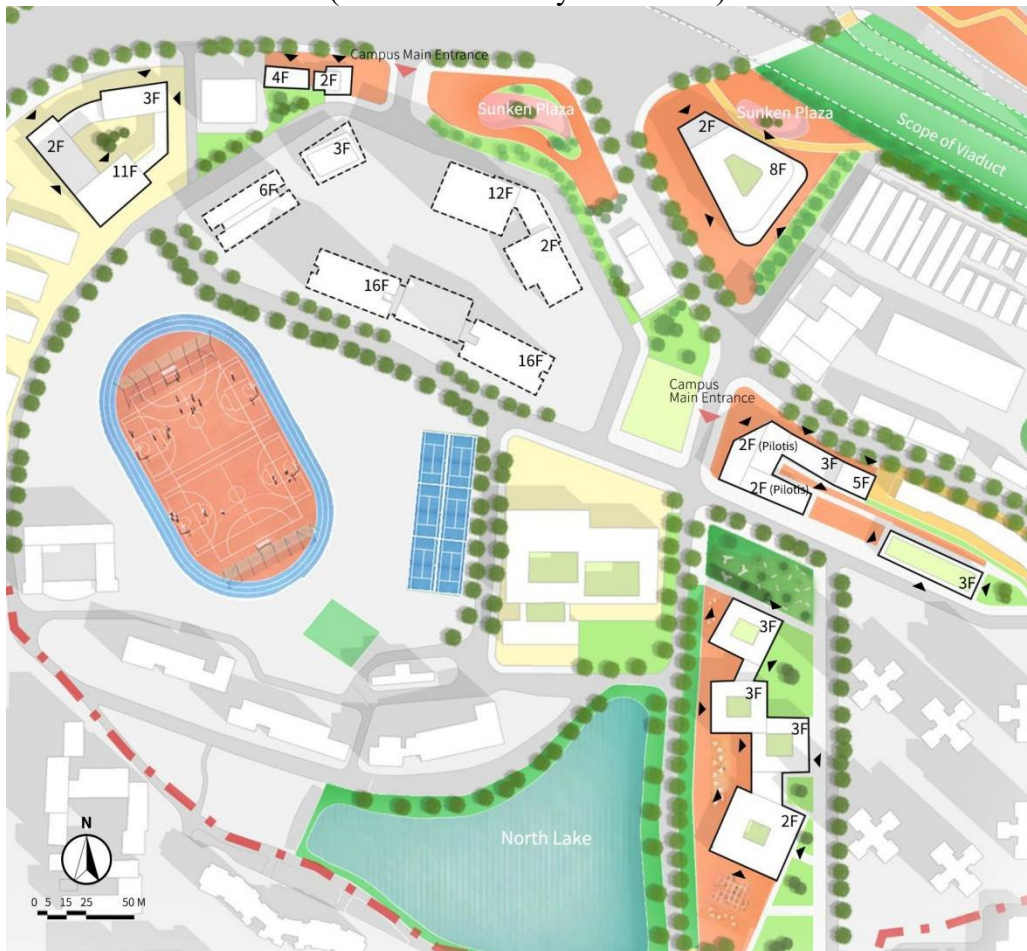


Figure 6- 40 Node 3 Floor Plan
(Source: Drawn by the Author)

Node 3 is situated at the boundary between SCUT North Campus and the city. The

existing boundary is primarily defined by solid walls, which are rigid in form and lacking in permeability; the campus's rich landscapes and public resources have long been isolated from the city. At the same time, the physical barrier of the main thoroughfare makes it extremely inconvenient for campus users to reach the opposite urban district, leaving daily connections between the campus and the city in a state of low efficiency. The design objective lies not in opening up the boundary, but in transforming this rigid boundary into a transitional zone with spatial depth, a sense of place, and functional interactivity.

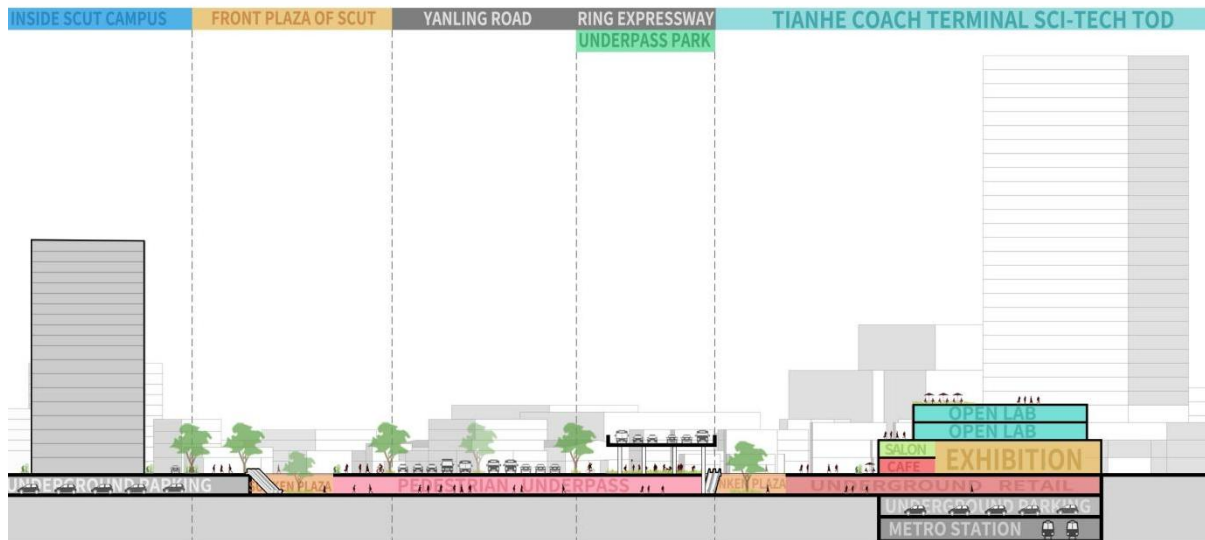


Figure 6- 41 , Section of Node 3
(Source: Drawn by the Author)

In terms of spatial connectivity, the underground passage serves as the fundamental means of linking the north and south, allowing campus users to bypass the barrier at the ground level of the main thoroughfare and conveniently reach the opposite urban district, thereby integrating the previously separate campus and city sides into a continuous slow-traffic network. In terms of functional layout, the two campus entrances are respectively integrated with the Fab Lab and the Innovation Technology Building, serving as anchor points for campus-city interaction open to the city, accommodating industry-academia-research exchanges and innovation exhibitions, and transforming the entrances from mere access control points into interface spaces for university-city symbiosis. The Campus Cultural Centre, developed in conjunction with the North Lake landscape resources, integrates cultural facilities such as the concert hall and library with the lakeside scenery; under the premise of orderly accessibility, it offers high-quality cultural and natural experiences to the urban public, making the campus's landscape resources an organic component of urban public life. These functions unfold along the boundary, collectively forming a university-city symbiotic interface that is both permeable and recognisable.

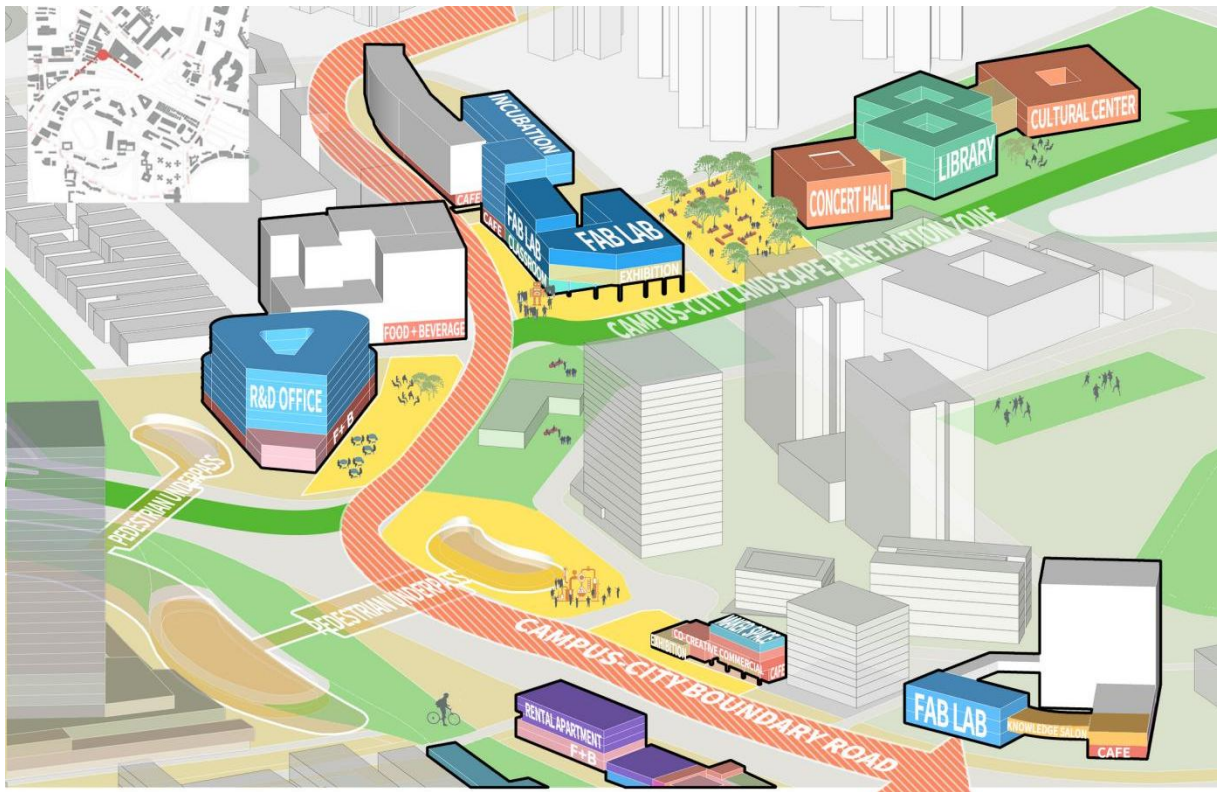
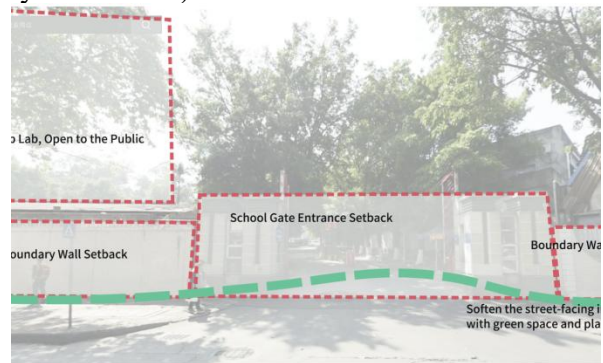


Figure 6- 42 Node 3 Functional Axonometric Diagram
(Source: Drawn by the Author)



a) Before Renovation



b) Renewal Strategy



c) Street-level view of the SCUT campus gateway



d) Bird's-eye view of the SCUT campus gateway



e) Waterfront perspective view of SCUT North Lake

Figure 6- 43 Rendered Views of Node 3
(Source: Drawn by the Author)

6.5 Summary of This Chapter

This chapter systematically presents the regeneration design for the SCUT-Tianhe Coach Terminal District based on three progressive strategies: spatial connectivity and interface restoration, functional hybridity and symbiotic space implantation, and multi-stakeholder co-governance and activation. Spatial connectivity and interface restoration addresses the area's most pressing physical barriers, establishing a continuous and accessible spatial framework through north-south three-dimensional connectivity, the construction of a public space sequence, and boundary softening at the university-city interface. Functional hybridity and symbiotic space implantation builds upon this foundation, filling the functional content of campus-city interaction through the establishment of a functional layout framework, spatial synergy along the innovation chain, and the implantation of three types of symbiotic spaces. Multi-stakeholder co-governance and activation proceeds from both the perspectives of spatial use and institutional mechanisms, extending from spatial support for multi-stakeholder convergence scenarios toward the construction of a progressive governance framework to ensure the long-term operation of symbiotic relationships. These three strategies progress sequentially from the physical to the functional and from the functional to the institutional, collectively constituting a systematic response to the issues identified in Chapter 5. The experiences and reflections presented by these design practices are further discussed in the conclusion of Chapter 7.

Conclusion and Outlook

Research Conclusions

Against the backdrop of the national Innovation-driven Development Strategy and Built-Environment Regeneration, this study adopts University-City Symbiosis as the core perspective and addresses the regeneration proposition of existing areas surrounding universities in established urban districts. Through theoretical synthesis and comparative case studies of domestic and international examples, a Principles Framework for University-City Symbiotic Regeneration is constructed and subjected to empirical verification and further development through the SCUT-Tianhe Coach Terminal District as the research subject. The following principal conclusions are drawn.

Conclusion 1: A Systematic Principles Framework for University-City Symbiotic Regeneration

This study distills a principles framework for university-city symbiotic regeneration centered on Spatial Connectivity and Openness, Functional Hybridity and Symbiosis, and Multi-stakeholder Co-governance and Activation. These principles correspond to three intervention levels—spatial, functional, and institutional—and collectively form a systematic principles framework to foster university-city symbiosis. At the spatial level, the framework focuses on anchoring transit nodes, optimizing slow-traffic networks, and constructing sequences of public spaces, with an emphasis on restoring physical connectivity along the university-city interface; at the functional level, the focus is on mixed-use configuration and the implantation of three types of symbiotic spaces, aiming to activate the flow of knowledge and the convergence of innovation between the campus and the city; at the institutional level, the emphasis is on the construction of co-governance spaces and the establishment of multi-stakeholder deliberative mechanisms, ensuring the long-term sustainability of university-city symbiosis. These three principles progress sequentially from the physical to the functional and from the functional to the institutional, forming a comprehensive intervention system.

Conclusion 2: Priority Sequence and Application Logic of the Principles Framework

As demonstrated by the site-specific validation in the SCUT-Tianhe Coach Terminal District, the implementation of the above three principles is governed by an inherent precondition structure: Spatial Connectivity and Openness serves as the physical prerequisite

for functional integration and multi-stakeholder co-governance—if the physical fragmentation of the university-city interface remains unaddressed, both functional implantation and institutional construction lack a basic spatial foundation. This precondition structure has been fully validated in the SCUT-Tianhe Coach Terminal District; however, regarding the universal applicability of the principles framework, the intervention priority sequence of the three principles is not fixed across all sites but should be determined based on the dominant contradiction of the site: sites with prominent spatial fragmentation should prioritize the restoration of physical connectivity, while sites with weak functions or governance deficits may adjust their intervention starting points accordingly. This approach enhances the principles framework's adaptability to different site types and provides a transferable intervention pathway for similar studies.

Conclusion 3: Soft Intervention Pathways for University-City Symbiosis in Established Urban Campuses

Unlike the open campus models of newly built university towns or Western universities, the spatial relationships between established urban campuses and surrounding communities in China have evolved over a long period, involving complex ownership, usage, and socio-historical contexts. Direct replication of the Western experience of removing walls and fully opening campuses is neither feasible nor appropriate; nor can radical measures such as large-scale spatial restructuring serve as viable solutions. The present study demonstrates that, in such settings, university-city symbiosis must be guided by the principle of Soft Intervention: spatially, boundary softening replaces the elimination of boundaries, and localized interface permeation replaces wholesale opening; functionally, the introduction of spillover anchor points and symbiotic space implantation replaces the comprehensive sharing of campus functions; institutionally, the gradual establishment of multi-stakeholder deliberative mechanisms replaces one-time institutional restructuring. The core of Soft Intervention lies in respecting the historical accumulation of existing university-city relationships: while maintaining the fundamental layout, it seeks spatial nodes and institutional gaps where intervention is feasible, thereby promoting the gradual emergence of conditions for symbiosis. This approach holds certain reference value for similar regeneration projects around existing universities in Chinese cities—particularly for site types where campus walls remain difficult to remove and ownership relationships are complex.

Conclusion 4: University-City Symbiotic Regeneration Guidance Plan for the SCUT-Tianhe Coach Terminal District

Based on the principles framework for university-city symbiosis and a systematic analysis of the site, this study proposes a regeneration proposal tailored to the specific conditions of the SCUT-Tianhe Coach Terminal District. The site's core distinctiveness lies in the coexistence of high accessibility potential—derived from the interchange node of Metro Lines 3 and 6—and the structural spatial fragmentation caused by elevated road networks that sever north-south connections and campus walls that enclose the university-city interface. The proposal prioritizes spatial connectivity as the primary intervention level: by combining a three-dimensional connectivity strategy involving the establishment of underground passages at the metro transfer node with the construction of public space sequences and boundary softening, a continuous and accessible spatial framework is established. Subsequently, functional symbiosis is activated through a layered TOD layout and the systematic implantation of three types of symbiotic spaces. Furthermore, a progressive multi-stakeholder coordination mechanism is constructed using civic co-governance spaces and the University-City Forum as platforms. The progressive implementation of these three strategies aims to transform the currently dysfunctional university-city interface zone into a symbiotic zone where knowledge, innovation, and elements of public life flow continuously.

Research Innovations

Innovation 1: A systematic principles framework for the regeneration of established urban areas surrounding universities

Existing research on university-city relationships has largely remained at the level of descriptive analysis or single-dimension intervention, with relatively few studies proposing an operationable principles framework that integrates spatial, functional, and institutional dimensions in a systemic manner. Drawing on the cross-integration of symbiosis theory and Triple Helix theory, this study constructs a university-city symbiosis regeneration principles framework encompassing the above three dimensions, addressed to the practical proposition of regenerating established urban areas surrounding universities. The framework articulates the sequential intervention logic of three principles and their prerequisite structure, and proposes an analytical approach for determining intervention priority according to the dominant contradictions of a given site. Building on existing university-city regeneration research, it offers a framework perspective with operational referential value.

Innovation Point 2: A Supplementary Research Perspective on the Regeneration of Transit-Node University-City Interfaces

Existing research on university-city symbiosis has shown limited focus on stock

regeneration sites characterized by a rigidly enclosed university-city interface that has persisted over time, centered around rail transit transfer nodes. This study focuses on the SCUT-Tianhe Coach Terminal District, a site that exhibits the dual characteristics of high accessibility as a rail transit node and a highly enclosed university-city interface, making it representative of this site type. The soft intervention pathways and three-dimensional connectivity strategies proposed in this study provide a practical perspective for reference in the regeneration research of such sites.

Future Research Directions

This study has certain limitations that warrant further refinement and expansion in subsequent research.

First, the regeneration proposal put forward in this study remains at the conceptual design stage, and the specific implementation pathways within the SCUT-Tianhe Coach Terminal District have yet to be examined in depth. As policy conditions, funding sources, and collaborative partners evolve, the content and pace of implementation will require corresponding adjustments. Subsequent research could build upon the framework established in this study, incorporating more detailed phased implementation pathways and flexible adjustment mechanisms to further enhance the proposal's practical feasibility.

Second, the strategy framework for university-city symbiosis constructed in this study is based on empirical research of a single site, and its generalizability remains to be further verified. Subsequent research could select other university-city interface sites at rail transit nodes with similar characteristics for comparative studies. Through cross-validation across multiple cases, the applicable boundaries and adjustment conditions of the framework can be further clarified.

Third, as this study adopts an urban design perspective, the arguments remain relatively limited in terms of institutional and economic feasibility. The long-term maintenance of university-city symbiosis involves complex coordination among stakeholders and resource allocation mechanisms. Incorporating perspectives from disciplines such as management and economics will help develop more rigorous arguments regarding collaborative governance mechanisms and development and management models, thereby further strengthening the comprehensive feasibility of the proposed approach.

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攻读硕士学位期间取得的研究成果

一、已发表（包括已接受待发表）的论文，以及已投稿、或已成文打算投稿、或拟成文投稿的论文情况（只填写与学位论文内容相关的部分）：

序号	作者（全体作者，按顺序排列）	题 目	发表或投稿刊物名称、级别	发表的卷期、年月、页码	与学位论文哪一部分（章、节）相关	被索引收录情况

注：在“发表的卷期、年月、页码”栏：

- 1 如果论文已发表，请填写发表的卷期、年月、页码；
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- 不够请另加页。

二、与学位内容相关的其它成果（包括专利、著作、获奖项目等）

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2026 年 5 月于华南理工大学图书馆

四、答辩委员会决议书

答辩委员会对学位（毕业）论文的评语（主要包括：1. 论文选题与综述；2. 学术水平与创新性；3. 论文综合能力表现；4. 学位（毕业）论文答辩情况；5. 存在的不足之处和建议等）

论文选题聚焦高校周边存量地区校城关系重构这一议题，选取天河客运站片区为研究对象，针对性较强，具有一定的现实意义与创新角度。

论文提出柔性介入作为既有城区老校区周边存量更新的基本取向，对同类型地区更新实践提供了一定的参考价值。论文结构基本完整，分析较为深入，设计成果体现了作者将理论框架转化为空间语言的基本能力。

根据投票结果，答辩委员会一致同意喻琬淇通过硕士学位论文答辩，同意其毕业，并建议授予建筑学硕士学位。

论文答辩日期：2026 年 5 月 22 日

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