Graduation Studio Report

Metropolitan Ecology of Places Series

Towards a Sustainable and Liveable Desakota:

Designing for sustainable industry transition in the peri-urban territory of the Greater Bay Area

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Title:
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acknowledgements

This thesis represents ten months of my research on the GBA Desakota region. It is significant in my growth as an urban planner and designer, reflecting my knowledge of interdisciplinary synthesis, cross-scale research, and reflection on the existing planning system. None of these developments would have been possible without the help of many people. Therefore, I would like to express my gratitude to them.

First and foremost, I would like to extend my sincere thanks to my mentors, Dr Alexander Wandl and Cinco Yu. For Alex, I am deeply indebted to you for guiding me through challenges in such a complex context with your knowledge, time, and enthusiasm. Thank you for your precise and critical questions that continuously motivated me to reflect and progress, as well as your encouragement that gave me confidence. Thank you for giving me the best learning experience I've had so far.

For Cinco, I feel fortunate to have you on this journey, who is always passionate and supportive. I appreciate your inspiration for my project, guidance on the right track, and patience in leading me to think rationally and open-mindedly. Our discussions have always motivated me to generate innovative ideas and delve deeper into the value of this project.

At the same time, my great thanks go to my fellows who have gone through all of this with me, especially my studio peers: Yueqi, Pieter, Anna, and Nicole. Additionally, I am grateful to my friends from China, Xuhui and Lihong, who travelled a long way to assist me with field trips. Without your listening, help, and support, accomplishing this project would have been tough.

I would like to thank Dr Qinyi Zhang for discussing Desakota in China and providing me with valuable insights, and Dr Cecilia Furlan for creating a pleasant learning environment and organising lectures at Metropolitan Ecology of Places Studio.

Finally, I want to express my gratitude to my family and friends, primarily: my parents, who always give me love and support, as well as provide professional knowledge in the field of governance based on their work experience; my uncle, Wing, who has been caring during my time in the Netherlands and, as an industrial entrepreneur, has shared many opinions from the perspective of industrial transformation; and my partner, Zhaoxi, who has been a constant source of love, understanding, and courage, whether in my happy or challenging moments.

I am grateful to have enjoyed this year with all of you and I hope this project brings you the same enjoyment and pride.

CONTENTS

Abstract

This thesis explores spatial strategies for achieving sustainable industry transition in the dispersed urbanised areas of the Greater Bay Area (GBA) in China. Since 1978, urbanisation in the GBA has accelerated, significantly expanding beyond metropolitan regions. These dispersed areas, described as the *Desakota*, encompass a patchwork landscape of urban and rural settlements, as well as industrial and agricultural lands. However, this region faces pressing issues, including unsustainable industrial activities, fragmented landscapes, inadequate public services, and a loss of identity. The existing urban-rural dichotomy planning system fails to address these challenges, leading to environmental degradation and a decline in quality of life. Therefore, there is an urgent need for a regional strategy to explore the potential for sustainable and liveable urbanisation in Desakota.

Hence, this thesis adopts the "Netzstadt" concept as a guiding methodology from a regional perspective. It leads to defining Desakota's spatial and functional nodes and connections, identifying potential elements for sustainable industrial transformation, adapting structural features through reference projects, experimenting with a design project, and proposing an adapted planning system.

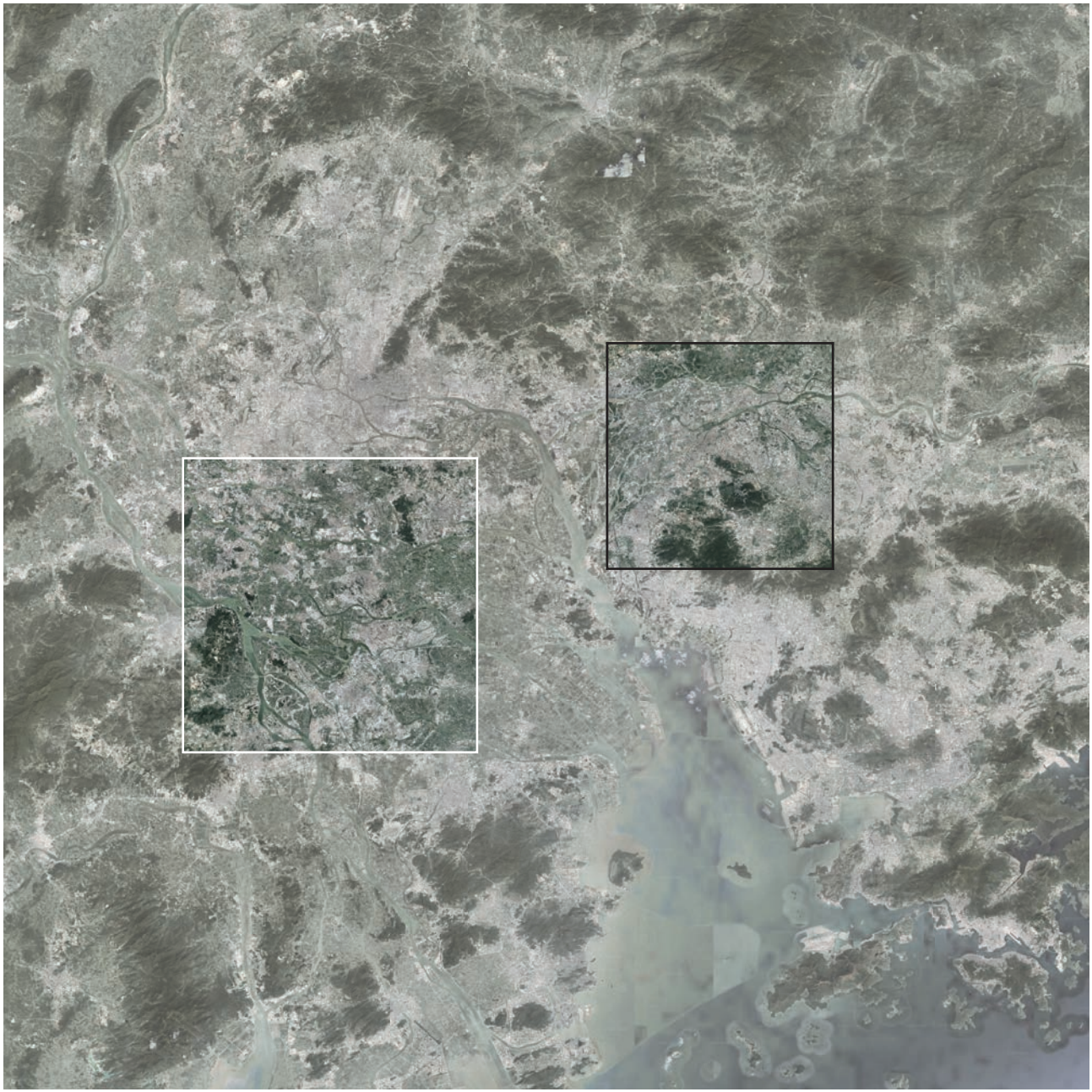
These assignments yield three significant outcomes. Firstly, the adapted structure plan proposes a decentralised development pattern of Desakota, envisioning a circular and symbiotic industry conversion, repurposing industrial redundancy for metropolitan publicness, and enhancing the green and public network. Secondly, a showcased design project incorporates industrial, open space, and residential elements, proposing a specific spatial morphology and physiological flow. It emphasises the local identity and demonstrates the importance of involving local actors in the transition. Thirdly, a more decentralised and flexible spatial planning system should be employed to materialise the proposed Desakota structure.

By implementing these strategies, the desakota of GBA can progress towards a sustainable and liveable future that integrates nature, supports diverse livelihoods and lifestyles, and optimises resource management. This thesis can also provide transferable knowledge to other similar dispersed areas on how the pattern, flow and policy could be synthesised into future urbanisation and contribute to ensuring the sustainable development of society and ecology.

Keywords: Desakota, dispersed urban development, sustainable industry transition, territorial metabolism, network structure, stractegic spatial planning

Patchwork landscape; source: image by M

Mengjuan Tian (Tian, 2019)



Satellite view of the GBA; Source: Google map

Preface

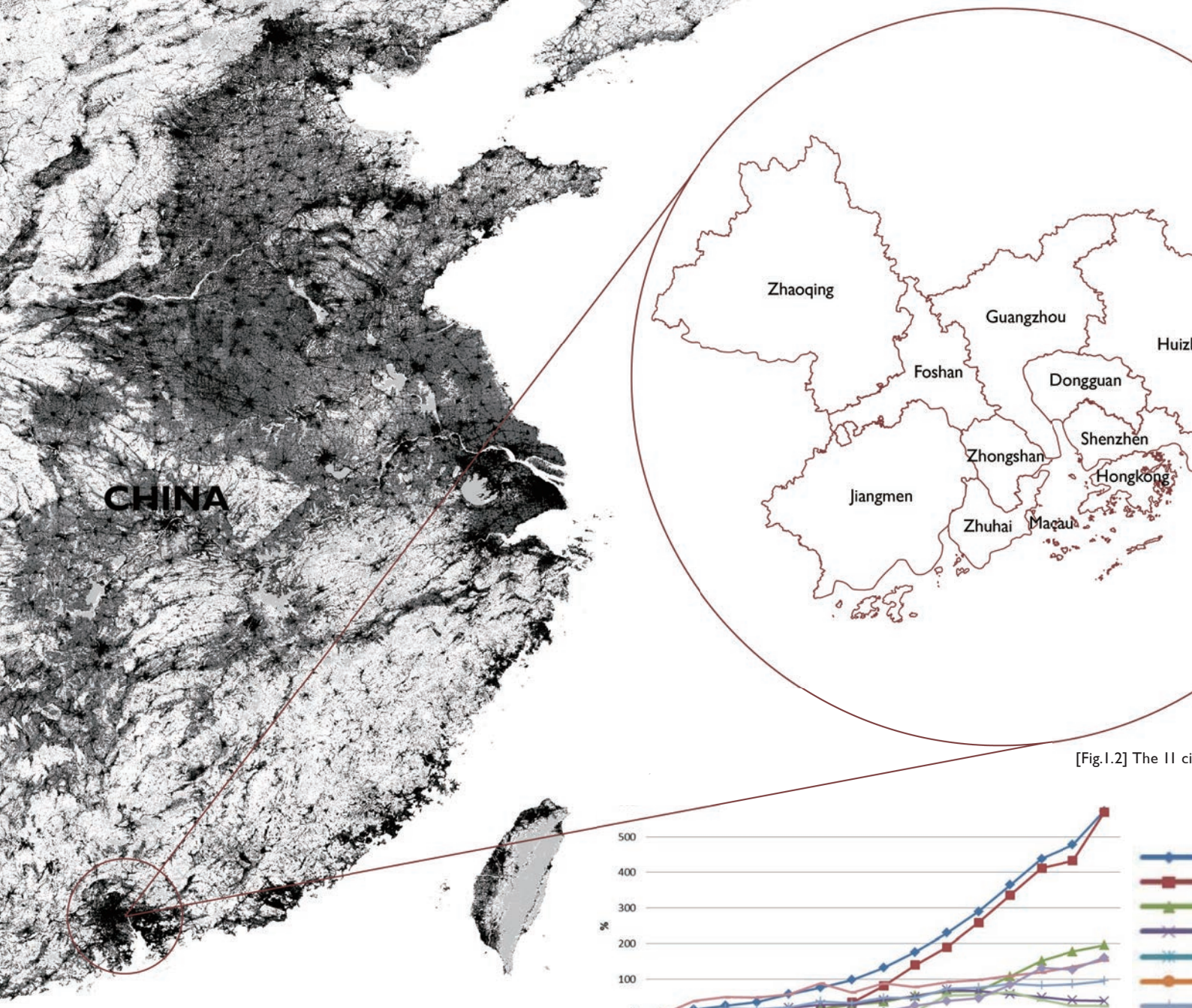
MOTIVATION

This thesis explores the phenomenon of peri-urbanisation inspired by the observations of the Greater Bay Area (GBA) megaregion in China.

Observation of this satellite map shows that the dispersed urbanised form can be identified significantly apart from the major metropolitan areas in the GBA (see white outline). The emergence of these areas, also called peri-urbanisation (Webster & Li, 2020), manifest in a patchwork landscape of urbanised and rural settlements and industrial and agricultural landscapes, which are most intensive along the transport infrastructure that connects the major cities. However, these areas have urgent problems: expanding in an unsustainably industrialised manner, with the cost of deteriorating environments. As a similar region lies beyond the main city cores, the municipality of Dongguan is a reference (see black outline), with almost all agricultural land being converted into industrial and urban areas within 20 years, resulting in socio-ecological threats.

Therefore, the dispersed areas need an alternative development model to avoid a similar situation. Transcending the mainstream development model is a complex and interdisciplinary subject. As an urban designer and planner, the task assigned is not only looking at the physical space of the peri-urban territory but also the flow and policy shaping it.

1. Context



[Fig.1.1] Population density distribution in eastern China; source: author's own based on the landscan dataset

[Fig.1.2] The 11 ci

[Fig.1.3] Changes in pollutant emissions and economic development in Guangdong Provin diagram from the report (Environmental Strategies and Measures in the Development Tr 2012) based on the data from Guangdong Bureau of Statistics

1.1 The Greater Bay Area in China

This thesis focuses on the peri-urban territory in the Greater Bay Area megaregion in southern China. The region comprised nine cities, Hong Kong and Macau Special administrative regions with a total population of over 86 million. As one of the most developed regions, the Gross Domestic Product was over 1668 billion dollars in 2020.

Peri-urbanisation describes the worldwide urbanisation phenomenon (Brenner & Schmid, 2013). Similar situations can be commonly discovered in China. Among them, the peri-urbanity in the Greater Bay Area demonstrate a distinct structure as their distribution is more intensive with better communications than in the north, which helps them develop more rapidly.

Historically, due to the geography of hilly terrain, the GBA and its peri-urban region had hardly been a cultural and historical centre of China until 1982, when it took up the strategic role of the gate of the country's opening-up policy. With its proximity to Hong Kong and Macau, many policies were released to boost its export growth. Entitled a greater autonomy, the small and medium-sized processing industry is dynamic in the peri-urban areas (Lin, 2018), making the areas more diffused.

As shown in Figure 1.3, the environment was under great pressure in the GBA. So the government started to transfer manufacturing industries from urban cores (Guangzhou, Shenzhen) to elsewhere. The main destination is the peri-urban region, which takes over mechanical factories (Development, 2012). In this process, more dispersed urbanised patterns expanded.

Therefore, it is urgent to look at these areas in transition, find out how they can be more sustainable, and provide an exemplary approach for similar regions.

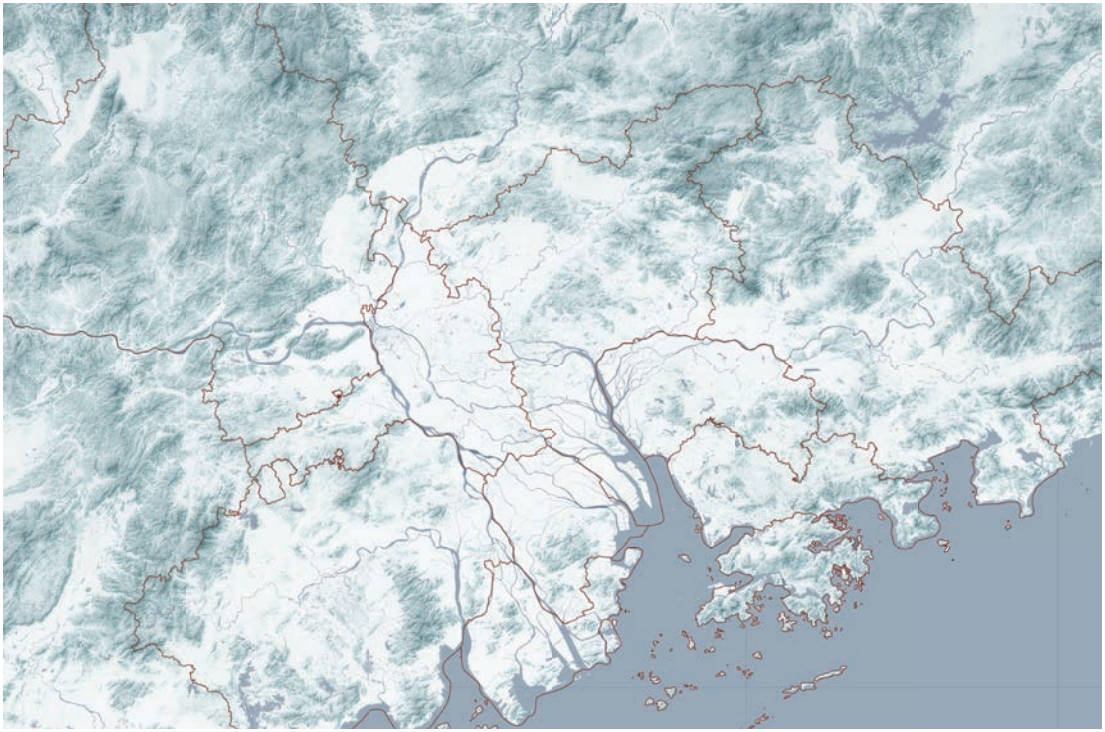
ties of the Greater Bay Area

GDP
gross industrial output value
volume of industrial waste gas emission
volume of industrial sulphur dioxide emission
volume of industrial soot emission
volume of industrial dust emission
volume of waste water diacharged
volume of domestic sewage discharged

ce (1996-2010) ; Source:
ansition of Eastern China,

1.2 The GBA - Geographical Condition

In view of the geographical condition, GBA is mostly located in the low-lying plain of the Pearl River Delta region that is formed by the junction of three main rivers. 24% of the land is only one meter above sea level, where the peri-urban areas are widely distributed. In these areas, human activity, settlements, and the natural environment have been intertwined and mutually adapted to the dense network of waters for hundreds of years. The traditional settlements were built in a decentralised concentration manner according to the river basin to defend against floods (Sun et al., 2019). The intense water network, the dispersed concentrated settlements and abundant agricultural resources laid a solid foundation for the transformation into industrial towns.



[Fig.1.4] Geography of the GBA overlapped with city boundaries; source: author's own based on OSM data

[Fig.1.5 & 1.6] Above: water-dependent agricultural life; source: photography by Zhong Wuyan (The Story of Nansha, 2021); Below: small town life adjacent to water; source: photography at Xiaohongshu ("Photography of Xiqiao Town in Foshan," 2022)

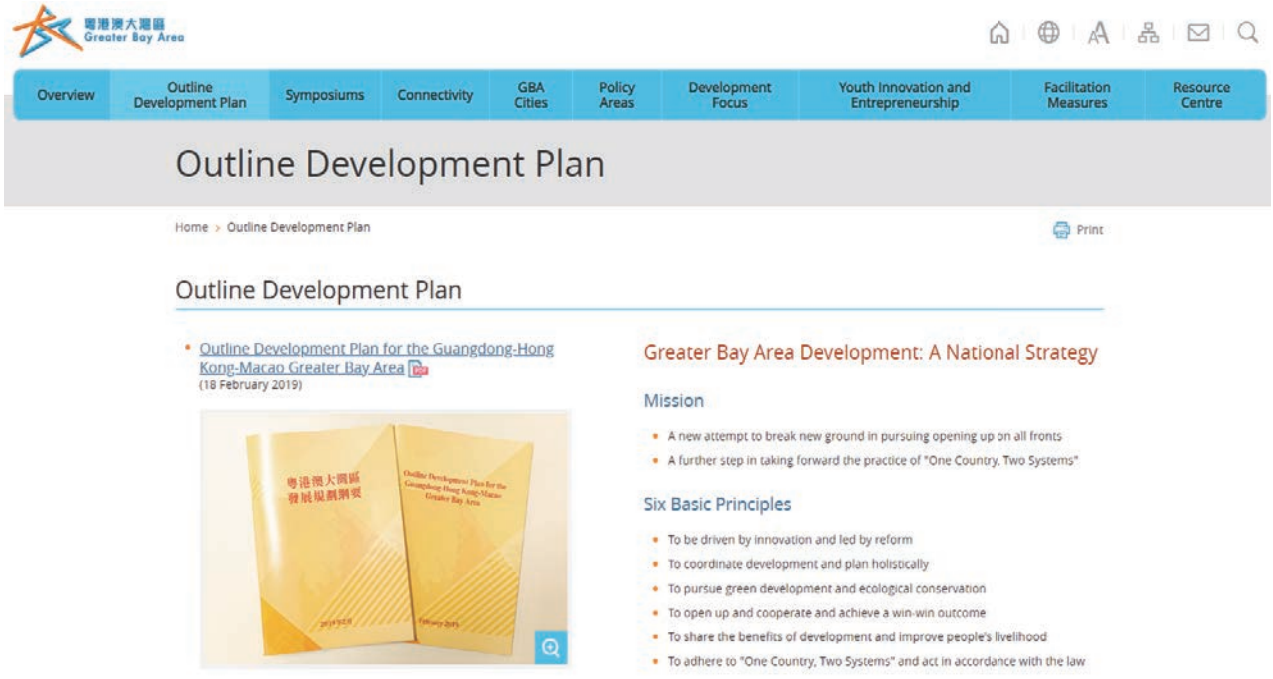
1.3 The GBA - Regional Networking

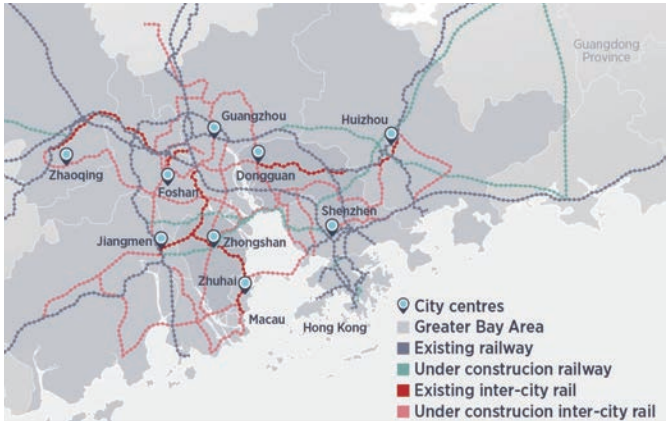
The GBA is not an administrative region but a national strategic plan released in 2019 (China, 2019). The goal is to deepen cooperation and integration within the region and to promote collaborative regional economic development.

Based on the current infrastructure network, a new spatial structure was proposed: The four central cities of Hong Kong, Macau, Guangzhou, and Shenzhen serve as the core of regional development to support the other seven cities to form important node cities with distinctive features and complementary functions. The cities of Foshan and Zhongshan, where the Peri-urban territory is mainly located, are planned to have more transportation infrastructures to strengthen communication with the central cities as they take the role of the manufacturing division. In the proposed GBA network, the peri-urban territory assumes the role of more connections. Hence, more dispersed patterns may emerge.

To sum up, the emergence of peri-urbanisation in the GBA results from the interplay of landscape conditions, export-processing industry development and regional development strategy. As part of the proposed GBA network, it needs to be acknowledged as a distinct region rather than a suburb. More attention must be paid to its social and ecological condition, transcending the urban and rural definitions.

[Fig.1.7] Urban landscape within the GBA region; source: image from Southcn.com (Lin, n.d.)



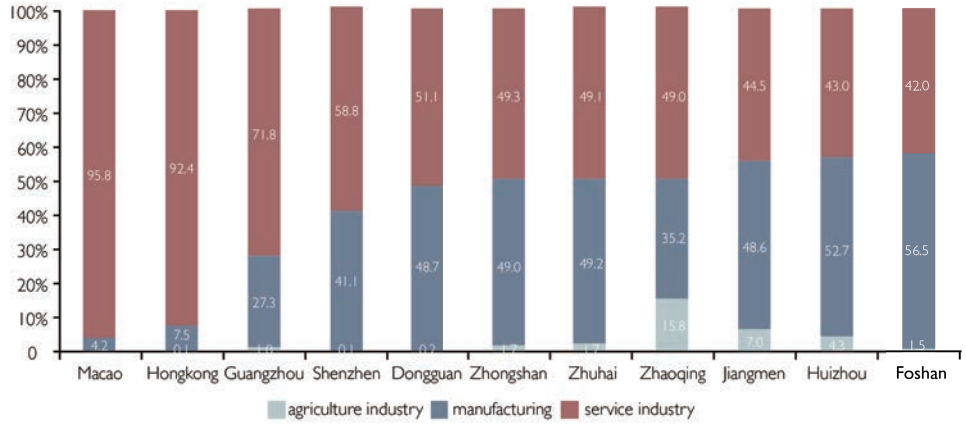


[Fig.1.8 & 1.9 & 1.10] above: Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area; Source: screenshot of the webpage of Greater Bay Area (Guangdong-Hong Kong-Macao Greater Bay Area - Overview, n.d.)
below-left: the proposed GBA network; source: image from territorial spatial planning (Territorial Spatial Planning of Guangdong Province, 2019);
below-right: the existing and proposed transportation infrastructure in the GBA region; source: image from the Internet (Opportunities Abound in the Greater Bay Area, 2022)

1.4 The GBA - Industry Transition

Before the national strategy for the economic centres in the GBA was implemented, this region had already gained fame as the "world's factory." The area attracted numerous foreign factories due to its low land prices, favourable tax policies, and surplus labour force. Simultaneously, local village collectives developed into intermediate producers. Their industrial activities primarily involved processing trade, particularly in electronic products. The production chain mainly entailed importing components, assembling them in village factories, and exporting them to Hong Kong through a dense network of waterways and roads. As a result, industrial development in the villages experienced rapid growth over the past 20 years. However, these areas face serious environmental challenges due to the lack of regulation, such as excessive emissions and water pollution (see Figure 1.3). After the year 2000, the government began implementing strategies for industrial transformation, aiming to shift towards higher-end manufacturing, which is still ongoing (Development, 2012).

Under the national strategy, the industrial transformation in the GBA, particularly in the peri-urban territory, has become more uncertain. Firstly, the economic centres exhibit a trend towards deindustrialisation, while other second-tier cities (see Figure 1.11), such as Foshan and Zhongshan, show a tendency towards excessive industrialisation as they absorb industries transferred from first-tier cities. As shown in Figure 1.12, the peri-urban territory of the GBA assumes a more significant role in the development of manufacturing. The industrial transformation in this region has some clear prospects, including 1) the government's envisioned continuous transition towards high-end manufacturing(Development, 2012; province, 2021); 2) the elimination of surplus processing factories, which includes 70% of village-level industrial parks (Liu, 2019); 3) the consensus on sustainable development becoming a national policy(China, 2019), thereby gradually implementing low-carbon industrial transformation practices (such as promoting carbon trading and circular economy)(Xuelan Zeng, 2021; Zhu et al., 2019). However, these plans have not demonstrated a concrete and long-term strategy for advancing the sustainable industrial transformation of the GBA region.



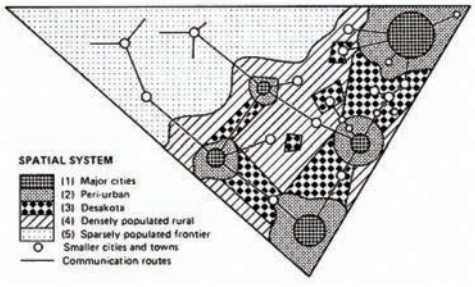
[Fig.1.11] Industrial structure of 11 cities in the GBA; source: The GBA Fintech Report 2019: Hong Kong-Macau-Guangdong Greater Bay Area Fintech Analysis & Recommendations, The Fintech Association of Hong Kong, April 2019

[Fig.1.12] Active industrial activities in GBA's peri-urban territory; source: image by @ZhouMini in Xiaohongshu

1.5 The Desakota

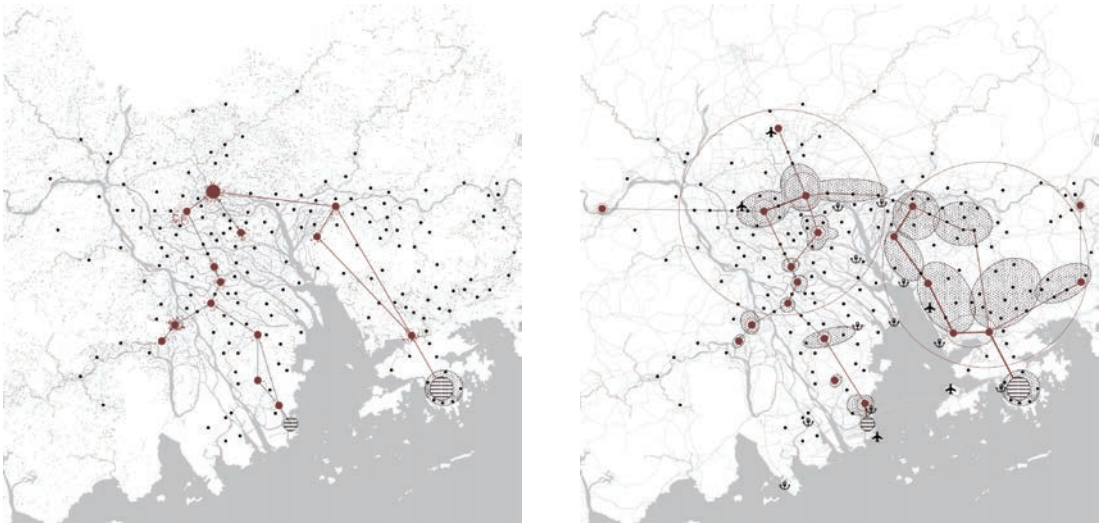
DEFINITION OF DESAKOTA AND ITS CONTEXTUALISATION IN GBA

In the Chinese context, few models describe peri-urbanisation as an in-between state of urban and rural classification. In this case, the Desakota model (Mcgee, 1991) that transcends urban and rural typologies is introduced to guide the spatial research of the dispersed urbanised areas. Figure 1.10 presents the Desakota model of the spatial configuration in the Asian context. This model identifies five main regions, of which type (3) is labelled the Desakota region.



[Fig.1.13] Spatial configuration of a hypothetical Asian country; Source: diagram by Terry McGee (Mcgee, 1991)

In detail, the regions designated as desakota have six main features. They are: the large population engaged in smallholder cultivation; the increase of non-agricultural industries; a mixture of land uses for agriculture and non-agriculture with the staggered layout;



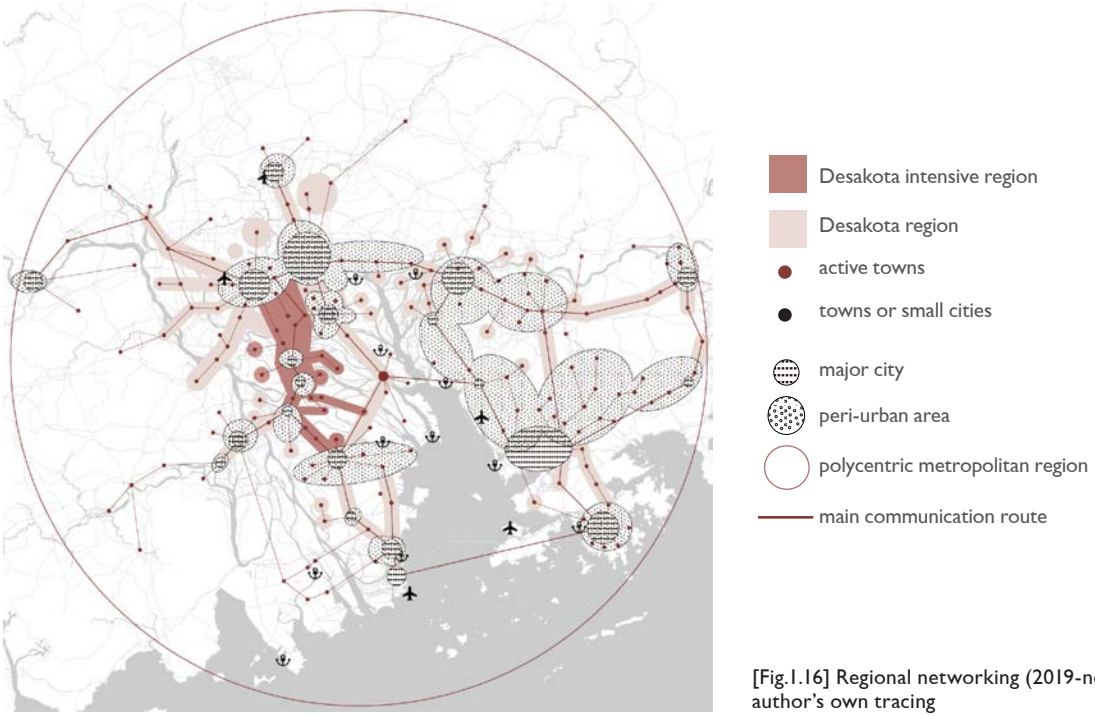
[Fig.1.14 & 1.15] Reading the GBA using the desakota model. Left: rural industrialisation (1980-1997); right: urban expansion and metropolitanisation (1997-2019); source: author's own tracing

strong fluidity and mobility of people, goods and information within the region; and the informal sector being extended. Based on these features, the Desakota regions and their change over time are depicted through mapping (see figure 1.14 to 1.16). As shown in figure 1.16, the highlighted area is the urgent territory chosen as the research and design area because the new centrality of life is emerging with easier accessibility.

THE POTENTIAL

Special conditions of the mature industrial foundation of Desakota in the GBA provide the potential capacity to transform. On the one hand, dispersed settlement patterns can be characterised by the diversity of culture and nature and have the potential for mutually complementary development on the basis of current communication networks (Sieverts, 2003).On the other hand, as this region becomes increasingly developed, fewer densities of processing industrial activities and the industry transition towards more circular and green can be achieved and contribute to the in-built redundancy of factories. This large number of buildings means freedom of new functions; thus, Desakota can be adapted in response to the different natural and cultural features.

By that, the questions are raised: what is the current quality of life in Desakota? And what factors are limiting the sustainable and diverse development of Desakota?



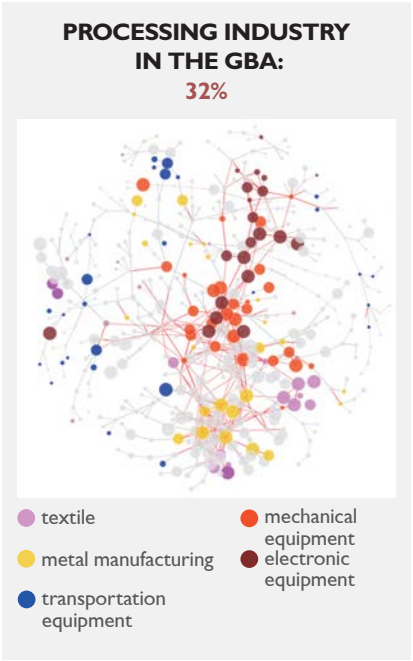
[Fig.1.16] Regional networking (2019-now); source: author's own tracing

2. Problem Field

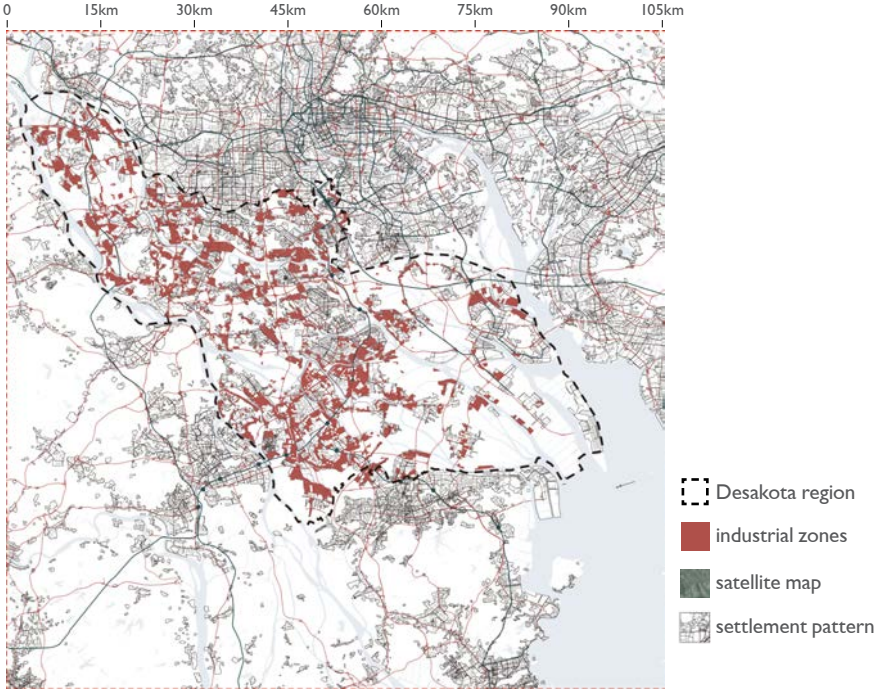
2.1 Problematisation - the Quality of the Desakota

The desakota region attracted a large amount of international and domestic investment in the manufacturing industry, predominantly in the metal, chemistry, mechanical equipment, textile and furniture industries. But most rely on a scattering distribution of similar small-scale and labour-intensive export-processing firms; thus, the industry's material and energy flow linearly consumes large amounts of resources and generates environmental pressure.

Similar small-scale and labour-intensive processing firms are characteristic of the low-end industrial clusters in the desakota, which leads to inefficiency and unsustainability of resources and the environment.



[Fig.2.1] Industrial structure of GBA; source: diagram from essay (Li et al., 2021)



[Fig.2.2] Distribution of the industrial zones in the Desakota region; source: author's own based on OSM data and tracing

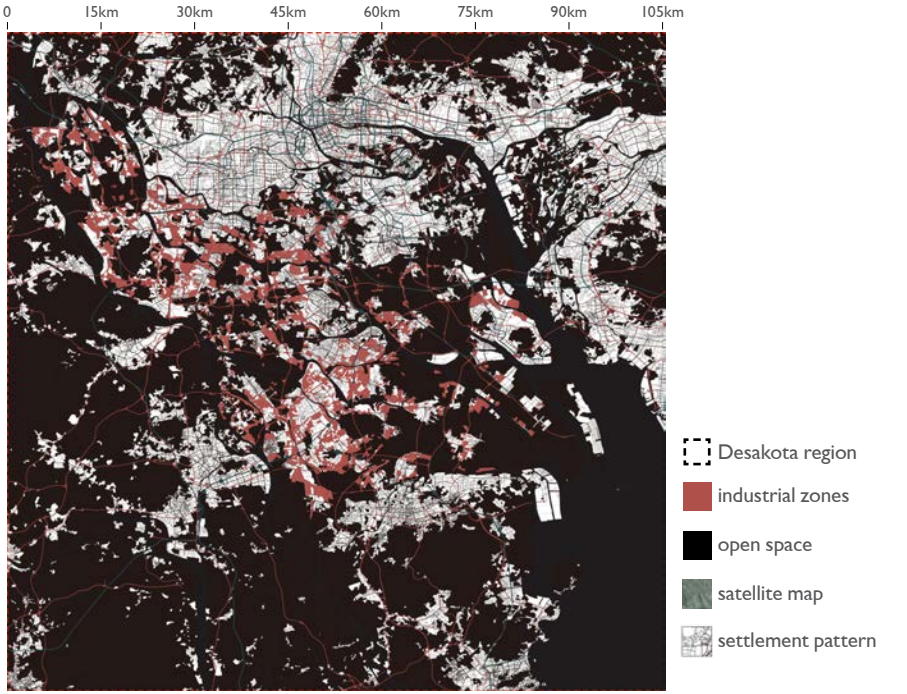
Generally, the village collective in China owns the resources of rural land. Most of the villagers in this region make their livelihood through the rental economy, renting their farmland to manufacturing firms village by village. Therefore, almost half of the farmland is converted into scattered land for industrial production. Meanwhile, the cultivable landscape is cut into separate patches as the regional infrastructure crosses. On these grounds, landscape fragmentation in desakota reduces the biodiversity and ecosystem service, making it vulnerable to flooding risks, land subsidence and other social and environmental challenges.

The incompatible industrial activities and regional infrastructure within the agricultural landscape exacerbate landscape fragmentation and pollution, increasing social and environmental vulnerability.

REDUCTION OF OPEN SPACE DUE TO INDUSTRIALISATION AND URBANISATION:

50%

[Fig.2.3] Industrial estate in the Desakota; Source: image from sohu.com (Village Transformation in Xingtan Village, 2020)



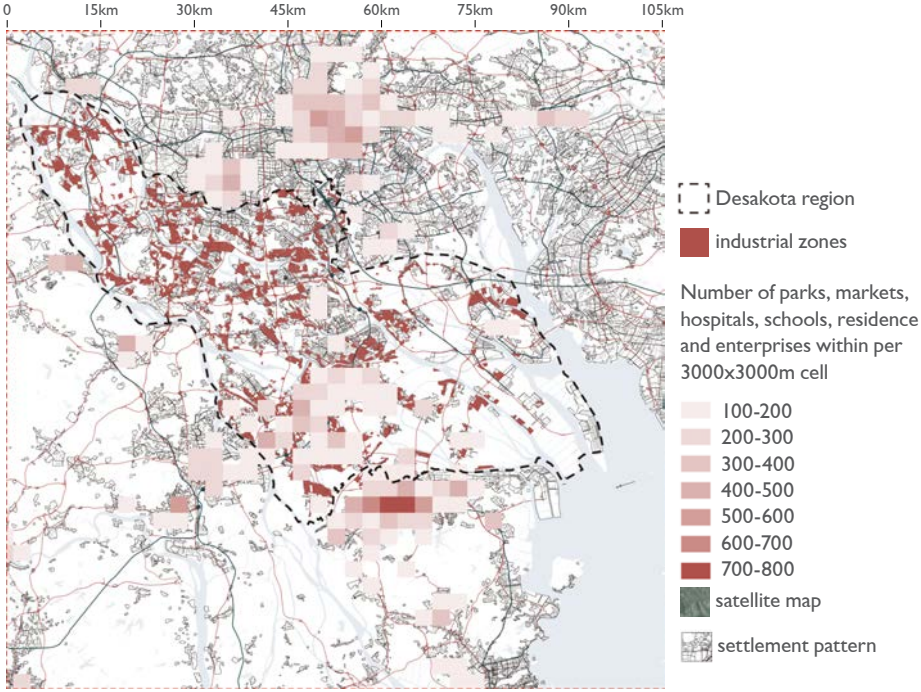
[Fig.2.4] Distribution of the industrial zones and open space in the Desakota region; source: author's own based on OSM data and tracing

The oscillating flows of people reflect the rhythm of life in desakota. The complex demographic composition in desakota could be summarised as three groups: 1. local villagers who work both in agriculture and other industry; 2. migrants from poor cities looking for their livelihood; 3. commuters from other towns or cities for better economic opportunities (Zhou Y, 1991). The human flows generate a greater need for facilities and resources. But it is not ensured within Desakota. For instance, people's basic need for education, health care and recreation is not satisfied. Hence, liveability can not be safeguarded in the desakota region.

The human flows generate a greater need for public facilities and resources, which is not ensured within the desakota region, resulting in uninhabitability and inequality.

MIGRANT:
50% OF THE TOTAL POPULATION;
85% OF THEM WORKING FOR MANUFACTURING

[Fig.2.5] Rural migrants working for processing manufacturing ; source: image from BBC NEWS Chinese (BBC News Chinese, 2014)



[Fig.2.6] The industrial zones overlapped with the density of public services in the Desakota region; source: author's own based on OSM data and tracing

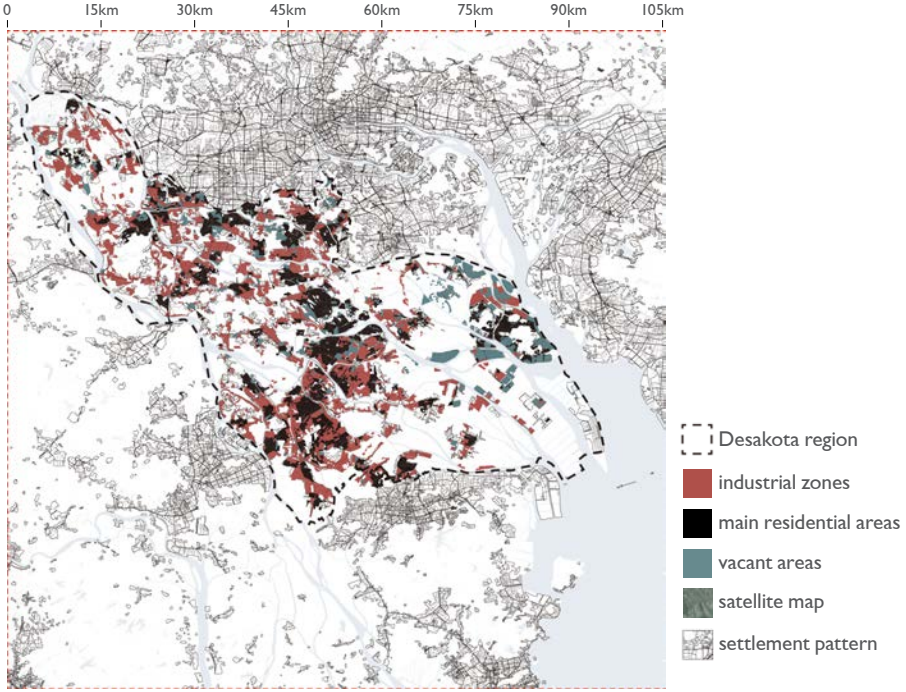
Spatial heterogeneity characterises the urban form of desakota, namely that productive buildings and living buildings are arranged spontaneously, blended and intensively. The living space is mainly formed by: similar high-rise apartments within enclosed blocks and the low-rise housing that is too intensive to meet the public need for qualified life. As for the productive space, they directly affect the quality of life. All these morphological elements mix and result in residents, farmers, and workers' exposure to pollution, traffic threats, and publicity loss. Additionally, as the industry transformation to a high-end industry takes place, more and more factories are vacant or converted, but most of the transformation results in similar modern housing and a gradual loss of identity.

The arrangement of buildings in desakota is spontaneous and disordered, resulting in unfavourable habitability, vacant land and identity loss.

OLD INDUSTRIAL CLUSTER UNDER THE TRANSFORMATION:

70%

[Fig.2.7] Hybrid land use of industry and different types of residential areas; source: image from ZSBTV (The Development of Xiaolan Town, 2022)



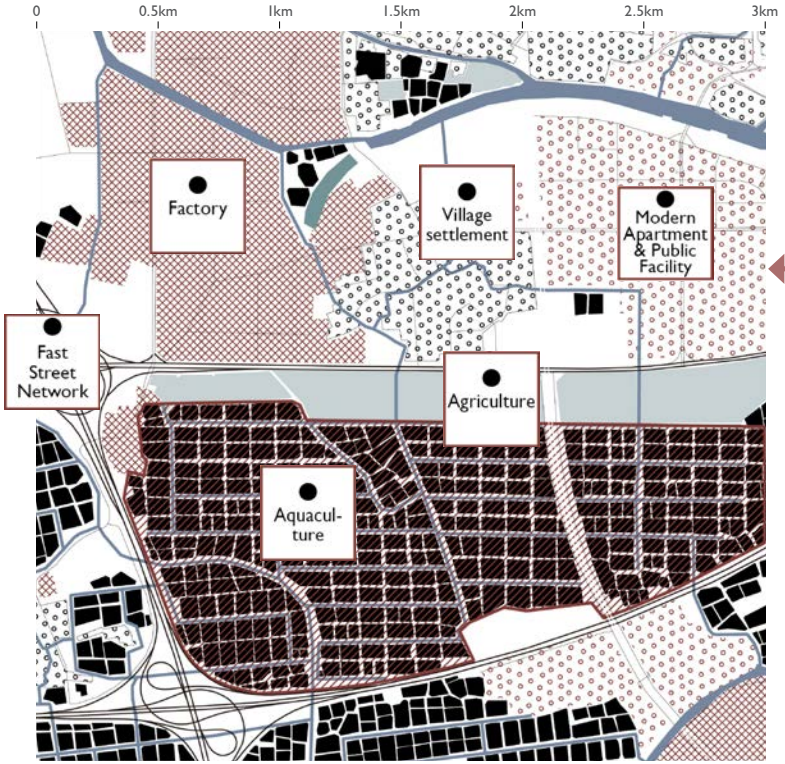
[Fig.2.8] Distribution of the industrial zones, reisdential areas and the vacant areas in the Desakota region; source: author's own based on OSM data and tracing

2.2 Problematisation
- Regional Planning System

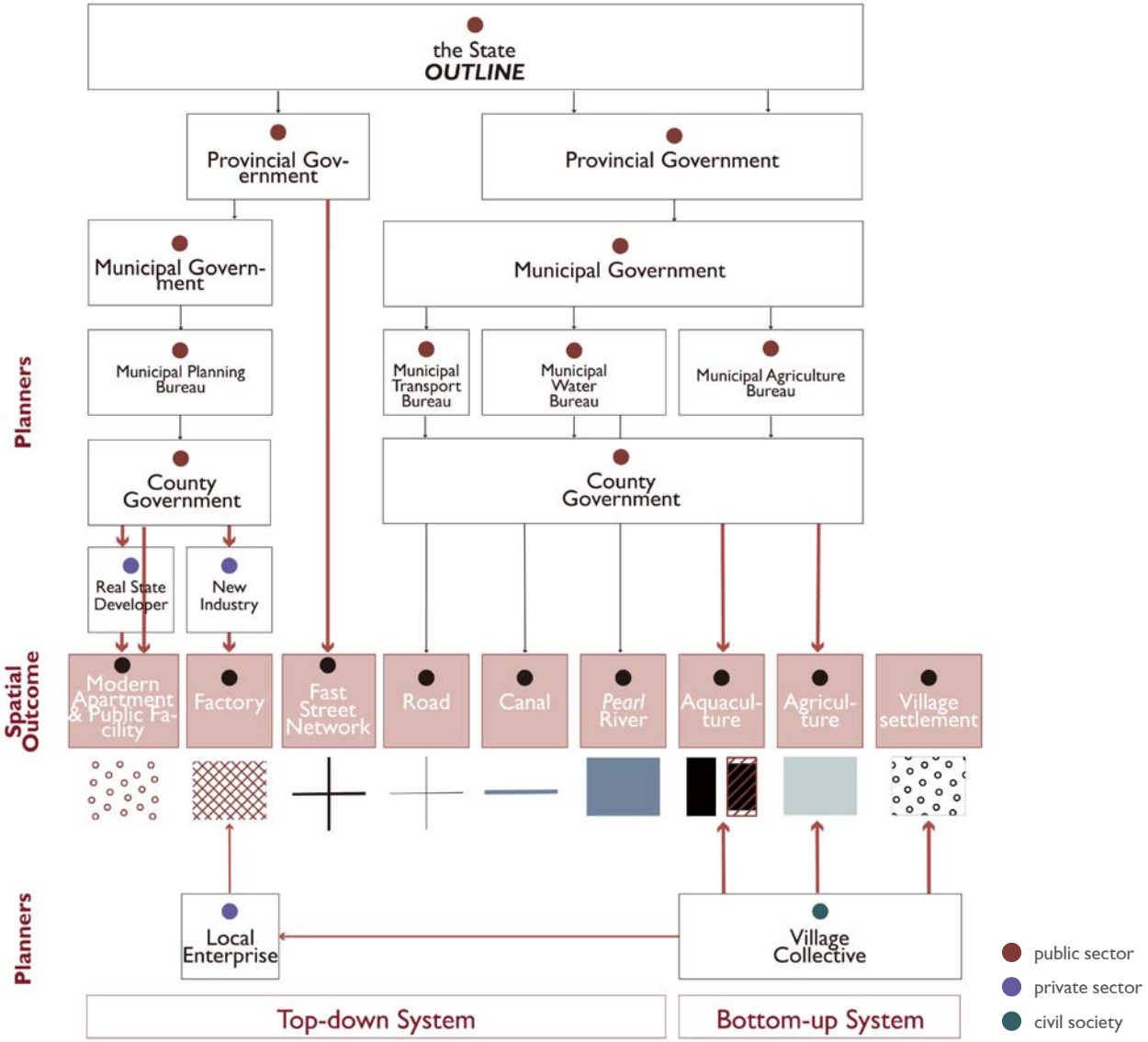
The spatial planning system in the GBA region is one of the factors causing the low-quality settlement and unstainable industry chain. The traditional planning system intervenes only in urban or rural areas. For the urban typology, the planning focuses on blueprint of development and networking, simulating more infrastructure of connections and factories from major cities into the hinterland (Chen et al., 2017). They are proposed by the regional transport and planning bureaus without considering local conditions (see the fast street network and factory in figure 2.9). Meanwhile, the local government with an entrepreneurial spirit tends to attract more investment in factories and real estate based on this infrastructure. All of these actions lead to a fragmented result of urbanised space.

For the rural typology, the planning concerns rural revitalisation for food security and village life. As is shown in figure 2.9 and 2.10 of the aquaculture landscape, it is defined as legally protected areas by the regional agricultural bureau and administrated by the local agricultural authority. Without the specific principles of the planning system, this area is in direct proximity to urban and industrial functions. Cooperation of different sectors is hard to process here due to the lack of specific strategies.

To conclude, the urban or rural planning strategies of the traditional planning system are thus not effective in this area. Although some actions have been taken to improve the quality of life in the Desakota region, micro-scale interventions without a holistic view might even lead to more fragmented and unstainable results. Hence, the structure of Desakota should be rethought with a perspective beyond the urban and rural dichotomy.



[Fig.2.9] The spatial outcome of Desakota caused by the right framework of regional planning system; source: author's own tracing



[Fig.2.10] Regional planning system that is applied to the Desakota region; source: author's own based on the document review

Much of the dispersed territory of GBA cannot be described as either urban or rural typologies, so there is no understanding of the traditional planning system for these in-between areas.

2.3 Problem Statement

To conclude the foregoing problems, a complete statement is presented below:

[PROBLEM FIELD]

Since 1978, urbanisation has accelerated in the GBA due to China's reform and opening-up policies. Apart from the dramatic expansion of major metropolitan regions, a dispersed urbanised landscape lying beyond the city boundary can be recognised here. These dispersed areas manifest in a patchwork landscape of urbanised and rural settlements and industrial and agricultural landscapes, which are most intensive along the transport infrastructure that connects the major cities. However, these areas have urgent problems: expanding in an unsustainably industrialised manner and lacking specific spatial planning. So this thesis looks at these dispersed urbanised areas in the GBA and explores the potential for sustainable urban development.

[SOCIETAL RELEVANCE]

The phenomenon of peri-urbanisation has been widely recognised in the GBA region due to the interplay of landscape conditions, export-processing industry development and regional networking of economic centres by transport infrastructure. The flow of people, goods, and information rapidly grows in these areas, generating a new and diffused arrangement of architecture.

However, this new picture fails to ensure quality of life and sustainability, which leads to the decay of its social and ecological structure. First, many industrial activities rely on a scattering distribution of similar small-scale and labour-intensive export-processing firms; thus, the industry's material and energy flow linearly consumes large amounts of resources and generates pollution. The incompatible activities are mostly within the agricultural landscape, causing dramatic environmental pressure, including chemical, metal and water pollution and huge carbon dioxide emissions. Besides, the human flows from industries generate a greater need for liveability, which is not ensured with current morphological and functional elements.

The spatial planning system in the GBA region is one of the factors causing the low-quality settlement and unstainable industry chain. The urban-rural dichotomy planning system either focuses on economic centres' development and networking or only concerned with planning rural revitalisation for food security and village life. However, much of the dispersed territory of GBA cannot be described as either urban or rural typologies, so there is no understanding of these in-between areas.

[POTENTIAL]

In fact, special conditions of the mature industrial foundation of these dispersed areas in the GBA provide the potential capacity to transform. On the one hand, dispersed settlement patterns can be characterised by the diversity of culture and nature and have the potential for mutually complementary development based on current communication networks (Sieverts, 2003). On the other hand, as this region becomes increasingly developed, fewer densities of processing industrial activities and the industry transition towards more circular and green can be achieved and contribute to the in-built redundancy of factories. This large amount of buildings means freedom of new functions; thus, territorial metabolism and spatial morphology have room to be designed. At the premise of sustainable industry transition, the structures of dispersed patterns can be adapted in response to the different natural and cultural features.

[SCIENTIFIC RELEVANCE]

Some Chinese urbanists have acknowledged the condition and potential of peri-urbanisation in the GBA region region (Chen et al., 2017; Fan & Lei, 2009; Lin, 2018; Zhou Y, 1991). However, th. However, these works are mostly symptomatic descriptions without methodological innovations, mainly in economic and political aspects without spatial or functional investigation. Thus, as Brenner and Schmid argued (Brenner & Schmid, 2013) in planetary urbanisation, new strategies of specific research and comparative analysis are required, which transcend the assumptions for the research of peri-urbanisation within mainstream planning.

To this end, a description embedded in the Asian context is proposed by the term "Desakota" (Mcgee, 1991). By that, it positions the dispersed urbanised areas in rapidly expanding and polynucleated metropolitan regions. So the thesis borrows from this concept to define design areas and guide spatial research for sustainable industry transition.

PROBLEM STATEMENT

In short, the development of the Desakota region in the proposed network of the Greater Bay Area megaregion, with its current form, flows, and spatial planning system, cannot meet the condition of future sustainable and liveable urbanisation.

3. Conceptual Approach

3.1 Research Aim and Research Question

Based on the mentioned problems and the potential of Desakota, this thesis aims to transform the form, flow and planning system in Desakota to a sustainable and liveable future.
To this end, from a holistic perspective, the conceptualisation, analysis and design attempt to explore the potential structure plan of Desakota in GBA by figuring out: the spatial and functional structure of the Desakota, its interrelation with the regional network, the potential industry transition of sustainable future, the current features of this structure that can be adapted and improved to a proposed future, and how the planning system can take its responsibility

MAIN RESEARCH QUESTION

Accordingly, the main research question is specified:

What are the potentials of the desakota pattern to be adapted in the proposed network of the Greater Bay Area megaregion for industry transition that supports sustainable and liveable urbanisation?

SUB RESEARCH QUESTIONS

The sub-questions are built up towards the proposed outcome of the main question:

1. What are the morphological and physiological features of the Desakota network that consists of nodes, connections, and borders in the interrelated structure of the GBA megaregion?

2. What qualities can the Desakota network achieve, inspired by industrial transition and dispersed urban development reference projects? How can the current features contribute to the targeted qualities?

3. How to adapt the structure of the Desakota network by combining targeted qualities? And to achieve the structure plan, how can the spatial interventions be contextualised on the local scale?

4. How can tasks and responsibilities be regulated through the spatial planning systems?

3.2 Theoretical Framework

To answer the main research question, the first assignment should clarify the conceptual framework and methodology based on the theoretical position of the Desakota model. However, the Desakota model has its limitation: it does not provide a specific methodology for the research. In this case, the Netzstadt method (Oswald et al., 2003) is also used as the theoretical foundation that provides a synthesis platform for morphological and physiological analysis (see figure 3.5). On these bases, the Desakota region is understood as an urban system and uses the network as a metaphor for analysis and planning.

Apart from them, there are relevant works of literature on peri-urbanisation with perspectives of the worldwide phenomenon, Chinese context, understanding of metabolism, and morphological analysis approach, which support the theoretical framework that Desakota and Netzstadt mainly form.

All of these are presented below, with a reflection on transferability to the thesis:

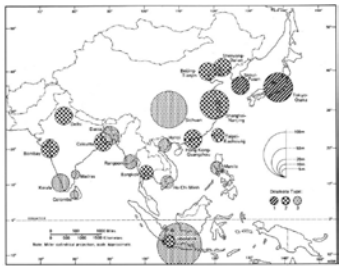
PLANETARY URBANISATION

Many urbanists have coined the terms to describe the phenomenon of peri-urbanisation in the hinterland: "La Città Diffusa" (Indovina, 1990), "Zwischenstadt"(Sieverts, 2003), or "Territories-in-between" (Wandl, 2020), but they are special cases in a European environment. A general description of these new forms of urbanisation could be explained by the term "planetary urbanisation" (Brenner & Schmid, 2013). By that, it refers to the fact that even spaces that lie beyond the traditional city cores and suburban peripheries—including small- and medium-sized towns, major transportation corridors, agro-industrial land use systems, and the "wilderness" —are increasingly interconnected with the rhythm of worldwide urbanisation. As a universally applicable hypothesis, it acknowledges the existence of peri-urbanisation in the GBA and that conventional planning can no longer produce a sustainable and ordered condition. Thus, based on different geographical and cultural conditions, boundary-exploding methodological strategies are needed to formulate the empirical investigation of peri-urbanisation.

THE EXTENDED METROPOLIS - DESAKOTA

As mentioned in Chapter 1, the Desakota model is one of the significant manifestations that consolidate the formation of peri-urbanisation. Terry McGee (Mcgee, 1991) describes those regions as desakota type 2 (see figure 3.1), where productivity gains in agriculture and industry and change to non-agricultural activities are focused particularly on the city cores and peripheral areas. The GBA is one of the representatives.

In addition to defining the spatial configuration of Desakota in a megaregion, the literature also proposes that Asian countries need to develop pragmatic strategies if they attempt to acknowledge the importance of Desakota beyond the urban-rural definition. These strategies should consider the future of agriculture as the economy grows, ways of releasing the surplus labour with the priority of its localised development, and effective strategies in response to the conflicts over incompatible land use and environmental pressure.



[Fig.3.1] Growth of core areas in Asia; source: image by Terry Mcgee (Mcgee, 1991)

Situated in the GBA, the reality of Desakota's growth means the related planning decisions cannot be postponed. The consideration above should also be taken to minimise the negative effects of the mix that characterises the Desakota and to use the possibility of diversity, accessibility, and cooperation.

METROPOLITAN INTERLOCKING REGION

Due to the special economic and political conditions, the Desakota concept should be contextualised to better understand its presence and uncertainty in China.

Chinese urbanists have acknowledged the condition of Desakota in China (see figure 3.2) and pointed out that it can only be found in the Metropolitan Interlocking Region (Zhou Y, 1991). This region is recognised in well-developed areas, involving several metropolitan areas connected, plus extensive areas beyond them. As described in the literature, the coexistence of two driving forces characterises urbanisation in China, especially in the region of Desakota: it is pushed forward both by the development of modern industry and diversified agriculture and rural industry; by relying on state investment and individual initiatives of the township-run enterprises and village collectives; by the influence of adjacent large cities as well as the active development of small cities and towns. Hence, the traditional administrative boundary of large, medium and small cities, countries, and towns is hardly applicable to the cities and towns.

[Fig.3.2] The HongKong-Guangzhou-Macao metropolitan interlocking region; source: image by Zhou (Zhou Y, 1991)

The relationship between the core cities and small countries and towns recognised as the Desakota region in GBA needs to be redefined. Hence, the metropolitan interlocking region concept can help rethink the Desakota structure within the GBA network. In detail, this concept is formed by: two or more large cities as growth poles, important ports, accessible transit lines as development corridors between poles, and a number of small and medium-sized cities and towns along the corridor with intensive economic interaction. However, the work of literature is mostly symptomatic descriptions without methodological innovations, mainly in socio-economic aspects without spatial or functional investigation. Hence, it is only used as a reference and background model.

NETZSTADT APPROACH

To scientifically explore the structure of Desakota, the Netzstadt method presented by Oswald and Baccini (Oswald et al., 2003) provides a synthesis framework for regional planning that integrates morphological (the arrangement of territories) and physiological (the management of resources) perspectives. The interconnection of these two perspectives is based on understanding the new urbanity related to infrastructure development. This new urbanity can be recognised by the moving flows of people, goods, and information through infrastructure and between the settlements where the masses of architecture collect and individuals are dispersed. The discontinuities and alternative dimensions of urban architecture express this moving picture. To cope with this complexity, the Netzstadt method is proposed based on the simplified urban system model. It uses the network as a metaphor; thus, the urban system's morphology and physiology are represented by nodes, connections, and borders (see figure 3.3), which can be applied from the national scale to the individual scale. Using the same working language, analysis can be processed towards part of strategies to develop urban systems.

[Fig.3.3] Netzstadt model: transboundary network of nodes and connections; source: diagram by Oswald, Baccini & Michaeli (Oswald et al., 2003)

To conclude and contextualise, the Netzstadt method is applied using the following steps: the Desakota urban system is recognised based on nodes, connections, and borders; this system is structured into four activities of residing, working, nourishing, and transiting; it is supported by key resources of water, food, energy, and other materials; it is represented by six types of territories including settlement, waters, forest, agriculture, infrastructure, and fallow land; five quality criteria of identification, density, flexibility, degree of self-sufficiency, and resource efficiency evaluate the system and strategies.

With appropriate approaches (see figure 3.4) to defining scales, criteria of urban

qualities, networks and their features, and urban projects, the Netzstadt model contribute to building up the ways to reach the research aim. However, this framework is applied and tested in a European context, so some steps, especially the indicators of analysis and the quality criteria, should be adjusted to fit the condition of Desakota in GBA.

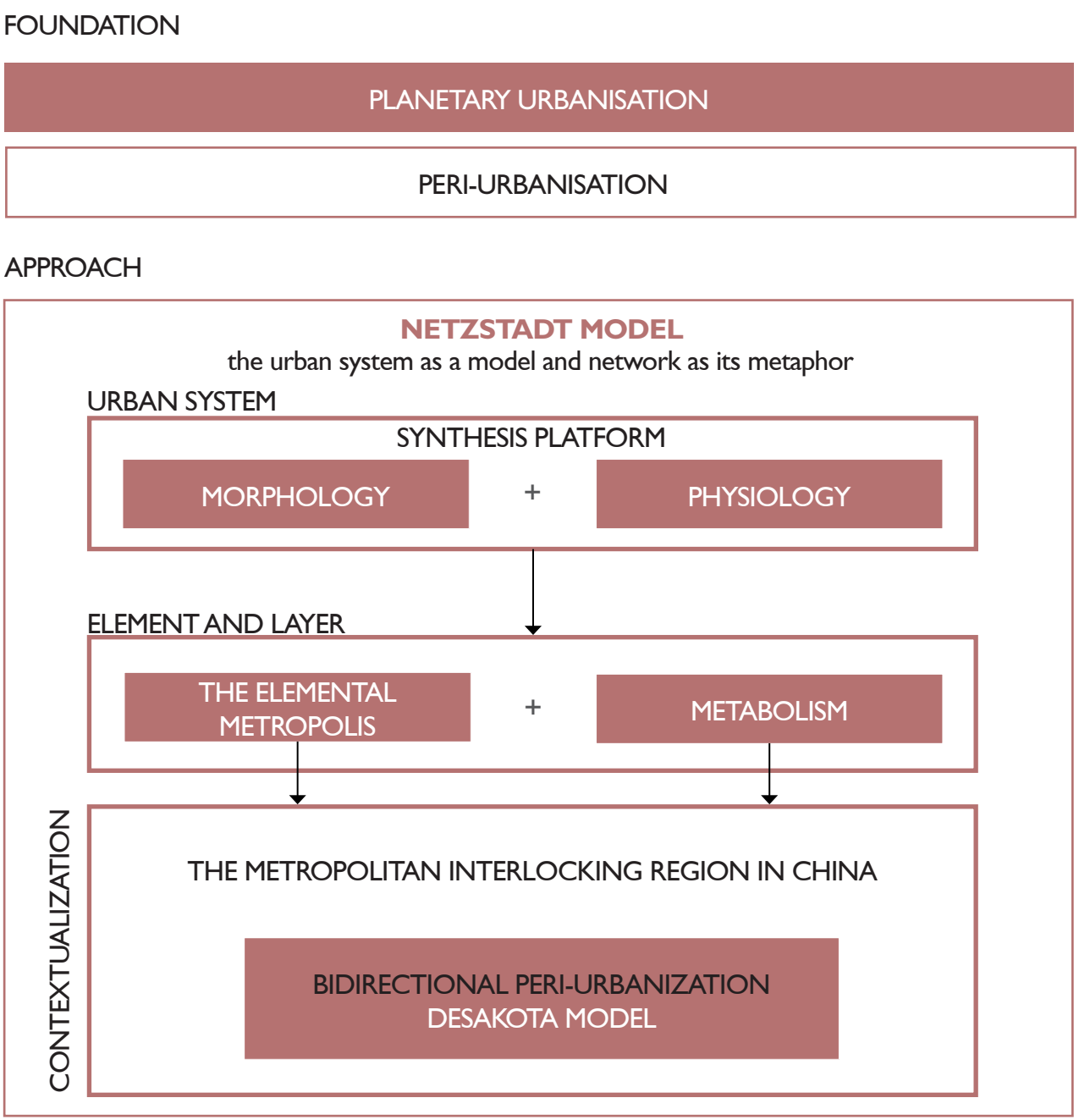
TERRITORIAL METABOLISM

The Netzstadt method is a transdisciplinary work integrating urban planning tasks with the concept of metabolism (Oswald et al., 2003). Metabolism designates the physiological processes in anthropogenic systems reflected in the flows of materials and energy in a given space (Baccini & Brunner, 2012). As the Netdstadt describes, material flow analysis should be applied to figure out the physiological feature. These flows in an urban system are assumed to be related to the actor "people". Dependent on the available socio-economic data, the indicators of the physiological network can be represented by the activities of people. Limited by the data collection, these social indicators can not concisely support the physiological analysis in Desakota of GBA; thus, more flow analysis methods should be considered to avoid misunderstanding.

THE ELEMENTAL METROPOLIS

Similarly, more concepts of morphological analysis are reviewed as a supplement. Elementarism as a method to understand and design the territory of Desakota in China is proposed by scholar Qinyi Zhang (Zhang, 2022). The referenced hypothesis of the element is from Paola Viganò (Viganò, 1999). Three levels form the method: the elements, including both the simple, like a street and the complex(or be called a typology), like the peasants' houses; the layer where the repetition of elements can be displayed in a structural and sense; the system consisting of various elements and their layers integrated by certain rules, where identity and belonging of a whole can be recognised. Rather than the traditional systems of ecology, mobility, housing, etc, the new "utopians" system is envisioned by the author based on the potential of the Desakota elements and layers. To avoid confusion about the term "system" that is applied in the thesis, only the levels of elements and layers will be applied to analyse the different features within the Desakota network, as the aim of this thesis is not only regarding the Desakota region itself but also about its relation to the whole GBA network; thus the term "urban system" from Netzstadt is more suitable. Besides, the layers analysis provides a platform for understanding the functional relations between the elements rather than just morphological relations.

[Fig.3.4] Five procedural steps of applying the Netzstadt; source: author's representation based on the diagram by Oswald, Baccini & Michaeli (Oswald et al., 2003)



[Fig.3.5] Theoretical framework

3.3 Conceptual Framework

As described, two main concepts of Desakota and Netzstadt are leading the conceptual framework that guides the goals, analysis, and design tasks. The process of adapting the Desakota structure in GBA towards a sustainable and liveable future is conceptualised, as figure 3.6 shows. The introduction from potential to tasks is presented below:

Specific qualities of Desakota can be briefly concluded as the diversity of economic activities, efficiency of resources due to the hybrid land use, freedom of movement, more interaction with nature, diverse agricultural products and multiculture (Mcgee, 1991). More potential qualities could be located in GBA: the developed industrial foundation, the opportunities for industrial transition supported by the government, and in-built redundancy. In conjunction with the five quality criteria of evaluation from Netzstadt (Oswald et al., 2003), the Desakota region of GBA has the potential to realise a future in which:

1) the dispersed settlement patterns with different livelihoods, cultures, natures, and lifestyles can keep their identities where the basic needs of people can be satisfied within the internal or accessible patterns;

2)the ability to handle social-ecological pressure like flooding and food crises is enhanced from a holistic network, namely by conserving and restoring nature and adequately leaving the variable-use and changeable space;

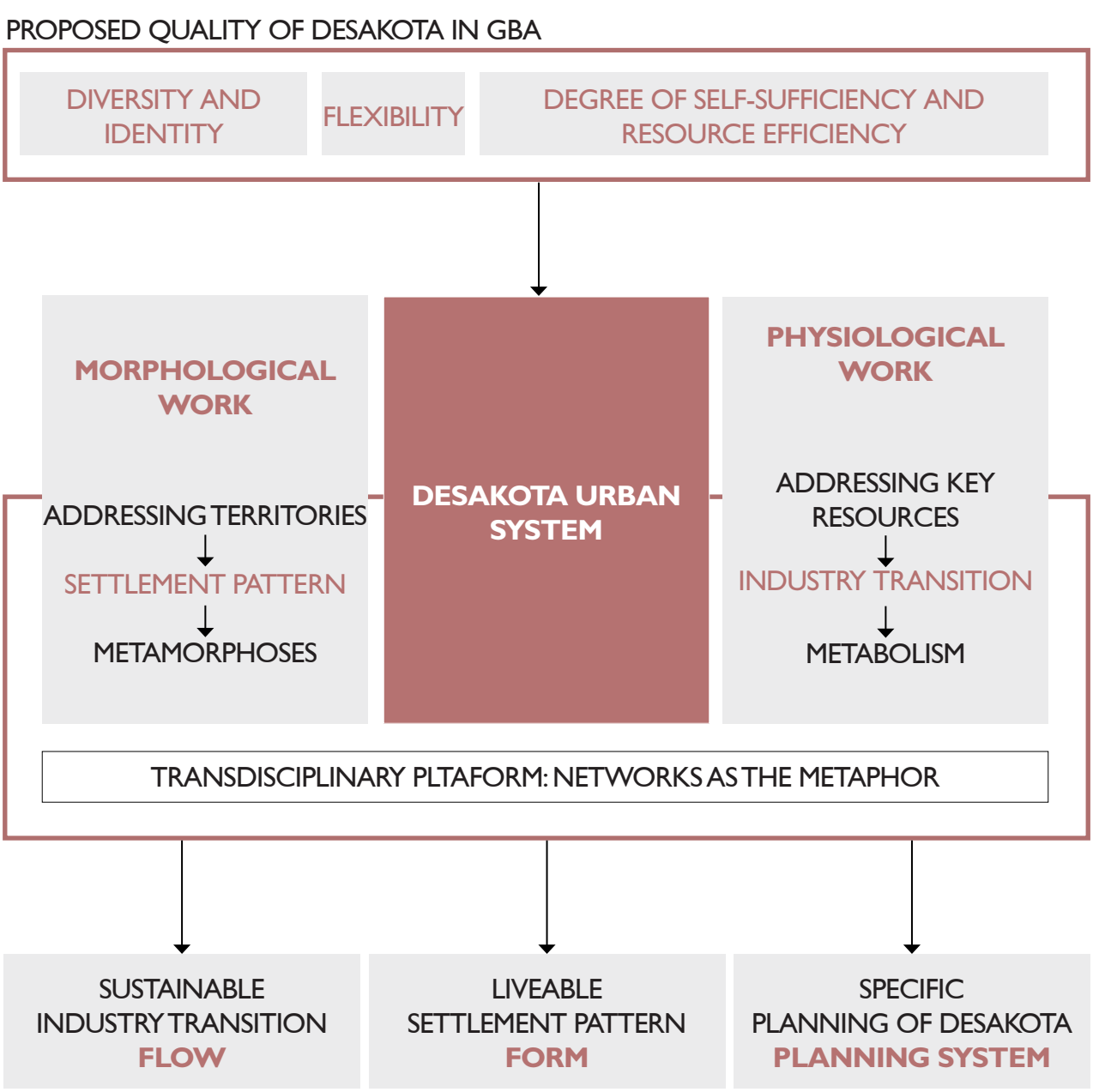
3)the degree of self-sufficiency and efficiency in resources, especially by industrial activities, is dramatically improved through the industry transition towards a green, circular, and symbiotic development.

All of these qualities are mutually supportive as well as limited. Based on these proposals, the design assignments for the flow, form and planning system in Desakota are specified:

1) Based on the existing industries, explore the pathway of a green, circular and symbiotic industry transition.

2) Under the transition hypothesis, identify the spaces of uncertainty in the settlement patterns, such as decommissioned factories and vacant land. Accordingly, they should be given new functions to transform the Desakota structure. These new functions may contribute to restoring nature, responding to the features of different patterns, completing public functions, or renewing industrial functions.

3)To support the tasks above, spatial planning as a tool should be used to realise the proposed structure of Desakota.



[Fig.3.6] Conceptual framework

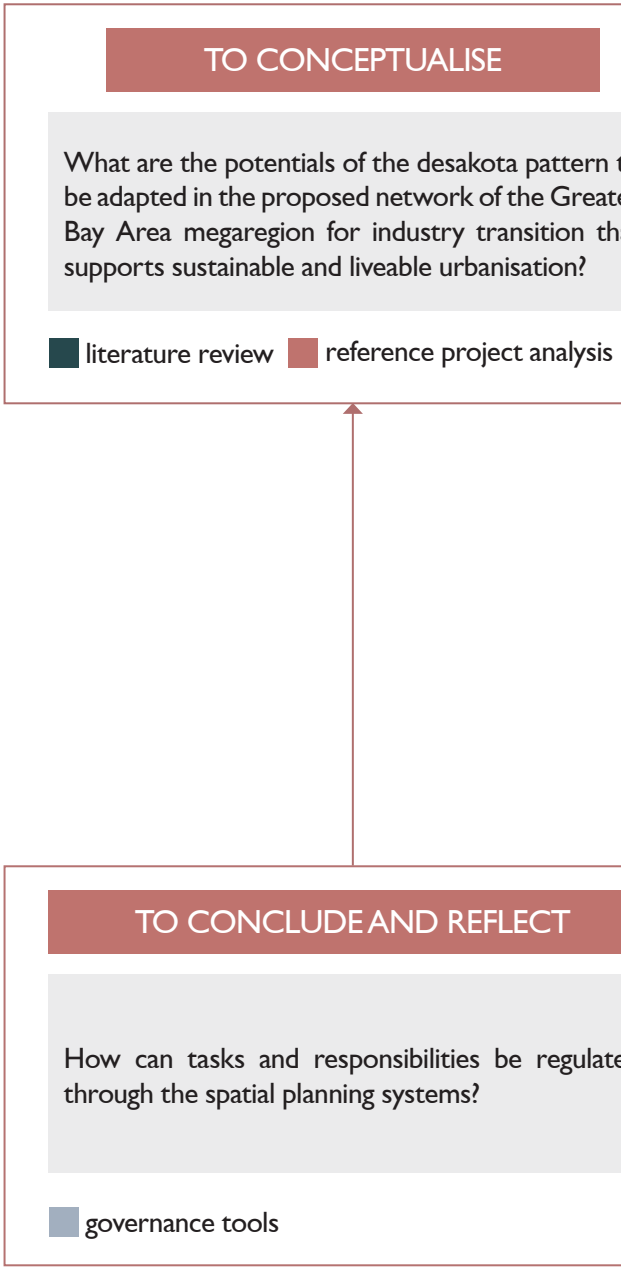
4. Method

4.1 Methodology

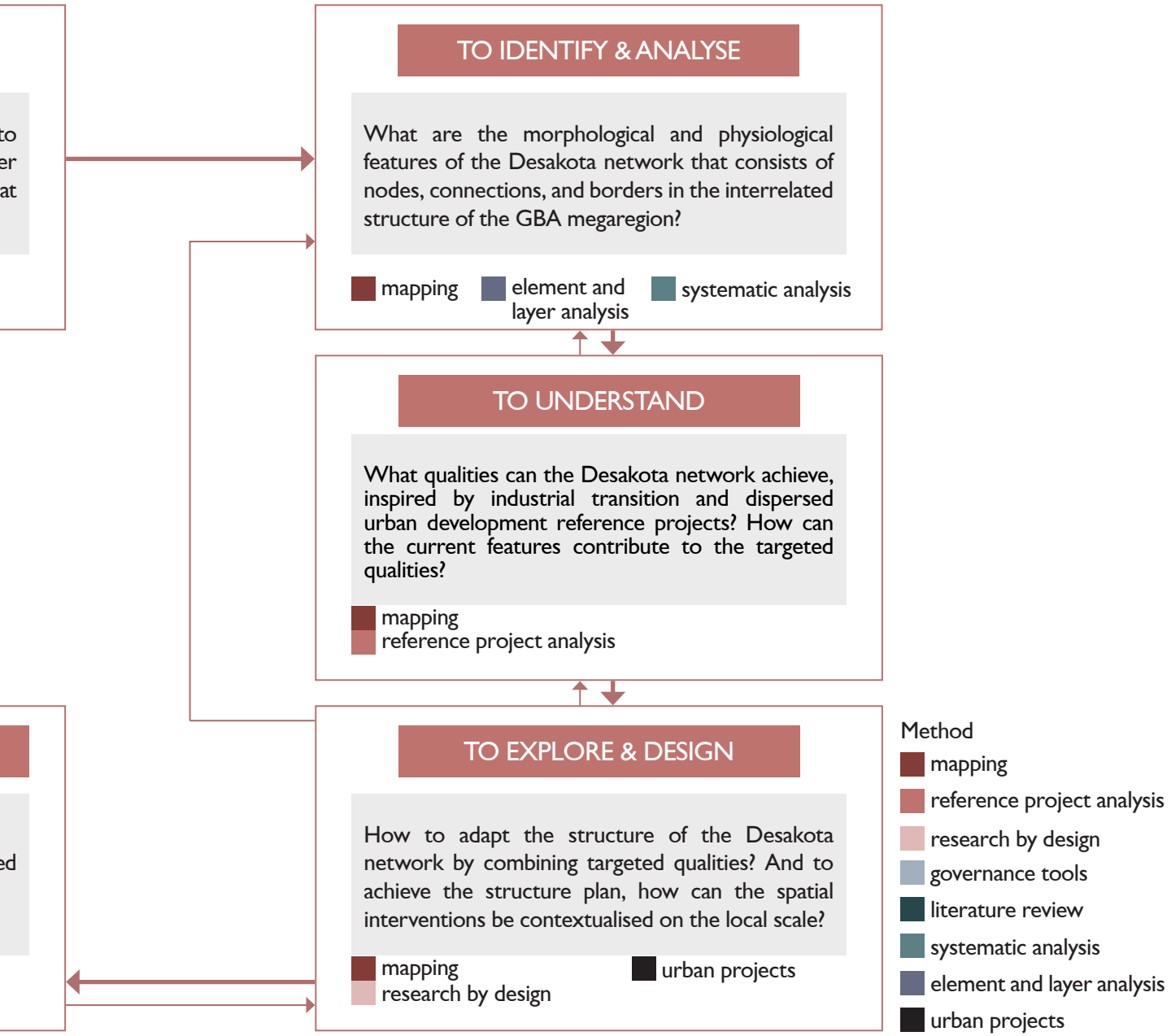
In accordance with the conceptual framework, the outcome of the thesis will be an adapted structure plan of the Desakota network, a design project and the supportive spatial planning system.

The sub-questions presented in Chapter 3.1 are built up towards this outcome. For sub-question 1, the assignment will be the identification and analysis of the Desakota network. The next step is to understand the precedent of reference projects and learn their qualities. For sub-question 3, the task is to propose a structure plan according to the targeted qualities and explore the design strategies through a design project. The last step is to reflect on the sptial design process of structure plan & design projects to propose the specific spatial planning framework and the adjustment of current planning system, including content, governance, and process. After design assignments, there will be a reflection on the theoretical realm to conclude the transferability of the thesis.

As shown in figure 4.1, the methodology includes five steps. It is not a liner way of analysis and design. After each step, a conclusion and reflection are proposed to make and adapt what has been and will be done. The main methods in the methodology diagram are described in the following pages.



[Fig.4.1] Methodology

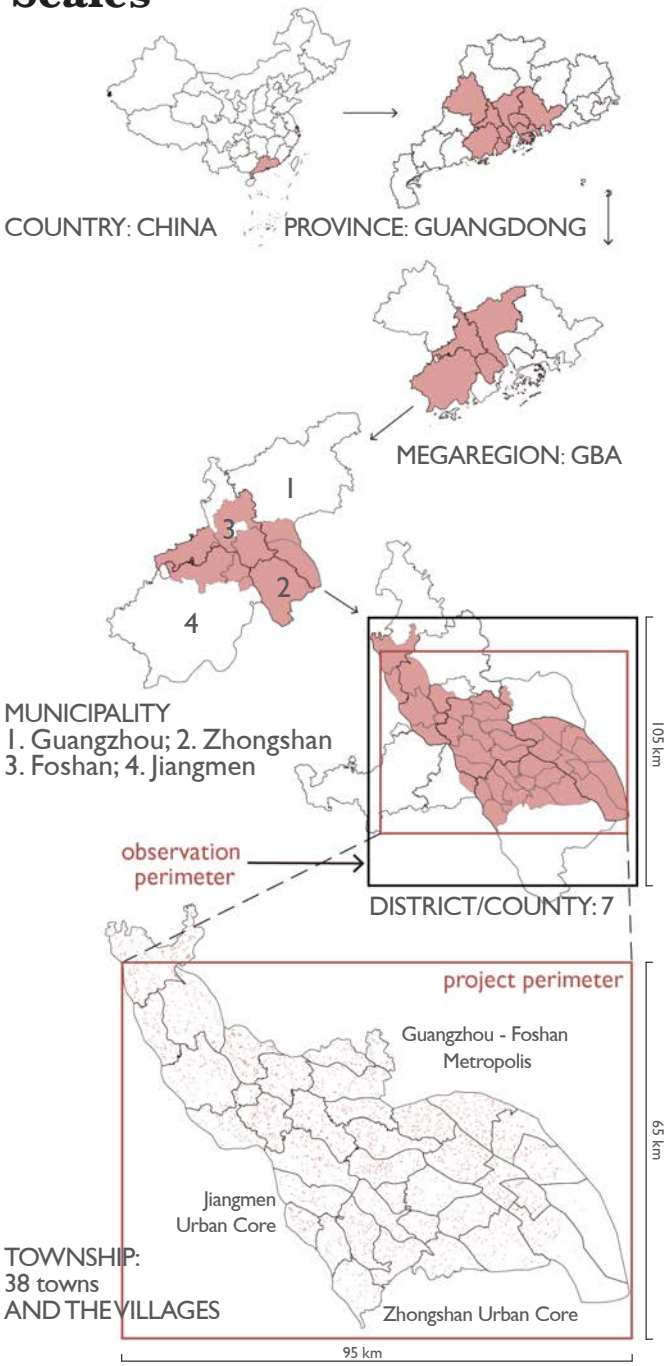

TO IDENTIFY & ANALYSE
What are the morphological and physiological features of the Desakota network that consists of nodes, connections, and borders in the interrelated structure of the GBA megaregion?
mapping
element and layer analysis
systematic analysis
TO UNDERSTAND
What qualities can the Desakota network achieve, inspired by industrial transition and dispersed urban development reference projects? How can the current features contribute to the targeted qualities?
mapping
reference project analysis
TO EXPLORE & DESIGN
How to adapt the structure of the Desakota network by combining targeted qualities? And to achieve the structure plan, how can the spatial interventions be contextualised on the local scale?
mapping
research by design
urban projects
Method
mapping
reference project analysis
research by design
governance tools
literature review
systematic analysis
element and layer analysis
urban projects

4.2 Methods - Mapping and Scales

Mapping is the most important method in this thesis. Hence, the scales of observation and design need to be clarified beforehand. The diagram (figure 4.2) shows that the administrative units, from the national to local scale, are defined as a country, province, prefecture, district, town(or sub-district), and village. The districts' boundary is too large for the project perimeter to define the Desakota border concisely. Therefore, the units of towns are selected to form the Desakota areas.

The project perimeter (see figure 4.3) is defined by the collection of township units in-between three urban cores, with the calibration of the water boundaries. The observation perimeter is confirmed to involve the adjacent urban cores and the surrounding landscape.

To clarify, there are two additional explanations. On the one hand, the town and sub-district are the rough division of urban and rural areas. Usually, a sub-district is seen as an urban or urbanised area, while a town is a mix of urban and rural areas. In the targeted areas, there are a number of towns as well as a few dispersed sub-districts. So they can be concluded as the Desakota region. On the other hand, as the following analysis presented, there are urbanised settlement corridors within the defined perimeter. Thus, it is difficult to distinguish the "perfect" Desakota region. These confusing areas are better to be all included in the design areas and treated as a whole Desakota network to avoid complexity, which will be assessed afterwards.



[Fig.4.2 & 4.3] Left: the selection of the scale; right: observation and project perimeter; source: author's own based on Google map and boundary data

4.2 Methods

reference project analysis

From the analysis to the design of the network, the reference projects, including the Ruhr metropolis in Germany and Shanghai metropolis in China, provide an appropriate presence for the future of Desakota. It will be used by a literature review to provide the design reference to the thesis. In addition, a case study for specific strategies, such as industrial symbiosis, is also applied to the design and exploration part.

- reference projects in industry transition and dispersed urban development

systematic analysis

It is used to understand the industry
form the industrial layer as part of th
systematic mapping, diagrams, and se
industry chain in Desakota and propo
the future.

- systematic mapping, section and dia
analysis

research by design

When the desired outcome is proposed, this tool helps promote and visualise the ambition in the physical spaces. It is to find the possible spaces to contextualise the strategies and visions and examine how they interact with the local context.

- key design concepts and vision
- structure plan and design project

element and layer analysis

As described in Chapter 3.2, the t
open space can be described as the
replication of elements forms the
limitation: it cannot recognise the qual
this method is applied to zoom in and
the Desakota.

- analysis of industry, residence and o

elements in Desakota and how they
e Desakota urban system; it includes
ctions that help analyse the potential
se the potential industry transition in

gram in the industry element and layer

ypologies of industry, residence and
complex elements in Desakota. The
layers. The regional analysis has its
ity and real life on a local scale. Hence,
figure out the different features within

pen space in the Dedakota

urban projects

They provide a method by which the selected urban development strategies can be introduced, pursued and coordinated (Oswald et al., 2003). These strategies and related urban projects should test the combination and adjust. Additionally, each urban project is combined with the tools of research by design and reference project analysis, such as the case of industrial symbiosis.

- design projects

governance tools

These include policy analysis, stakeholder analysis, and stakeholder engagement strategies. They contribute to understanding the actions and actors towards the proposed vision.

- spatial planning framework
- adjustments to the planning system

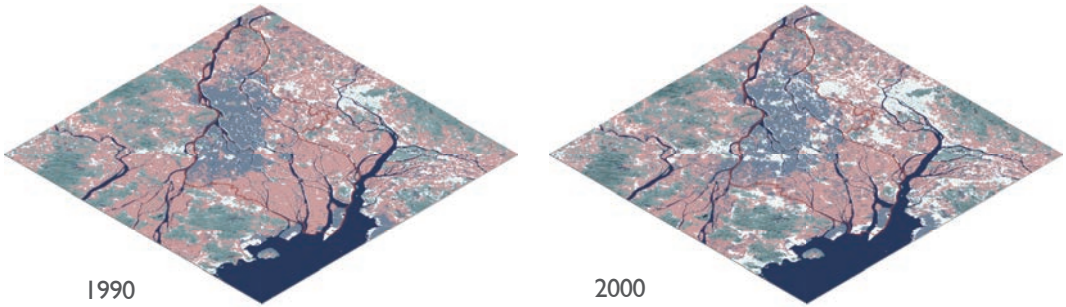
5. Analysis

5.1 Synchronous and Diachronic Study

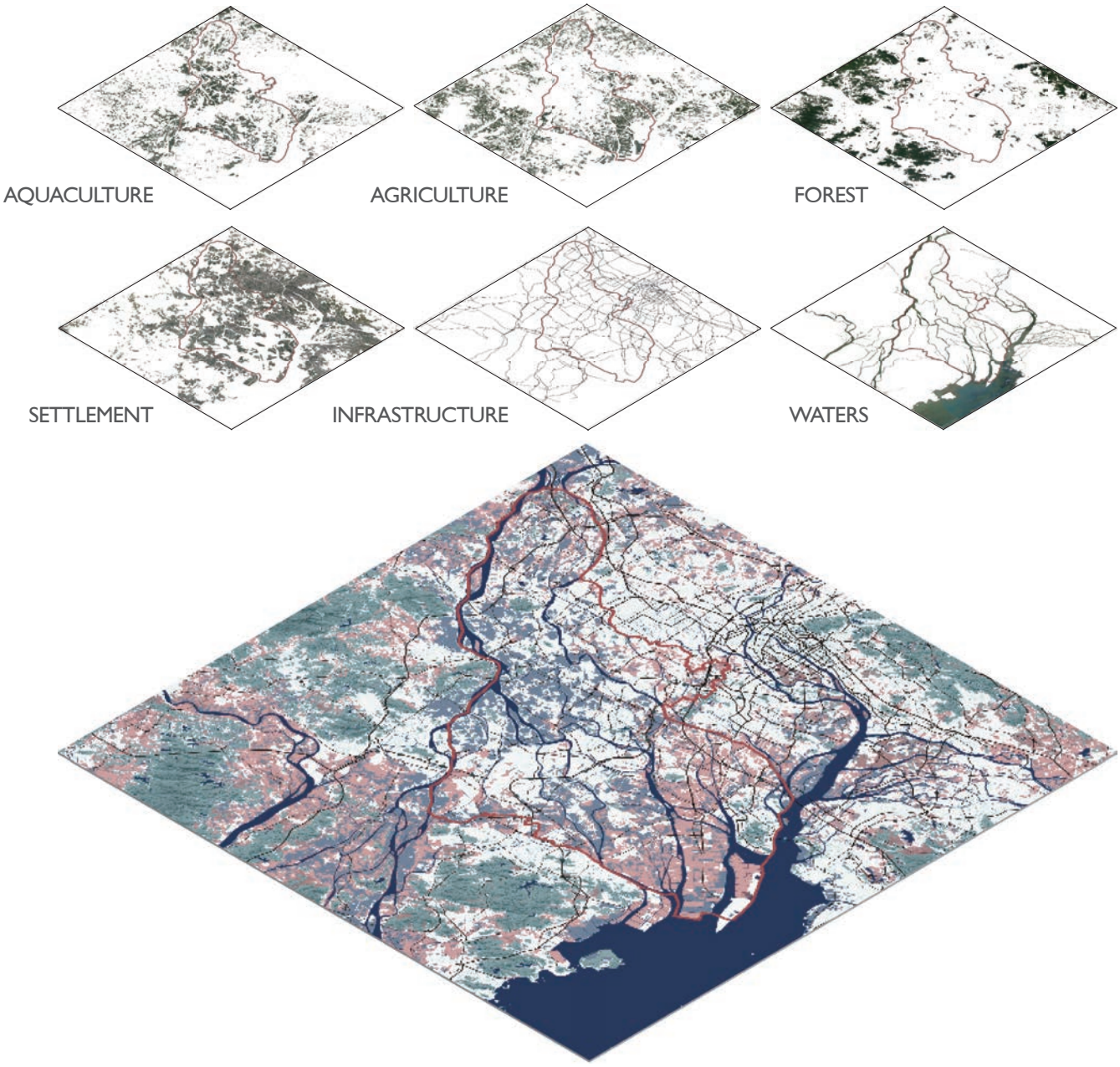
Territories are the basic components of the architecture of the urban system (Oswald et al., 2003). This section will illustrate the present territorial form in the Desakota of GBA and how the form was changed historically. Then the following analysis focuses on how this form can be reshaped based on its features.

The Netzstadt model (Oswald et al., 2003) proposed that the earth's surface can be described and shaped differently based on six types of territory: waters, forest, settlement, agriculture, infrastructure, and fallow land. Based on the GBA condition, the types are divided into waters, forest, settlement, agriculture (including horticulture), aquaculture, and infrastructure. To clarify, agriculture and aquaculture are differentiated here because they are both widely distributed and have alternative socio-ecological effects. The details of these types will be analysed as elements and layers afterwards.

The hierarchy of the territorial types on the regional scale has shifted over just 30 years. At the beginning of the reform (1980-1990), with little morphological change, waters, aquaculture and agriculture were dominant here. The local development is directly based on the resources of these territorial types. There was a disparity of urban and rural areas. From 1990 to 2000, as export-oriented industrial activities increased, the original urban core expanded. Small villages along the highways and with a rich agricultural base are developed into small towns, transporting their industrial products to Hongkong by highway or waterway infrastructure. But agriculture and aquaculture types are still predominant. In the next twenty years, types of settlement and infrastructure tend to dominate. Types of open spaces became the patchwork distributed among them. The originally developed towns expanded and connected as settlement corridors, while the other villages were expanded separately towards small and medium-sized towns. The development hardly depends on local resources. With the exception of some food, the energy and raw materials are largely from external areas.



[Fig.5.1] Diachronic Study of territorial types; source: author's own based on ENVI

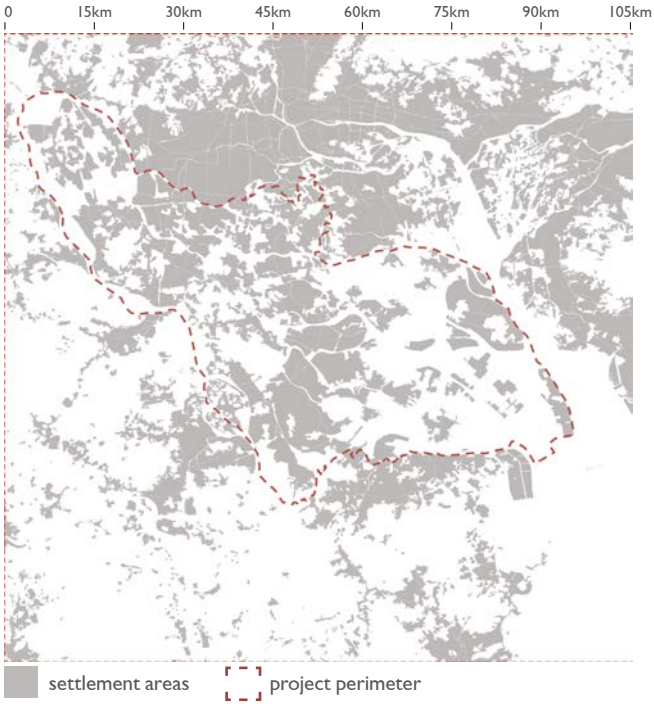


[Fig.5.2] Types of territory in 2020; source: author's own based on ENVI

5.2 Identification of Nodes and Connections - Morphology

The dominant types of settlement and infrastructure are represented as morphological nodes and connections here (see figure 5.5): 1) the nodes are defined by the superposition of settlement and infrastructure, namely identifying the settlement patches (see figure 5.4) and their internal structure (see figure 5.3); 2)between different settlement patterns (see figure 5.5), the connections manifest in the railways, fast street network of motorways and expressways, and waters. The primary roads and the others are mostly within the patterns; 3)the railways are all lifted; thus, they do not cut the patterns. But some of the fast streets function as barriers within the patterns, so these patterns are separated and treated as different patches. It is hard to tell in this map, but it will be considered when it is analysed with the physiological network.

[Fig.5.3] Waters and transport infrastructure; source: author's own based on OSM data



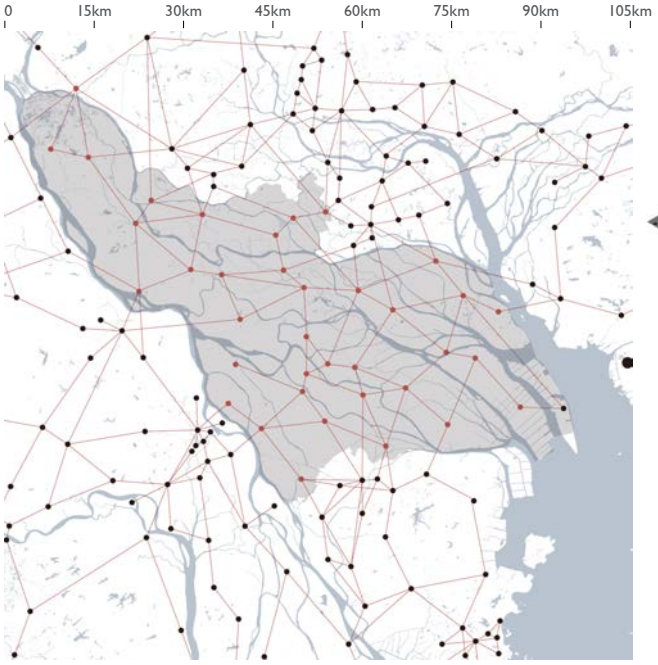
[Fig.5.4] Settlement areas; source: author's own based on ENVI

[Fig.5.5] Nodes with internal structure; source: author's own

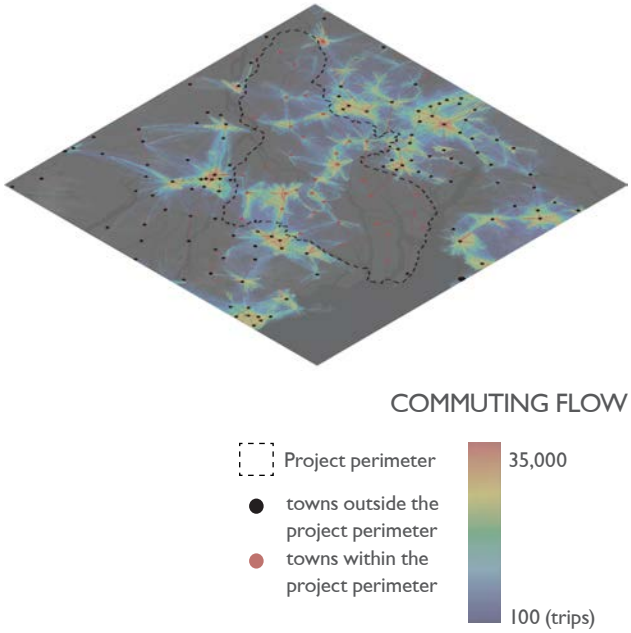
5.3 Identification of Nodes and Connections - Physiology

The centres of the towns and their physical road connections (see figure 5.6) are abstractly expressed as nodes and connections. By linking the threshold values to the nodes (see figure 5.8) and connections (see figure 5.7), the following characteristics should be emphasised:

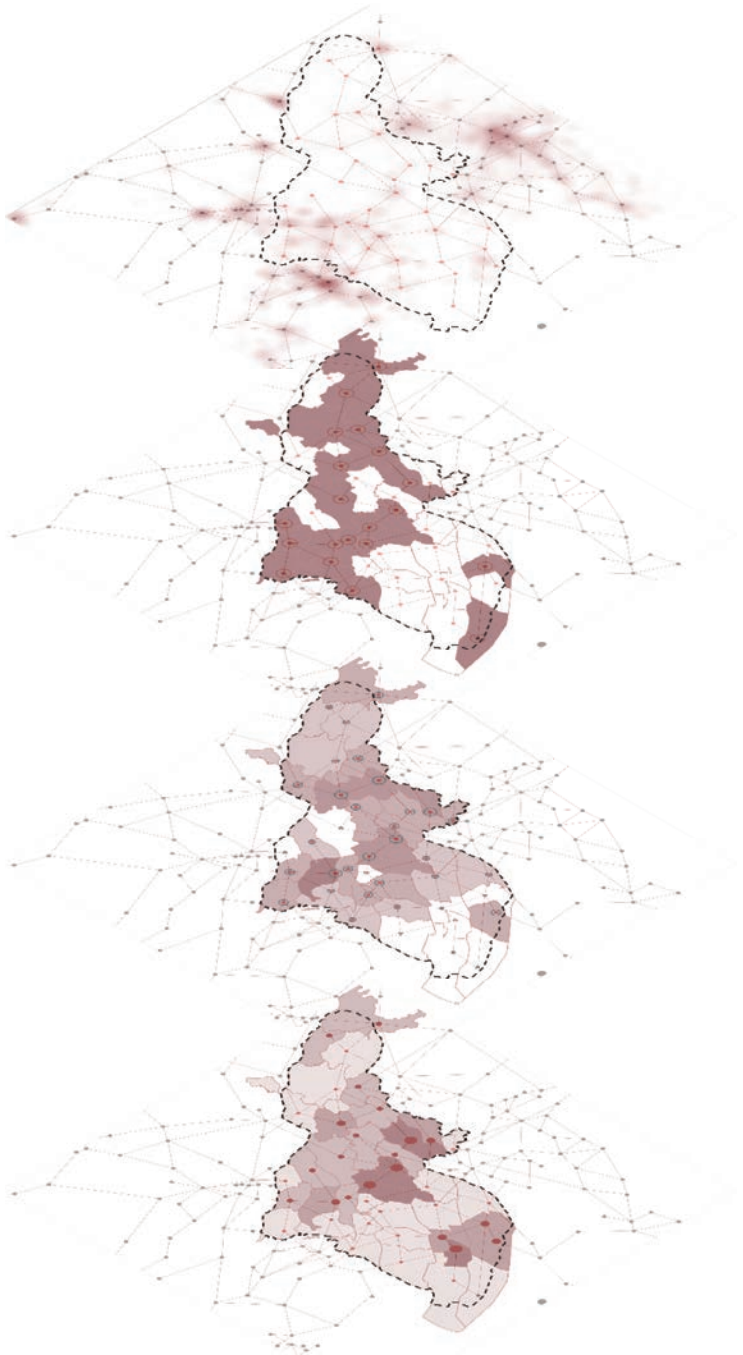
1)by overlapping the values, nodes can be roughly divided into five categories (see following diagram). The conclusion is mainly made by the indicator of inhabitant density and commuter flow, with the help of the other three value thresholds;



[Fig.5.6] The centers of towns and infrastructure; source: author's own



[Fig.5.7] Communiting flows based on orientation and destination analysis of Didi Sharing cars and taxis; Soure: author's own based on the map by Dingliang Yang (Yang, 2019)



HEATMAP OF PUBLIC SERVICES

Project perimeter

towns outside the project perimeter

towns within the project perimeter

heatmap of public facilities including parks, markets, hospitals, schools and housing

DENSITY OF WORKPLACES

Project perimeter

towns outside the project perimeter

towns within the project perimeter

density > 1

density of workplaces = workplaces / workforce inhabitants

DENSITY OF INHABITANTS

Project perimeter

towns outside the project perimeter

towns within the project perimeter

>10000

4000-10000

2000-4000

1000-2000

0-1000

density of inhabitants = number of inhabitants / area of town (km2)

ECONOMIC VALUE OF LAND

Project perimeter

towns outside the project perimeter

towns within the project perimeter

60-80 (€8-10.6)

40-60 (€5.3-8)

20-40 (€2.6-5.3)

<20 (€2.6)

GDP per km2 =GDP (million) / area of town (km2)

[Fig.5.8] Demographic analysis of towns and the extraction of their node values; source: author's own based on the data of national census, statistical yearbook and python data crawling

2)The L-nodes assume dominant positions, which can be treated as urban areas. They communicate with the major urban cores beyond the project perimeter through public transit. This assumption stems from the fact that there are many nodes beyond town centres but densely commuted. These sub-nodes are either working factories or railway stations. People within these L-nodes travel within the town. And they also receive commuters from smaller nodes. The conclusion is based on the fact that strong connections mostly relate to L-nodes, either across-boundary or between towns' centres and their sub-nodes.

3)The medium-sized nodes adjacent to the Large ones have commuting flows to or from the other-sized nodes (except XS). Strong connections relating to M-nodes are always with L-nodes or other M-nodes, and lighter connections are mostly with S nodes. The assumption is that people living here may work locally or in the L-nodes nearby; people from other M-nodes and S-nodes may work here.

4) S-nodes' flows can be discovered to relate to L and M-nodes or within the towns. They are transitioning, so people here work in the manufacturing of other nodes, local industry, and agriculture. And the XS nodes can be treated as the concentration of rural settlements.

5) The Desakota network is mainly connected with the GBA network by the corridors formed by a series of L- and M-nodes.

Above all, the functional network of Desakota is a hierarchical structure (see figure 5.9) of dominant roles with mainly attached nodes, dispersed but connected nodes and stray nodes. The flows between these nodes are not concentrated on individuals. It may be assumed that there is a high level of internal and external mobility.

CLASSIFICATION OF NODES AND CONNECTIONS BY THE OVERLAPPED VALUES

XL - node
mega city

L - node
urban characteristics

-high density of people: >4000/km2
-active economic activities in secondary and tertiary industry
-concentration of public services
-have workforce attraction and sufficient workplaces

M - node
peri-urban characteristics

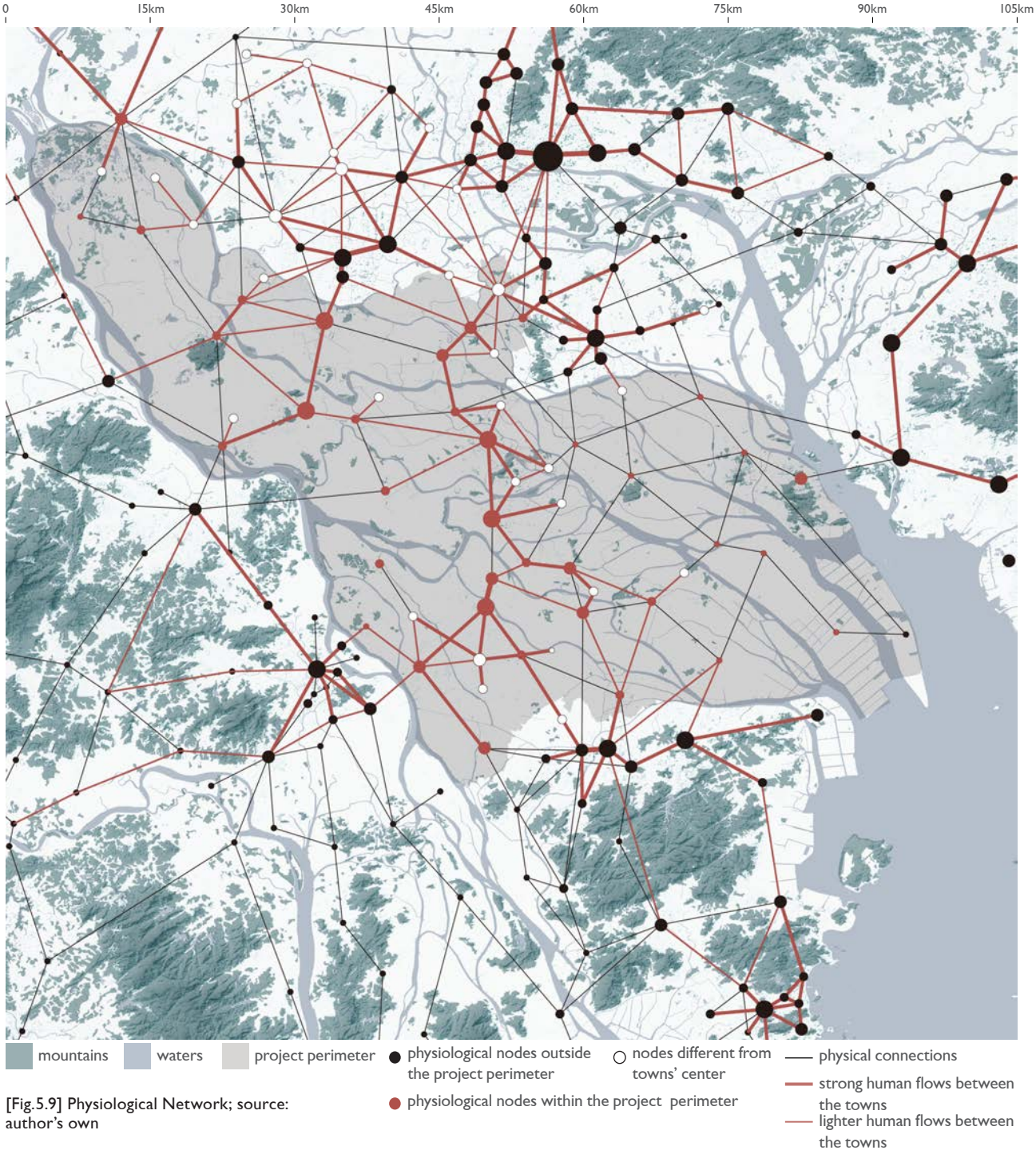
-high density of people: 2000-4000/km2
-economic activities dominated by the secondary industry
-lighter concentration of public services
-residential and working areas

S - node
transitional characteristics

-moderate density of people: 1000-2000/km2
-economic activities dominated by both first and secondary industry
-insufficiency of public services
-mixed areas for both urban and rural life

XS -node
rural characteristics

-less density of people: <1000/km2
-economic activities dominated by the first industry
-lack of public services
-concentration of village settlement



[Fig.5.9] Physiological Network; source: author's own

5.4 Morphological and Physiological Network

As figure 5.10 shows, the urban system of the Desakota region is represented as a network of nodes and connections in terms of morphology and physiology. The whole network can be characterised as that:

1) the nodes of morphology and physiology are not always overlapped. These morphological patterns without physiological nodes are mostly patterns seperated by fast streets, fragmented patterns straying around the main nodes or large areas of new or vacant industrial land. These excessively dispersed or isolated areas are not conducive to resource efficiency. They should be taken into consideration when proposing strategies.

2) the networks demonstrate that two main corridors in the desakota region join all L-nodes and their sub-nodes, most M-nodes and several S-nodes. Most people in Desakota live, work and move around the nodes within or around these corridors. The corridor in the east acts as a channel linking the four adjacent urban cores. Internally, the nodes that make up the corridor appear to be concentrated patterns; and they are separated by river branches; additionally, the nodes forming the corridor are not as closely linked to the outside as they are to each other, morphologically and physiologically. To conclude, although it can be seen as a corridor connecting the GBA network, there may be more possibilities for its morphology. Physiologically it is not exactly an urban corridor; thus, many functions may need to be adapted. The corridor in the west appears to be the expanding periphery of Foshan's urban core rather than a connection. It consists of two L-nodes which, together with their adjacent M-nodes, are connected as a whole, with fragments of open space interspersed inside.

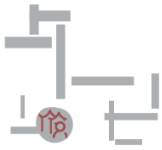
3)the two corridors separate the whole region into three parts, with different-sized patches sporadically distributed within these three zones. They appear in different structures: the easten one has most XS nodes in the vast open space. But the exception is the enormous patterns of new towns. They are constructed as a new regional centre with a regional port, industrial areas, and business zones. In the middle part, patches are distributed linearly alongside the connections linking the two corridors. These patterns are mainly S nodes, with one concentrated town areas and dispersed villages. People here are both engaged in the agricultural and manufacturing activities. The patches in the western part are interconnected into a cluster with XS & S-nodes.

In short, the Desakota region is structured by two corridors and three distinct zones that the corridors separate. For the convenience of later descriptions, these areas will be referred to as corridor and desakota areas respectively. Then the questions are raised: do these areas have alternative ways of interacting with nature? Do they provide different workplaces? Are there different ways of lifestyle? These answers will be explored in the following element and layer analysis.

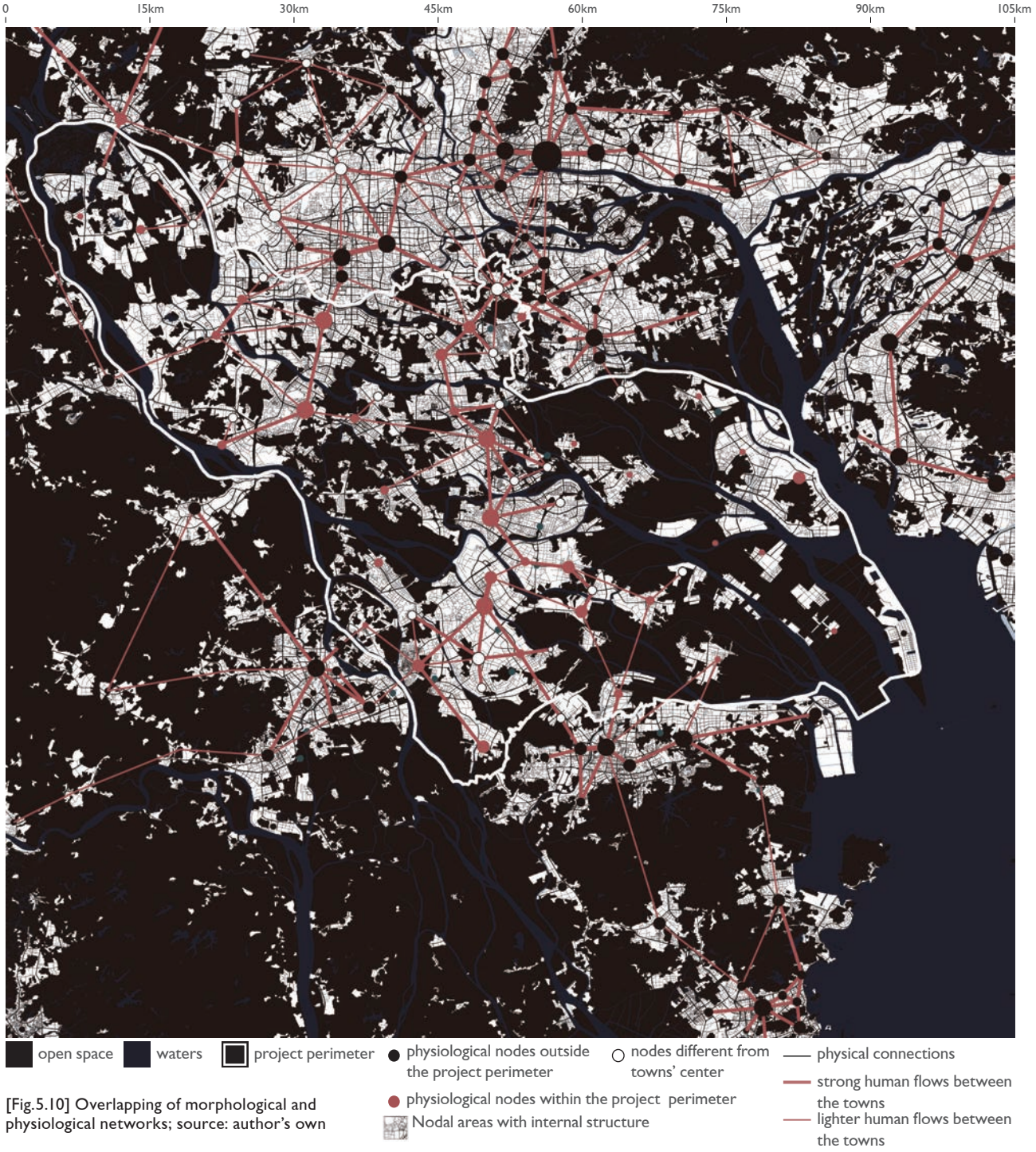
L - node
urban characteristics

M - node
peri-urban characteristics

S - node
mixture characteristics



XS -node
rural characteristics



[Fig.5.10] Overlapping of morphological and physiological networks; source: author's own

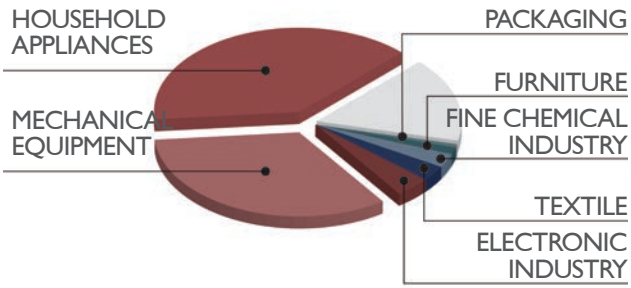
5.5 Element and Layer of Industry

In the case of the Shunde district, the Desakota region's industries depend on the production of household appliances, mechanical equipment, electronic components, textiles, chemical products and plastics, whose value exceeds 80% of the total economic value (see figure 5.12). Industrial activities provide a livelihood for more than 50% of the population.

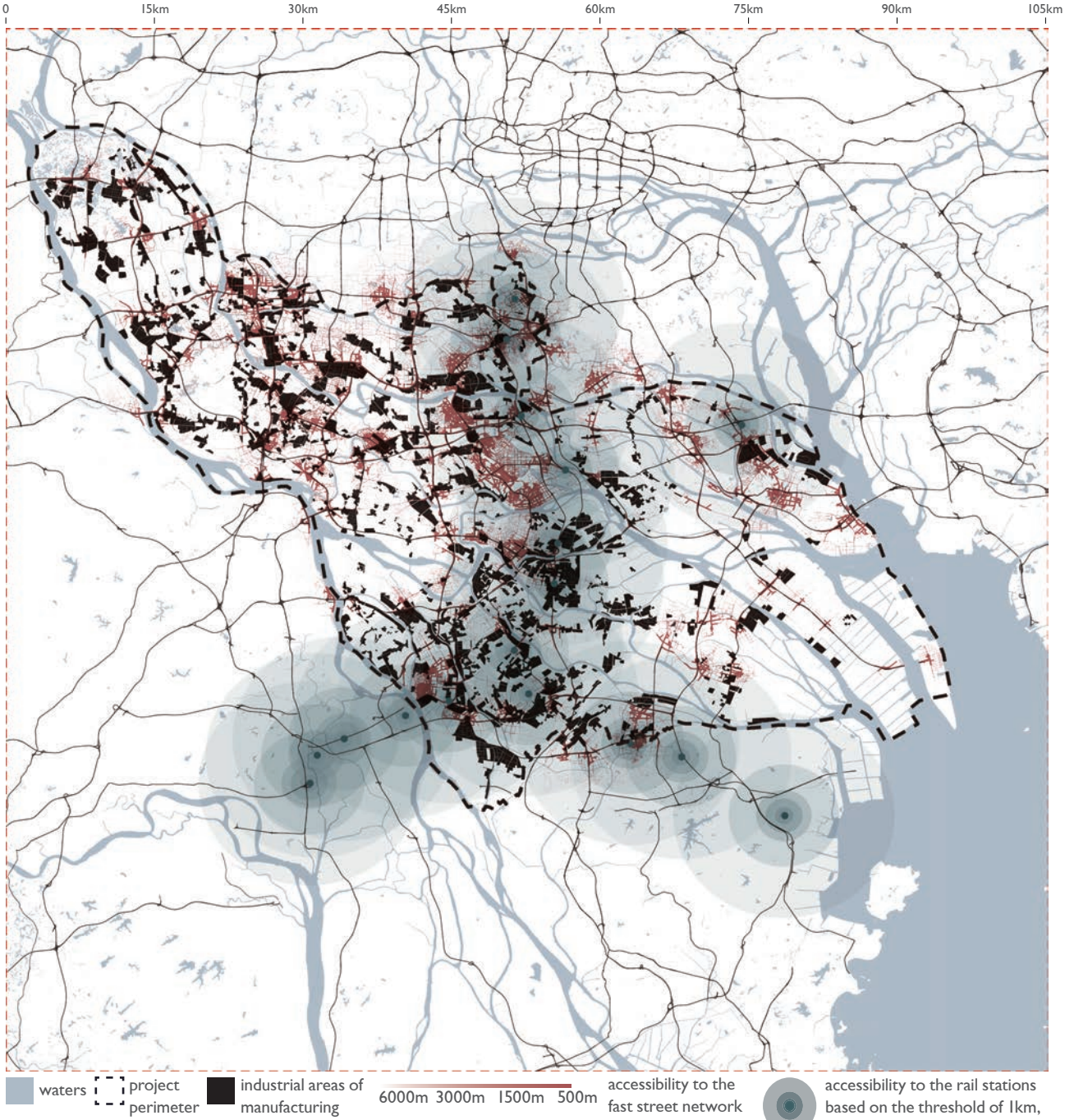
In Desakota, after research, the industrial elements (whose spatial quality is shown in section 5.16 & 5.17) can be understood as industrial parks because the factories here are most clustered. Most industries were led by township-run enterprises, with industrial parks built on a village basis. These scattered industrial areas occupy more than 70% of the industrial land, causing dramatic environmental pressure. As the government recognises the threat of these estates and attempts to transform them into high-end manufacturing industries, these areas are now being or waiting to be converted in various ways. However, they still exist as industrial estates.

As shown in figure 5.13, the repetition of these industrial elements forms a morphological layer superposed on accessibility. Most elements have a good road network, but only the part along the corridor can access the railway. To better understand the potential flow between different elements of this layer, two main categories of industrial chains, divided as closely related industry chains and weakly connected industries, can be predicted based on the distribution of industries (see figures 5.14 and 5.15).

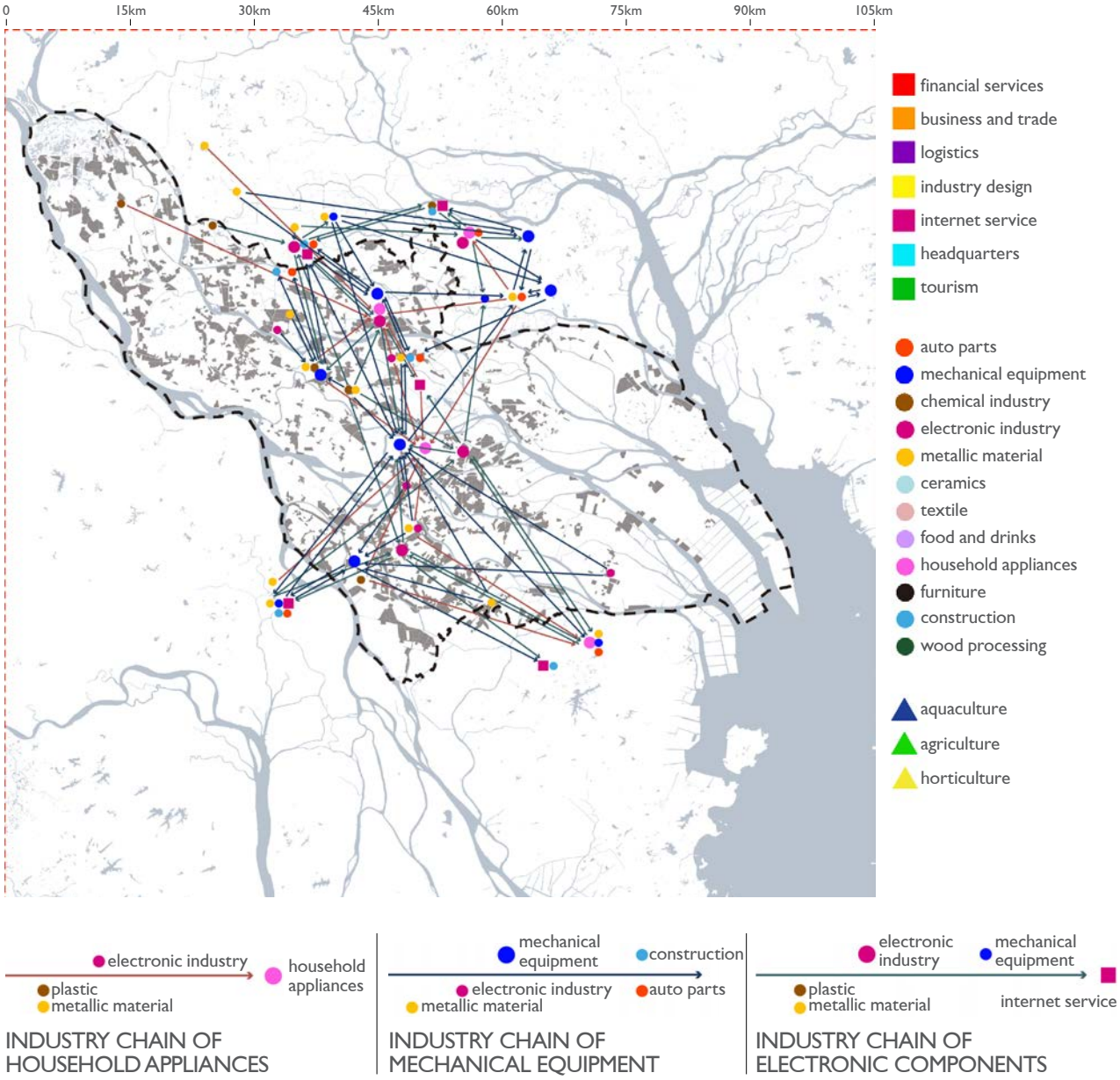
[Fig.5.11] One mechanical equipment industrial park in Chencun; Source: picture from Shunde village-level industrial park upgrading and transformation platform (Transformation of the Industrial Estate in Chenchun Town, n.d.)



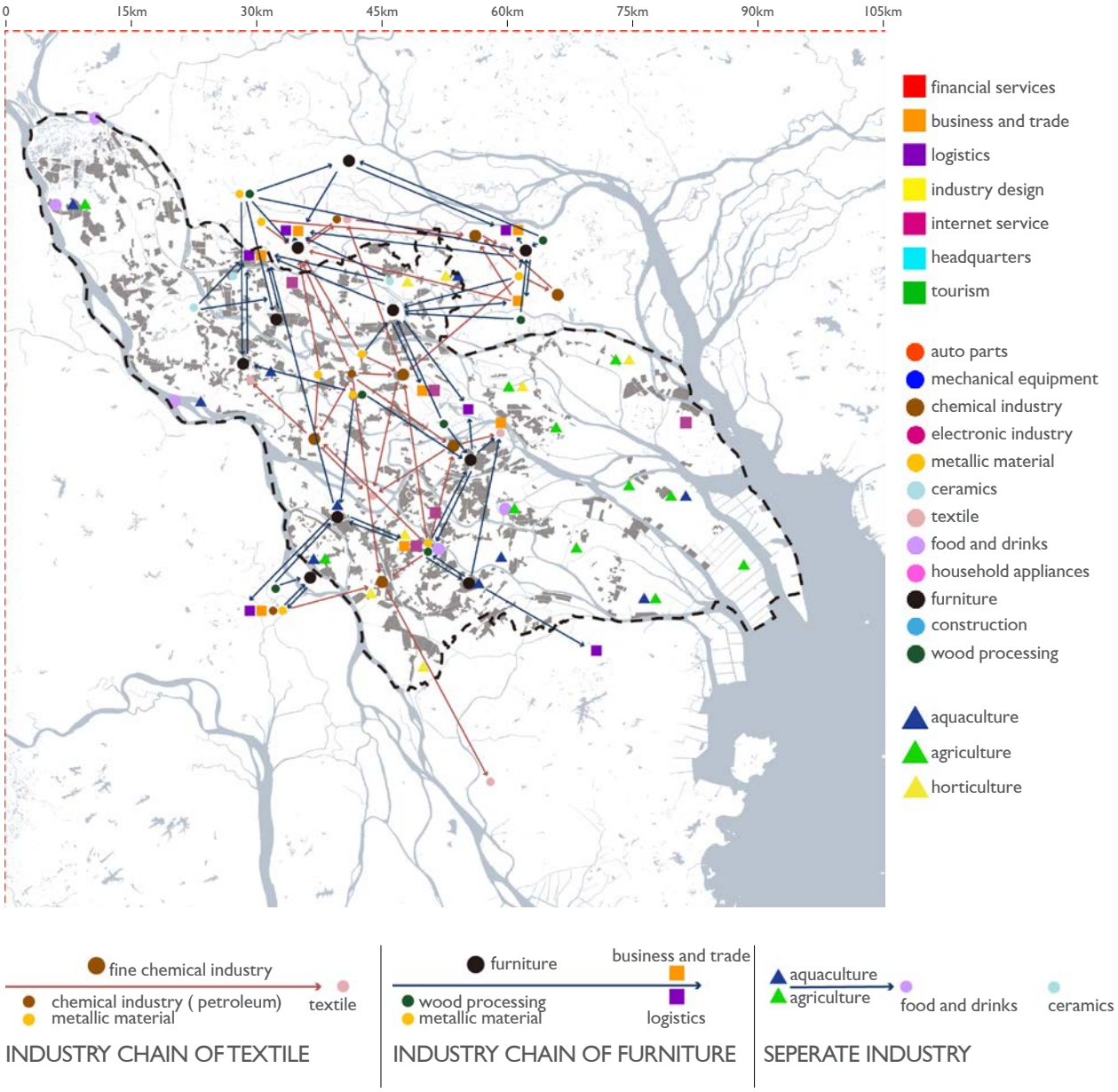
[Fig.5.12] Pie chart of the industrial ouput in Shunde district (part of the Desakota region) with above 80% of it being manufacturing industry; Source: author's own based on the data from Shunde economic statistics



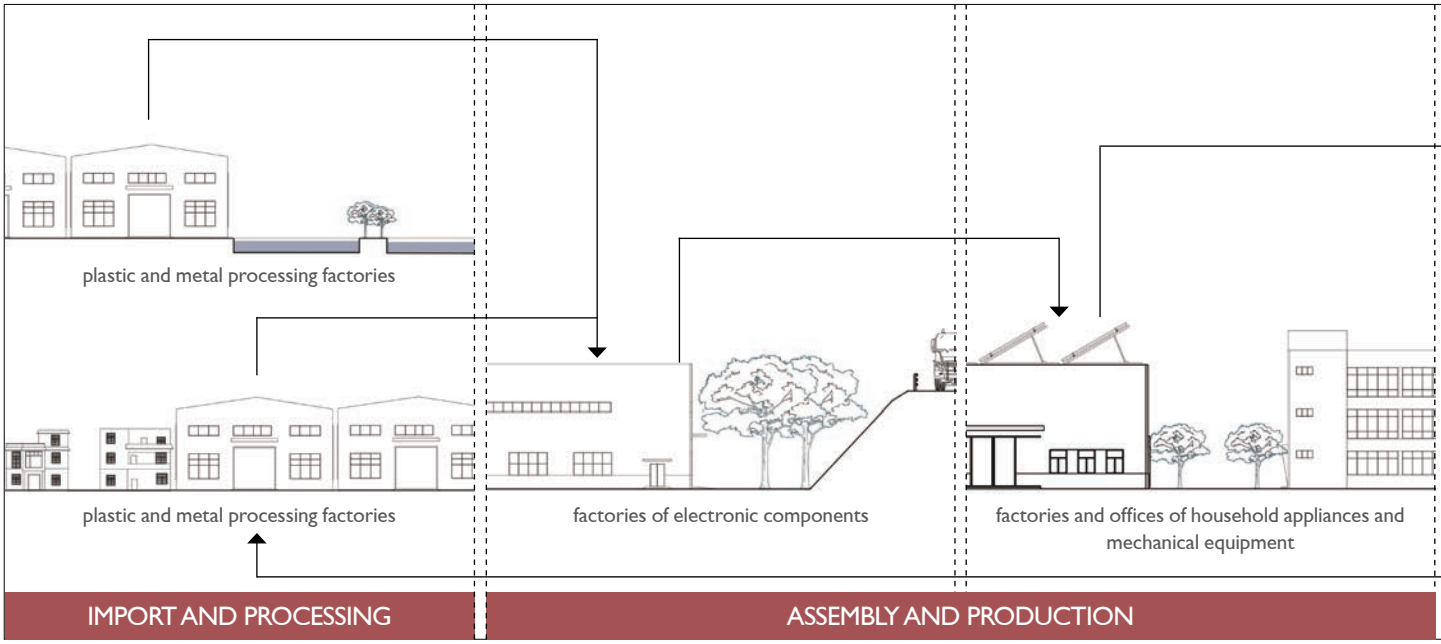
[Fig.5.13] Distribution of manufacturing industry and its accessibility to the fast street network and public transit; source: author's own based on OSM data



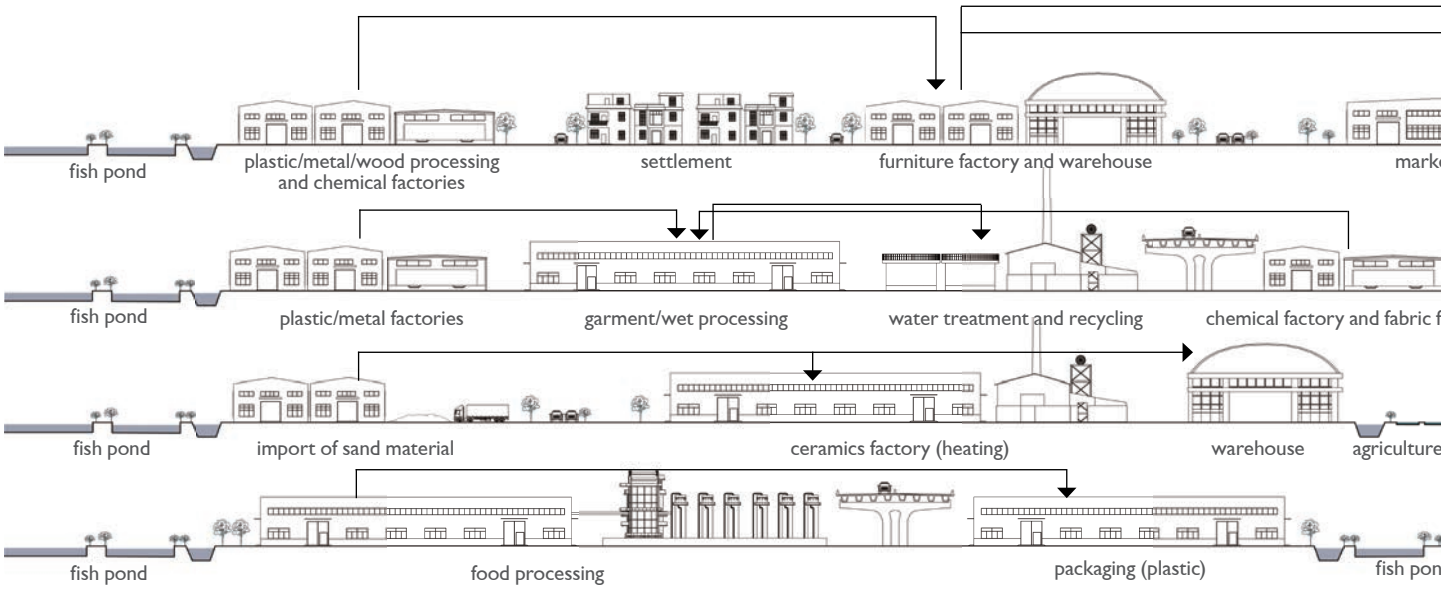
[Fig.5.14] Potentially closely related industries and their industry chains; source; author's own based on the POI data from essay (Wen, 2016)



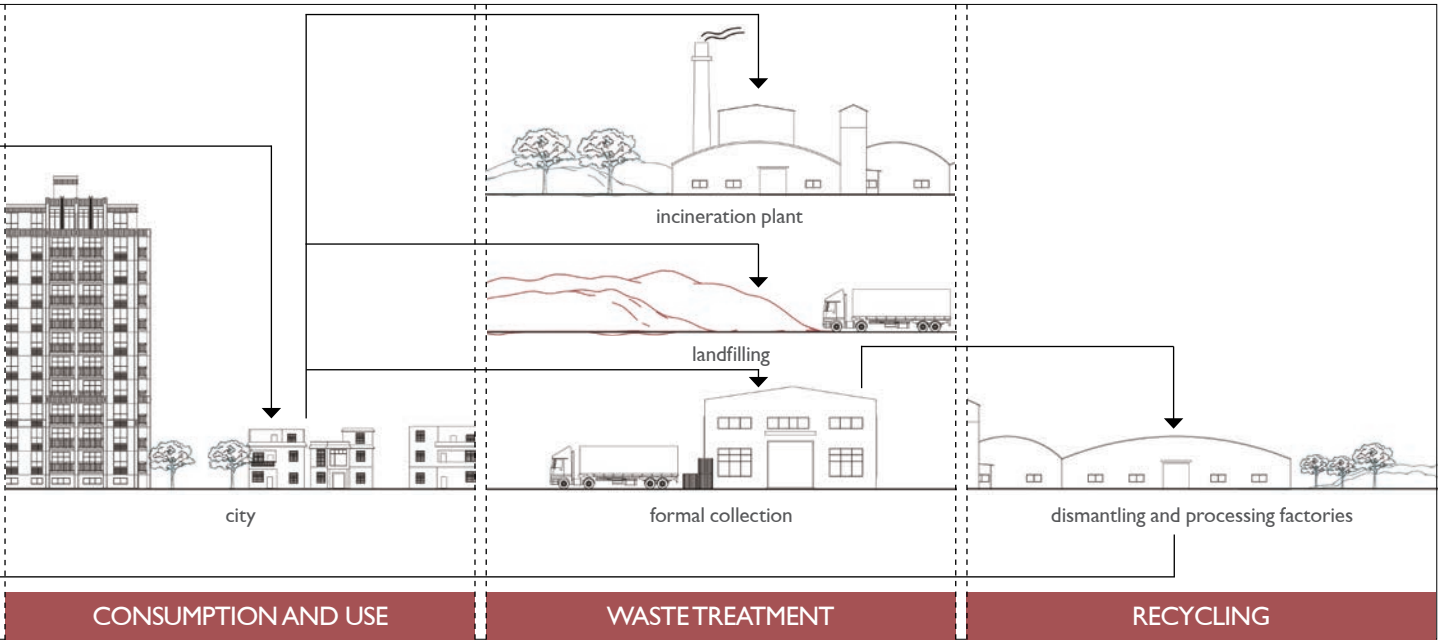
[Fig.5.15] Weakly connected industries and their industry chains; source; author's own based on the POI data from essay (Wen, 2016)

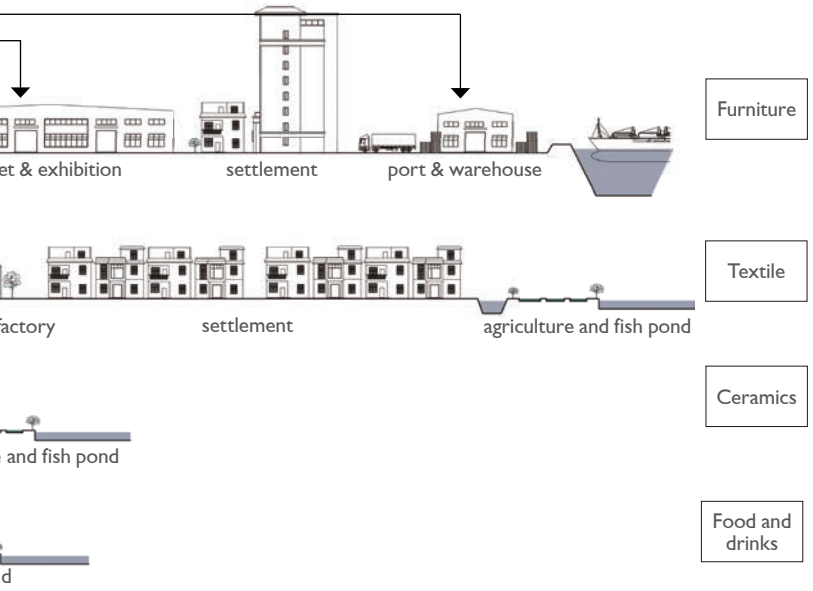


[Fig.5.16] Systematic section of closely related industries and their industry chains; source: author's own



[Fig.5.17] Systematic section of weakly connected industries and their industry chains; ; source: author's own





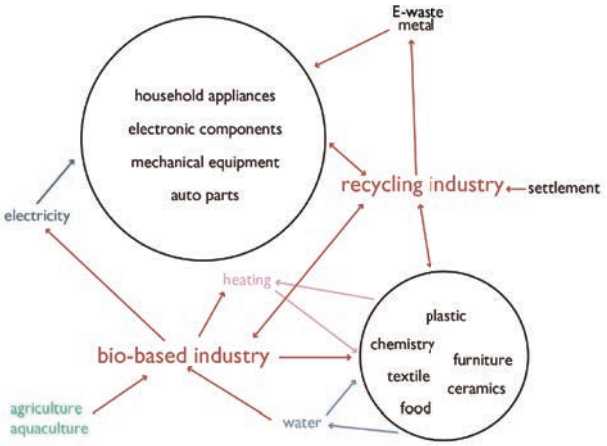
A regional cooperative network has formed among mechanical and electrical manufacturing, as depicted in Figure 5.14 and Section 5.16. These highly interconnected factories are predominantly located along the eastern development corridor and in the middle Desakota region. Other industries, illustrated in Figure 5.15 & 5.17, are distributed dispersed. These industries have complete supply chains within local industrial parks. For example, the western corridor hosts large furniture, textile, and ceramic manufacturing with associated fabric and chemical factories in adjacent areas. Additionally, metal and plastic processing, which are essential for almost all industries, are distributed in each area. However, they mostly operate near residential and natural areas, causing adverse social and ecological impacts.

CHALLENGES AND POTENTIAL

The conclusion of the systematic analysis is presented below: 1) Each main industrial area within the Desakota nodes generally specialises in 1-3 production fields (shown in Figure 5.19), with small industrial parks within or adjacent to provide hardware, plastic and chemicals. 2) Active industrial activities occur within the two corridors and the in-between Desakota (see Figure 5.19). 3)There are two potential clusters of symbiotic nodes, one being the mechanical production and the other being the furniture, textile, ceramics, and chemicals industries that share common demands for energy, heating, water, and chemicals (see diagram 5.20). 4)The current flow of industrial activities is linear, showing that industrial waste is disposed of through landfilling or incineration. Besides, these industries rely on imported primary products; the finished products are exported to other regions. Therefore, Desakota's industrial activities exhibit dependent and unsustainable.

Therefore, the urgent issues in the industrial layer include transitioning to a circular economy, promoting independence and sustainable industries like solar energy and biomass, and minimising the negative impact of industrial areas on residence and ecosystem.

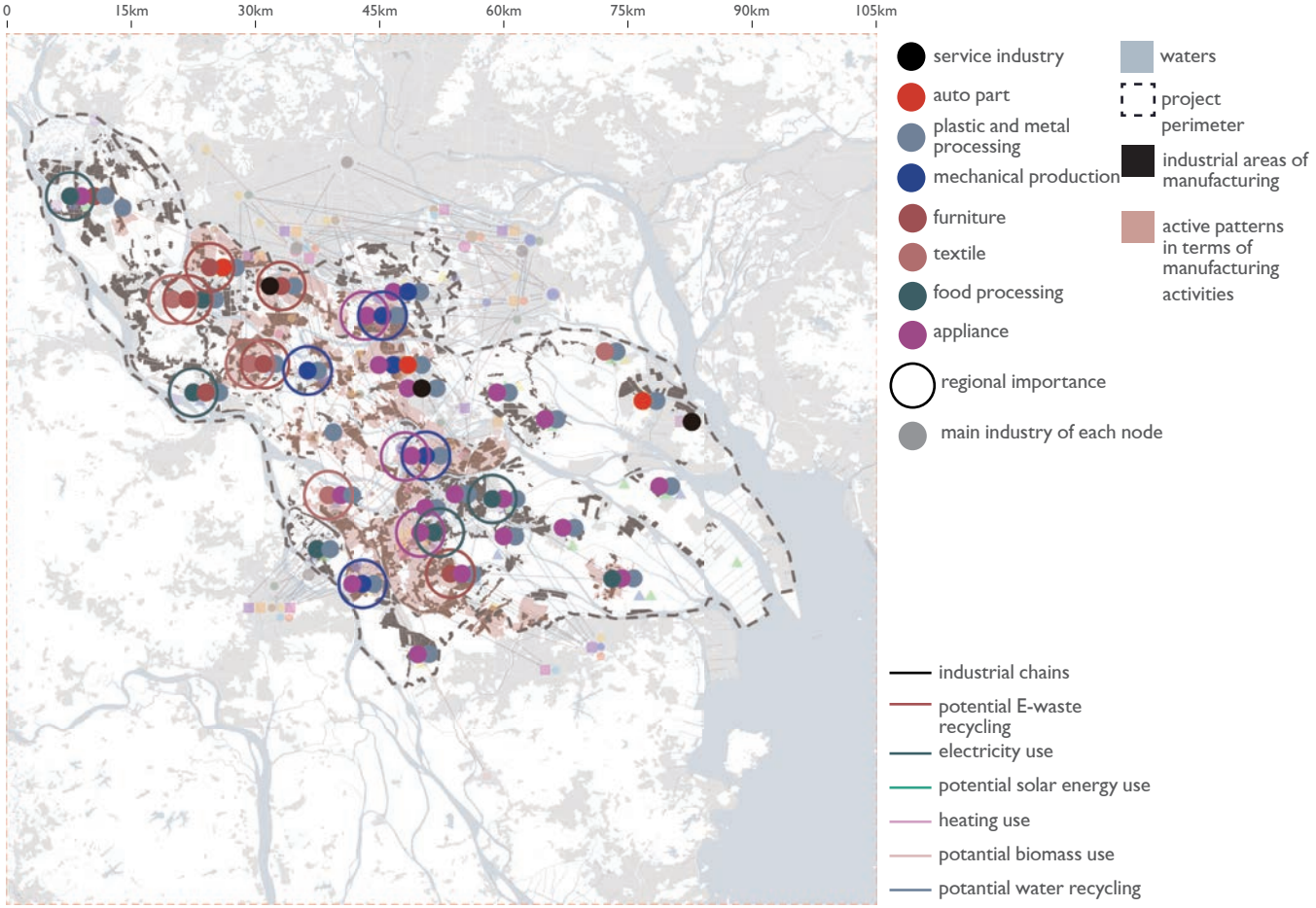
Considering the current quality, industrial symbiosis holds potential for sustainable transition in this region. This concept, as illustrated in diagram 5.18, specifically entails the introduction of circular and bio-based industries because: 1)the Desakota region has the potential to produce biomass, which can serve as raw materials and energy resource, thereby enhancing independence. Furthermore, bio-based products are more conducive to circular utilisation. 2) The machinery industry network has the opportunity to develop symbiotic networks for E-waste, metal

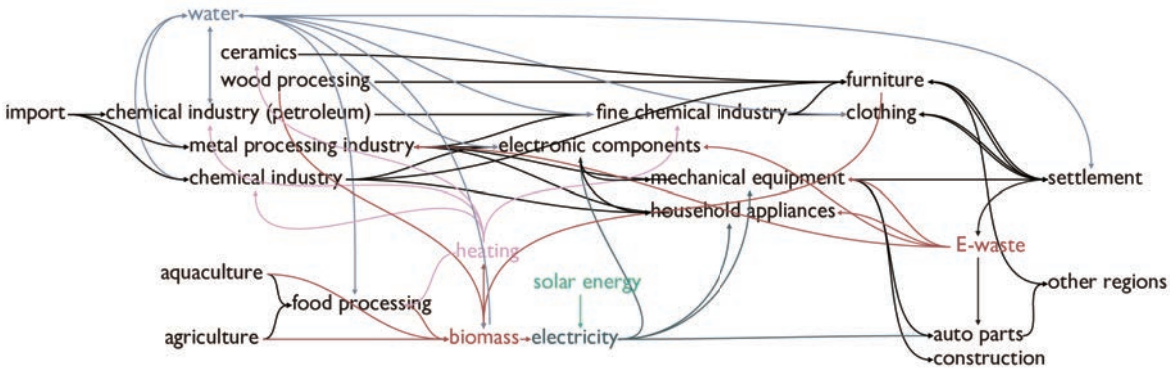


[Fig.5.18] Diagram of the potential industrial symbiosis based on the bio-based industry and recycling industry; source: author's own

recycling, and electricity production sharing. On the western corridor, due to common demands, industrial areas can share and recycle water, heat, organic waste, and bio-based products. The middle Desakota region also has the potential to transform into bio-based and circular industries, joining the symbiotic networks.

In conclusion, the industrial layer exhibits capacity for industrial symbiosis, which does not focus on proposing specific industry planning. Instead, it explores the possibilities of establishing circular facilities and transforming energy and raw materials within the dispersed industrial areas.

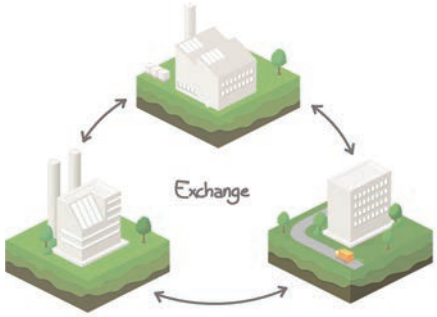




[Fig.5.19 & 5.20] Above: Systematic map of the active industry chains in the Dedakota region and the competence field of each node; below: Systematic diagram of the industrial chains and the potential of a more green and circular model in terms of resource use; source: author's own

POTENTIAL - INDUSTRIAL SYMBIOSIS

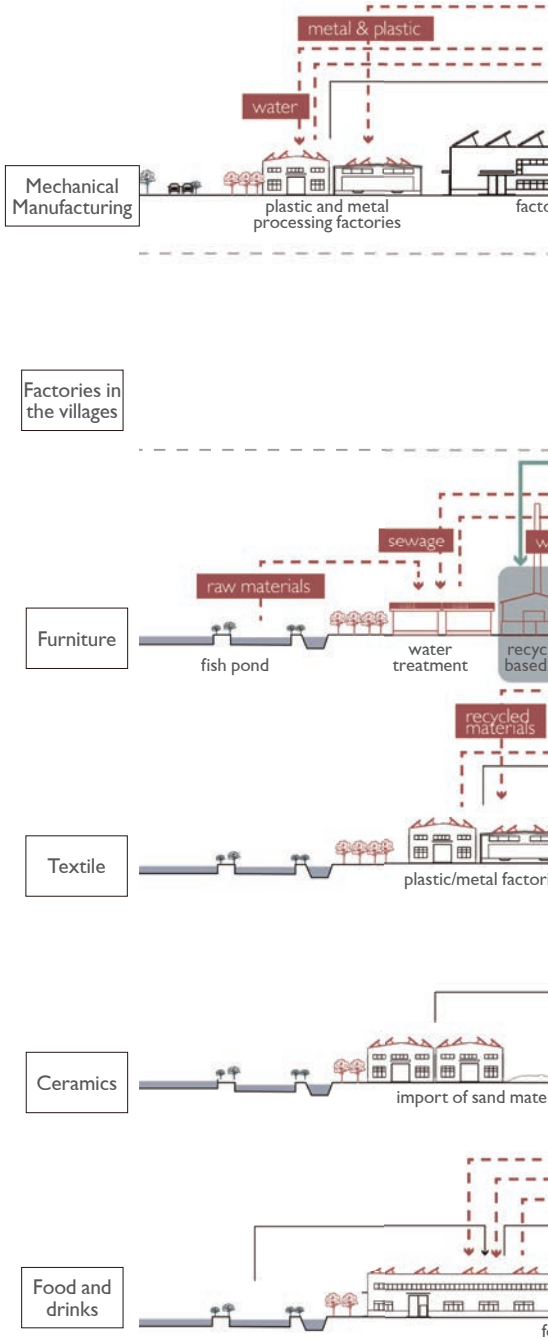
As shown in Figure 5.21, the concept of industry symbiosis is manifested through the exchange of by-products, water, energy, and other resources among different industries. Based on this concept, Figure 5.22 illustrates the potential industry symbiosis within the existing industrial chains in the Desakota region. The red portions represent the symbiotic potential within the industrial chains, while the green portions depict potential symbiotic relationships at the regional scale. As mentioned earlier, the diagram's mechanical manufacturing cluster is mainly concentrated in the eastern corridor. At the same time, the furniture, textile, ceramics, and food industry chains are distributed more dispersedly. However, large industrial zones are predominantly located in the western corridor. The middle Desakota region is characterised by small-scale and diverse factories, as depicted in the "Factories in the Villages" section. Therefore, these symbiotic relationships can serve as references for development strategies when considering the industrial potential in different parts of the Desakota region.



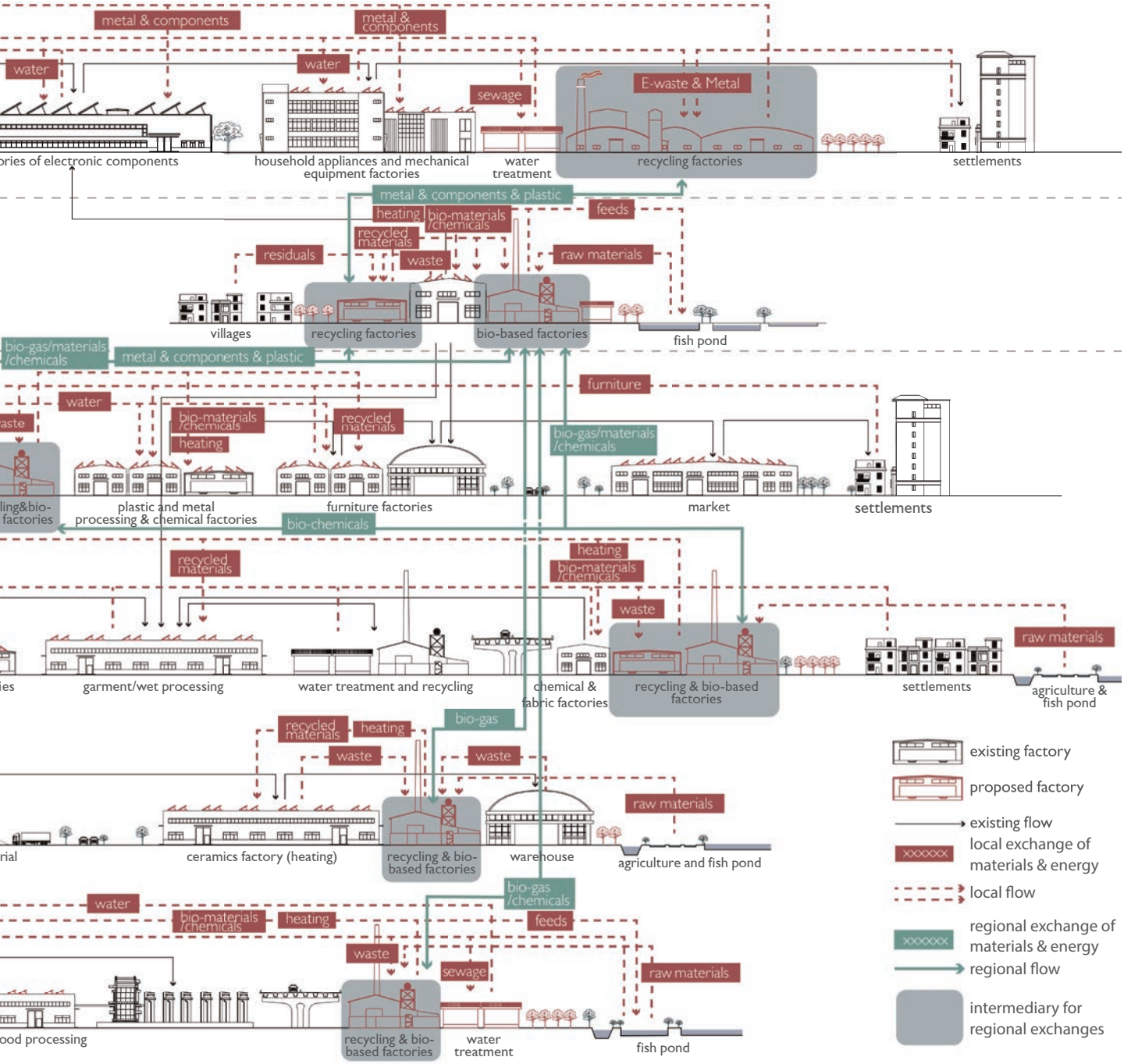
[Fig.5.21] Simple illustration of industry symbiosis concept; source: image from In-Crete (Industry Symbiosis, n.d.)

DEFINITION

European Commission: "the process by which wastes or by-products of an industry or industrial process become the raw materials for another"



[Fig.5.22] Systematic sections of potential symbiotic netwo



rks; source: author's own

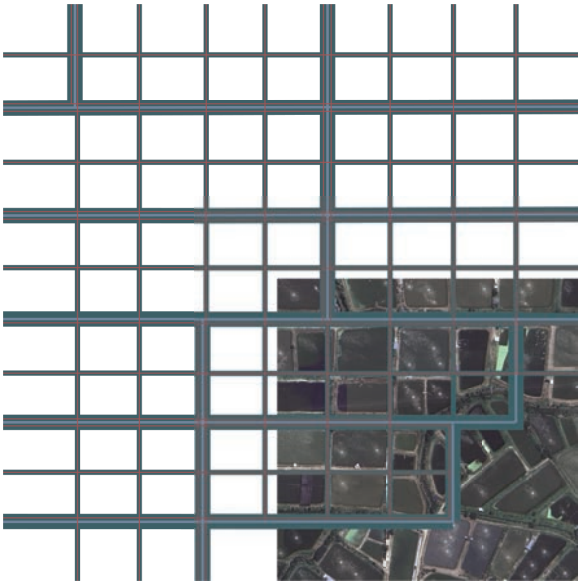
5.6 Element and Layer of Open Space

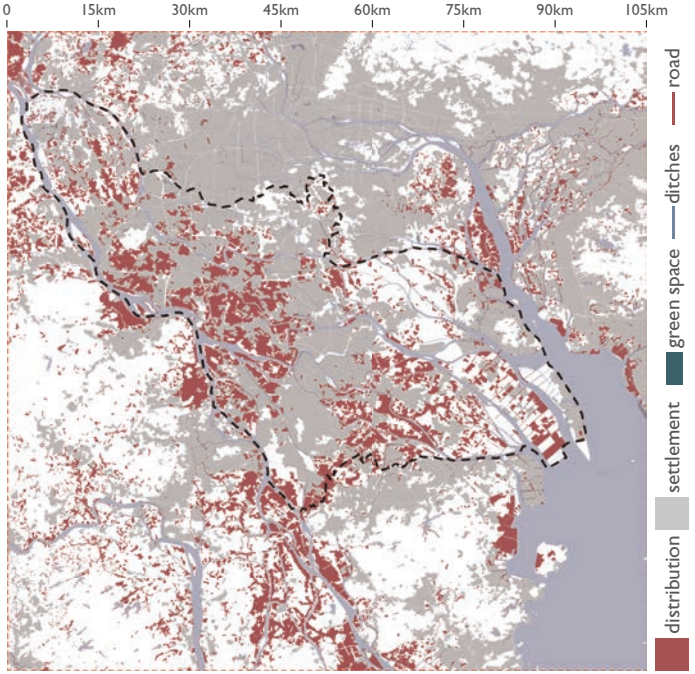
The territorial types of open space in Desakota include waters, agriculture, forest, and aquaculture. Waters are closely linked to the latter three and, therefore, are not analysed as a separate element. In the case of the agricultural type, horticulture differs significantly from common arable land in terms of scale and location; thus, it is introduced as an element. For the four main types of open space, the analysis is as follows:

1) The dike-pond system is a fish-pond agroecosystem that evolved in the flooding environment, combined with production and settlement needs. Given the water-logged-prone terrain, the ancestors reclaimed lowlands, constructed ponds and dikes, and planted vegetables with the dug-out mud(Tian, 2019). This activity shaped the areas along the river network. Figure 5.24 shows this element in all three zones, particularly in the middle Desakota area. In terms of the individual element, each pond is roughly 100x80 meters in scale; the dike between the ponds is 2 meters wide and filled with agricultural products; the higher dike encloses every ten to twelve ponds; these units form a blue-green grid network through irrigation ditches. Because it is integrated with people's living spaces and is run by small household farmers, its scale and structure offer potential in the subsequent design.

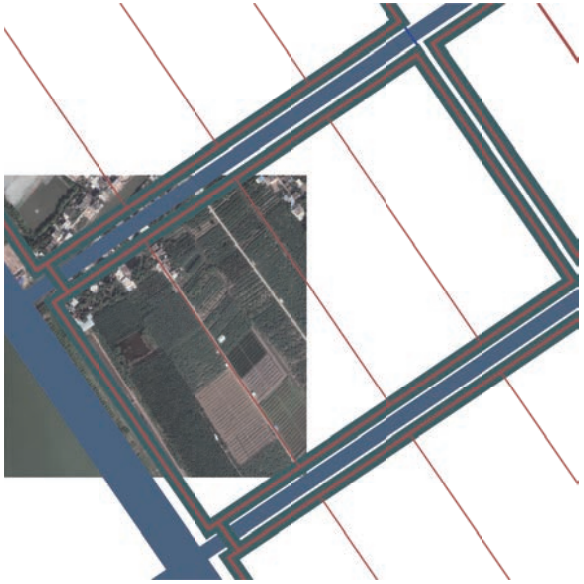
2) Arable land, which dominated agricultural activity throughout the GBA, appears to be concentrated only in the east of Desakota. Nansha islands, where it is located, need to be explained first. These islands have been gradually reclaimed over the last four hundred years based on the siltation of the delta estuary(Xiong, 2020). As the original aim was to spread agriculture and efficiently use the dike, the scale of the reclaimed units was massive, around 800x1000 meters or even 800x2000 meters. Within each unit, the crops are no longer restricted to fish farming, with the dynamics of vegetables and fruits. Additionally, some dikes are more than 30 meters wide, attracting migratory birds; thus, some are built internally as wetland landscapes. Although this open space is an artificial result, the process was gradual and harmonious with nature. The proposed urban planning by the government in this area needs to be rethought carefully.

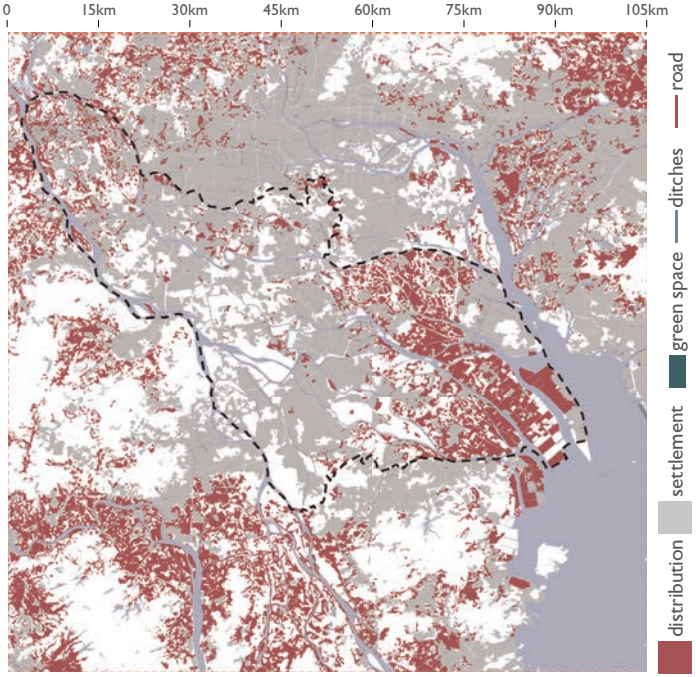
[Fig.5.23] From left to right: dike-pond system; arable land(polder); Fruit industry in the arable land. Source: the second & third images are from Huxiu (Jiuxing Travel (2021)).





[Fig.5.24] Left: dike and fish pond and its blue-green structure; right: distribution on the regional scale; source: author's own based on Google map and tracing, OSM data



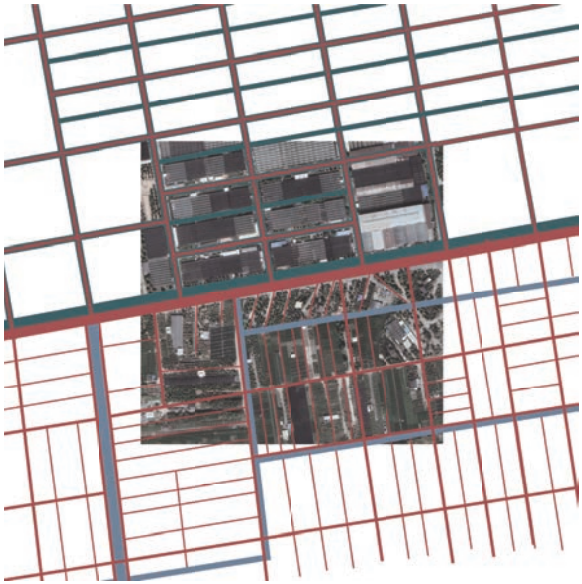


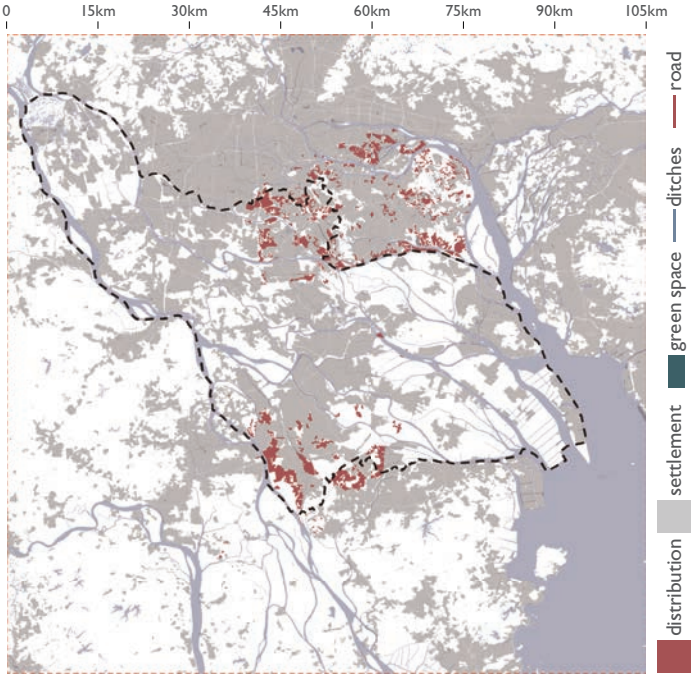
[Fig.5.25] Left: dike and arable land and its blue-green structure; right: distribution on the regional scale; source: author's own based on Google map and tracing, OSM data

3)Horticulture has developed from the dike-pond spaces and is distributed (see figure 5.27) close to the urbanised areas, on the corridor and adjacent to some L-nodes. A flower exhibition is an essential event in which most citizens participate during the festivals in this region. The scale of this element has been reduced to half that of the pond, making it easier to fit in the modular greenhouse and nursery gardens. Some flowers and trees are planted in the open space because of the favourable climate. As a non-protective open space integrated with the urban area, it can be quickly urbanised on the one hand and has a certain potential synergy with industry on the other.

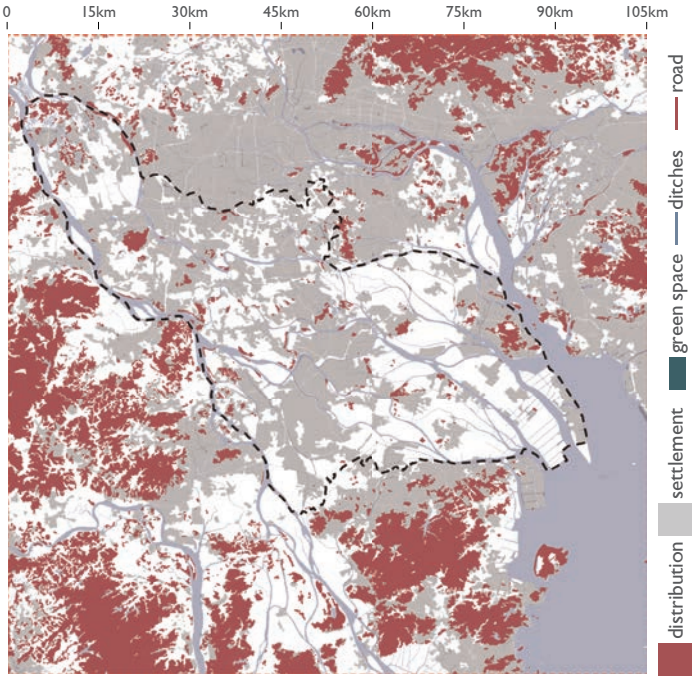
4) The topography of Desakota is not entirely flat. Small hills are scattered throughout the area. They are the locations of many village settlements for the sake of flood protection, microclimate regulation and the classic Chinese principle of planning houses with hills at the back and water at the front (Fengshui). Thus, as picture 5.26 & 5.28 shows, the forest space in Desakota is always mountainous, with settlements and a large pool in the front. Moreover, these mountains are surrounded by diverse agricultural activities from the villagers, including fish pond farming, horticulture, and traditional agriculture. However, these settlements were also the most favourable areas for urbanisation, so today, these forest landscapes are widely surrounded by urbanised landscapes where forests and mountains have become the leading public green space.

[Fig.5.26] From left to right: nursery garden; the forest is always combined with cultural buildings as a public space; the forest combined with argiculture and aquaculture. Source: the first image is from @323535928 in Xiaohongshu; the third is from Pengpai website





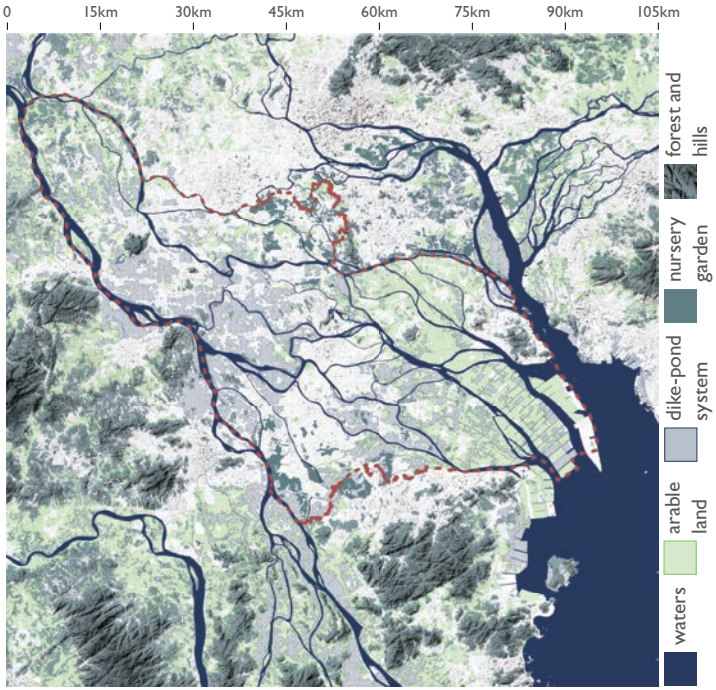
[Fig.5.27] Left: nursery garden and its blue-green structure; right: distribution on the regional scale; source: author's own based on Google map and tracing, OSM data



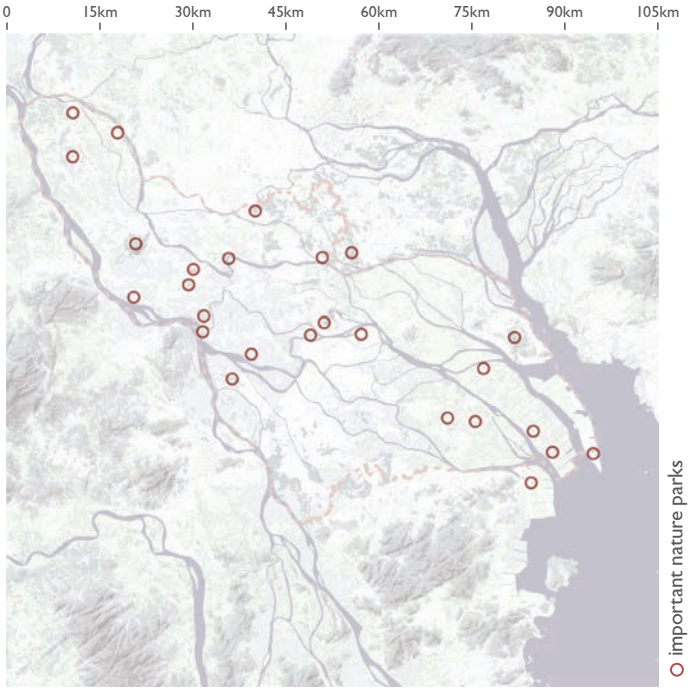
[Fig.5.28] Left: forest and its blue-green structure; right: distribution on the regional scale; source: author's own based on Google map and tracing, OSM data

OPEN SPACE ELEMENTS IN THE DESAKOTA NETWORK

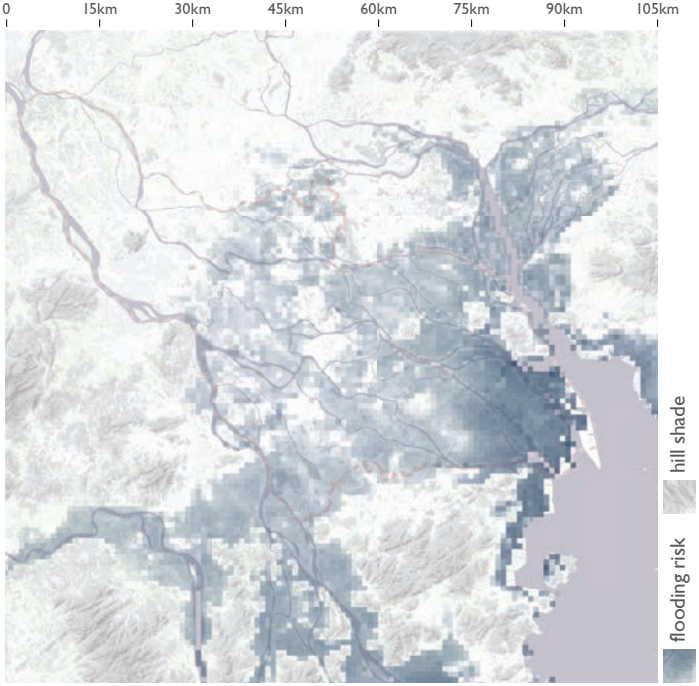
The four landscape elements and layers described earlier, along with the water network, collectively form the landscape system of Desakota, providing essential ecosystem services. In detail (see Figures 5.29 to 5.32), the water network is the backbone, supporting these landscape layers' nutrient cycling and life processes. The forest elements provide important natural parks in the region. They play a crucial role in providing cultural services. Fish ponds and arable land are distributed in low-lying areas and contribute to regulating the impacts of flooding. The main rivers supply water for the entire region, with the eastern side's arable land concentrated in providing food, while other areas engage in dispersed farming activities.



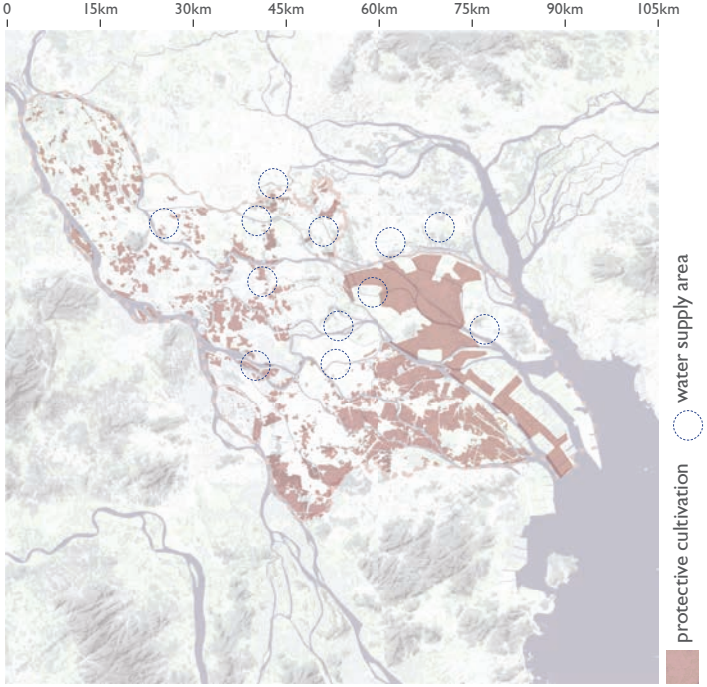
[Fig.5.29] Water network providng backbone for 4 landscape layers;
Source: author'own based on GIS data



[Fig.5.30] The distribution of natural parks of regional importance;
Source: traced based on the governmental document



[Fig.5.31] The prediction of flooding risk based on the altitude; Source: GIS data from website of Aqueduct Floods



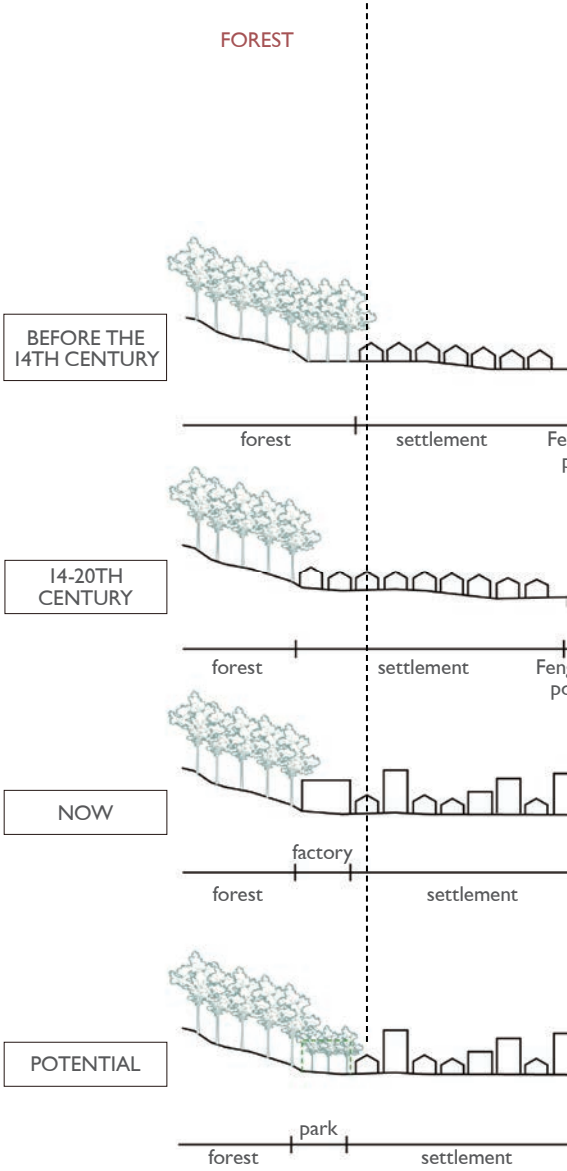
[Fig.5.32] The distribution of protective farmland and the source of water supply; Source: Data are from government document

CHALLENGES AND POTENTIAL

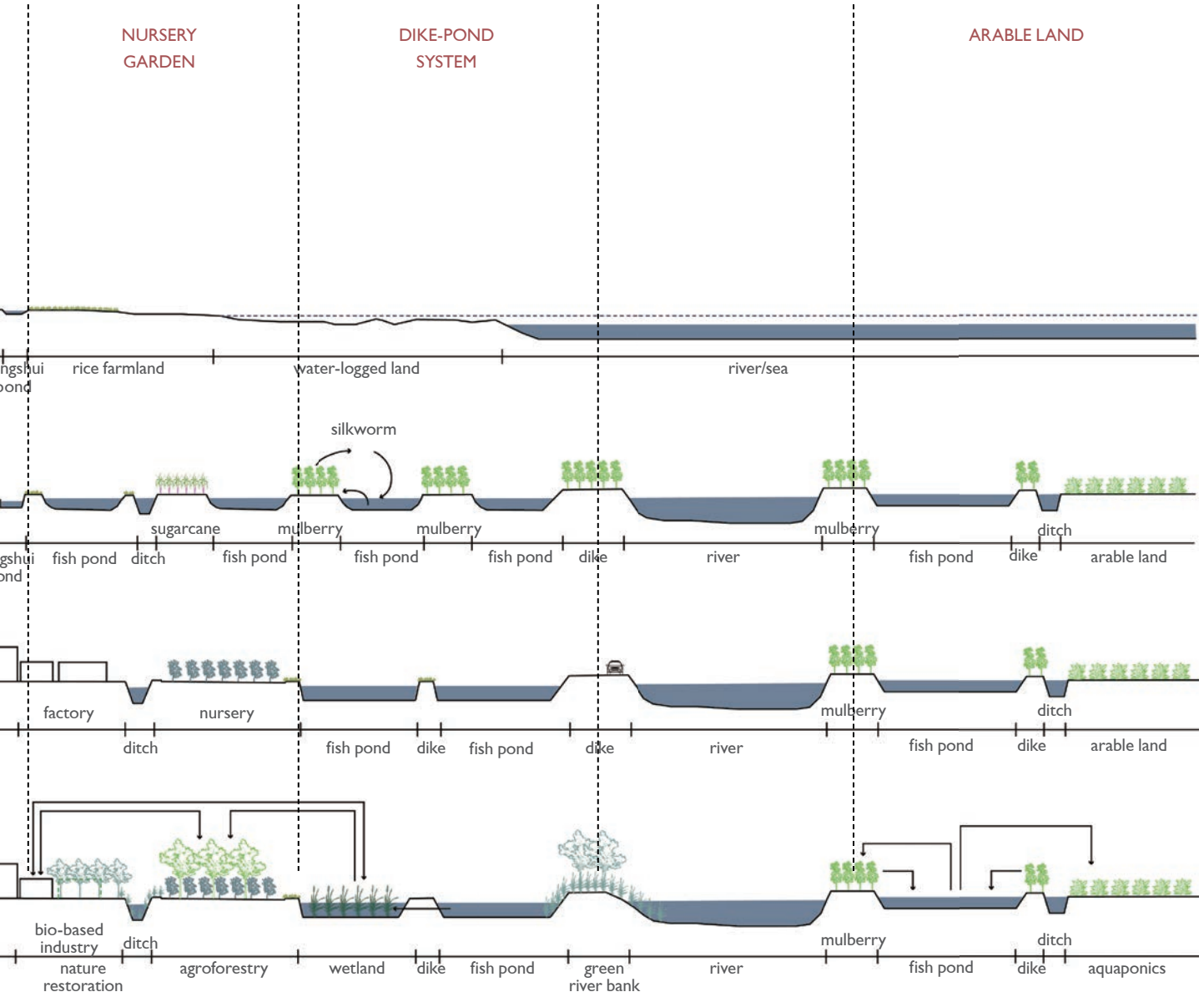
As shown in the changes in the sections (see Figure 5.33), the effect of the water network on nutrient cycling gradually diminishes during the dike hardening. Factories are built surrounding the forest element. The recycling system of the dike-pond landscape is replaced by high-density aquaculture practices, accompanied by severe eutrophication. Due to pollution from fish farming, more funds and water treatment are required to ensure the safety of food and water supply. Apart from protected farmland, fish ponds and nursery gardens are increasingly being utilised for development.

Therefore, the landscape system should adopt measures based on the following principles: 1)Restore the nature of water network to enhance its supporting service. 2)Address water pollution, requiring remediation of ditches and the transformation of pollutant industries and aquaculture. 3)Utilise nurseries as a supply of industry raw materials, such as converting them into agroforestry. 4)Redesign the industrial landscapes surrounding forests. 5)Establish nutrient cycling networks, such as the exchange between farmland and fish ponds as well as between fish ponds and bio-based products.

In conclusion, the landscape system can potentially enhance ecosystem services and promote circularity.



[Fig.5.33] Desakota's landscape over time and its potential



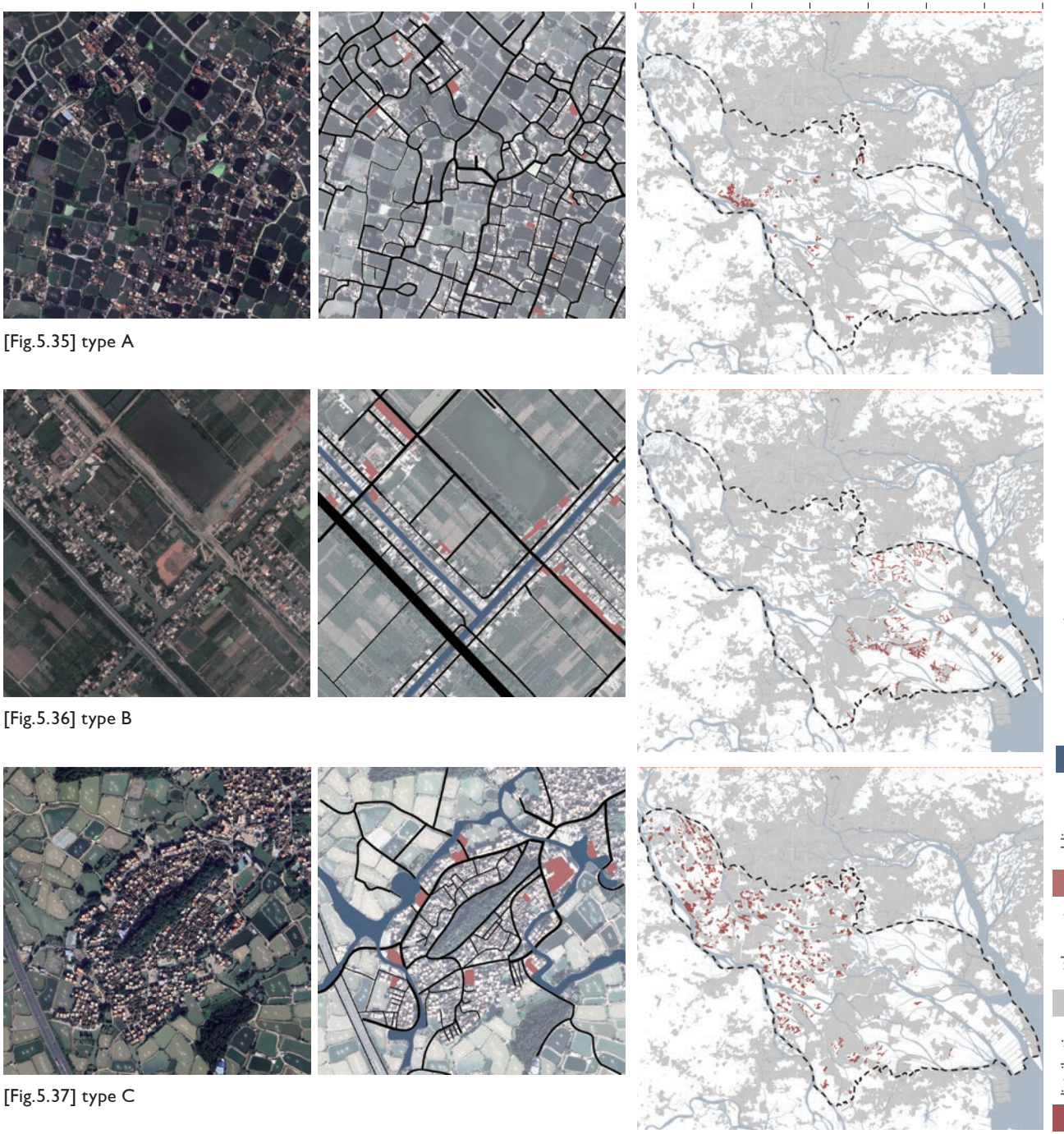
for the future; source: the diachronic sections refer to the diagram of essay (Tian, 2019)

5.7 Element and Layer of Residence

The lifestyle in the Desakota region can be categorised into two types: urban and rural. Regarding the rural lifestyle, there are three types of settlement patterns:

A) Settlement is distributed linearly on the dike of the dike-pond system. As the aquaculture economy declined, the dikes were widened to build houses. People extended their communal spaces by filling fish ponds. Such settlements are not common on a regional scale, as they emerged recently.
B) Another linear settlement pattern can be found near the arable land. Settlements spread along linear dikes with only three or four rows of houses, so most people live near the water and farmland. The streets between the long rows of houses or between the houses and the arable land are the main public spaces for the villagers. It is inconvenient for schooling and shopping, as the settlements with public services are concentrated only in the nodal parts and at great distances.
C) Most people resided in type C settlements. These settlements were either concentrated around hills or densely distributed on the plain. This concentration served flood control purposes (Sun et al., 2019). The culture of Southern China tends to form robust family networks, resulting in strong social ties between villagers (He, 2012). Continuous water networks flow between the residential areas and the ponds. These water bodies often flowed through the communal spaces of the village, including ancestral halls and their Fengshui ponds. However, with development, Fengshui ponds gradually became areas for the disposal of domestic wastewater, causing the pollution of ditches. The government has restricted this practice by establishing underground drainage systems in most villages. So the public facilities of type C village are more sufficient than the others. In terms of morphology, the pattern is irregular because villagers have a certain degree of autonomy when constructing their own houses, which also contributes to a distinct settlement culture compared to cities. Figure 5.37 illustrates that this rural pattern is still widely adopted in the middle and western Desakota areas.

[Fig.5.34] Aerial photography of type A residence; Source: image from Mengjuan Tian (Tian, 2019)



[Fig.5.35] type A

[Fig.5.36] type B

[Fig.5.37] type C

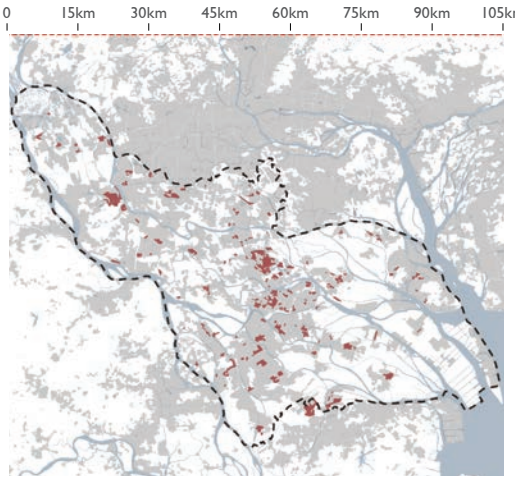
From left to right: types of residence, extraction of street, public space and waters, and distribution in the regional layer; source: author's own based on Google map and tracing, OSM data

Three types of urban settlement are outlined: superblock, urban village, and the modern urban neighbourhood.

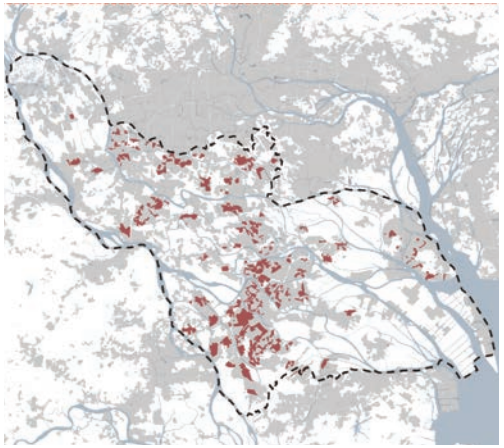
D) Superblocks are common in dense Chinese cities. Here, the road network is hierarchical: the primary streets create districts of 800x800 meters; the secondary streets of the city cut the inner part of the grid into four communities; each community consists of blocks of different scales, but they all follow a regular road network. Generally, each block has its own collective public space inside, but the blocks keep open.

E) Urban villages are a unique pattern in the Chinese context. This is because rural land ownership belongs to the village collective, and the other land belongs to the state. Accordingly, if the issue of land ownership is not resolved, the government will seek to build new urban patterns around them; thus, these villages will be retained between them, becoming urban villages. Their scale is indeterminate; as the figure 5.40 shows, they can be huge, over 1000x1000m, and internally the road network follows the irregularities of type C. The roads inside are narrow, which contain all the public life of the people in the area. These living patterns are found in abundance in both corridors of the desakota.
F) The last living element is the typical Chinese housing pattern: the gated community. This type of residence is metamorphosed based on 180x180m, with high-rise residential buildings distributed inside. It is configured with relatively qualified green space. In accordance with the urban planning guideline, these blocks are equipped with adequate public services in and around them. But all of these are enclosed in a fence and not open to the public. Thus even if two blocks are adjacent, there is little communication between them. It is the most familiar pattern of life for Chinese living in the city.

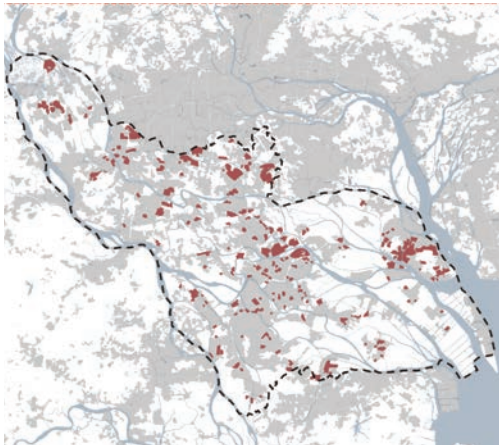
[Fig.5.38] Aerial photography of type D and F residence; Source: image from VJ shi (Aerial Photo of Ronggui Sub-district in Shunde District, 2020)



[Fig.5.39] type D



[Fig.5.40] type E



[Fig.5.41] type F

From left to right: types of residence, extraction of street, public space and waters, and distribution in the regional layer; source: author's own based on Google map & tracing & OSM data

CHALLENGES AND POTENTIAL

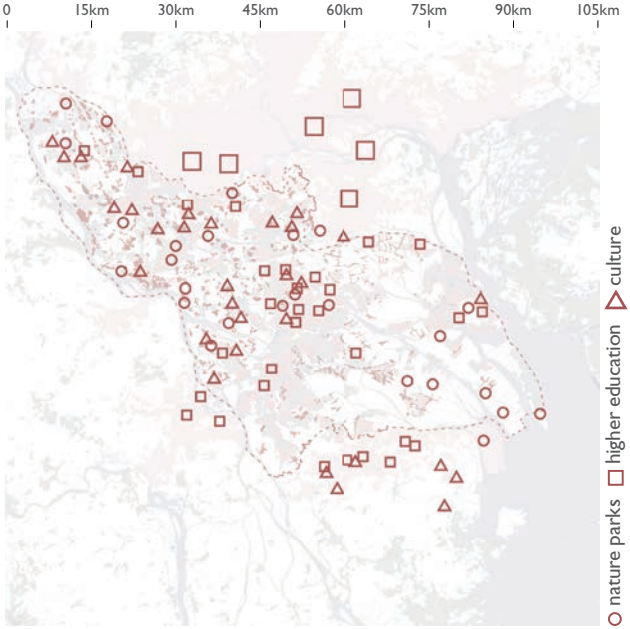
These residential elements constitute Desakota's settlement culture. The overall quality, in combination with the analysis of metropolitan publicness, is reflected in the following aspects:

1)the settlement nodes along the two development corridors primarily adopt an urban lifestyle, but these residential patterns lack public green spaces. As the landscape analysis concludes, forests are the main public green areas, but numerous redundant factories still surround them, diminishing the publicness.
2)The settlement patterns in the Desakota region are mainly concentrated villages, where public facilities are relatively lacking.
3)Besides the natural parks, this region also features various cultural points of interest, such as ancestral halls, historical gardens, and traditional houses, which are dispersed throughout the town nodes. Additionally, several L and M nodes have the presence of universities or colleges. Each town node possesses the potential to develop its own public life.
4)Public transportation, such as high-speed rail and metro lines, connects the L and M nodes on the eastern corridor to the metropolitan region. This regional network allows for shared services among the nodes and contributes to vibrant tourism in the area.
5)The local road network consists of primary roads providing communication routes between nodes; secondary and tertiary-level roads facilitating daily commuting and access to public services within the nodes. They have already formed a relatively complete network, even in the Desakota region, enabling communication between village settlements.

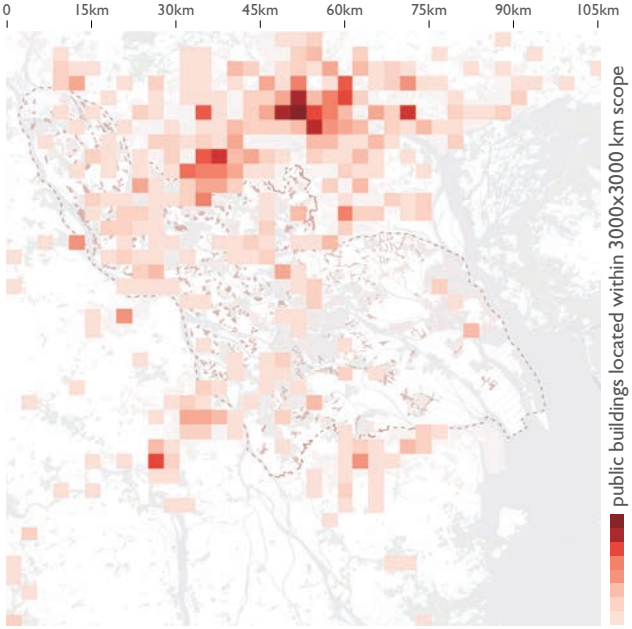
Considering the above characteristics, the issues that need to be addressed and the potentials that can be utilised in living environment are as follows:

1)Public services in Desakota need to be extended. Based on the service scope, in the western and middle Desakota regions, 3-5 villages have the opportunity to share public institutions and facilities through well-developed street networks. The eastern Desakota region requires more decentralised and smaller-scale public services.
2)Industry redundancy within the nodes along the corridors should be used to improve the quality of life. They can either provide room for future development or be redesigned into public spaces in densely populated areas.
3)Industry redundancy within Desakota nodes can also be utilised to improve public life.
4)The design of public spaces and residential patterns should base on the node's settlement culture, cultural and leisure resources and natural elements.

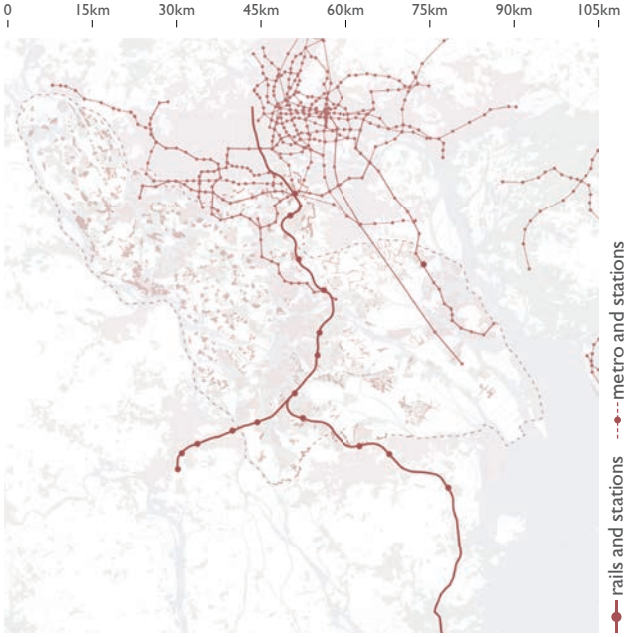
In summary, the potential of residential elements lies in the ability of different nodes to collectively form a diverse regional community and utilise industrial redundancy to enhance publicness.



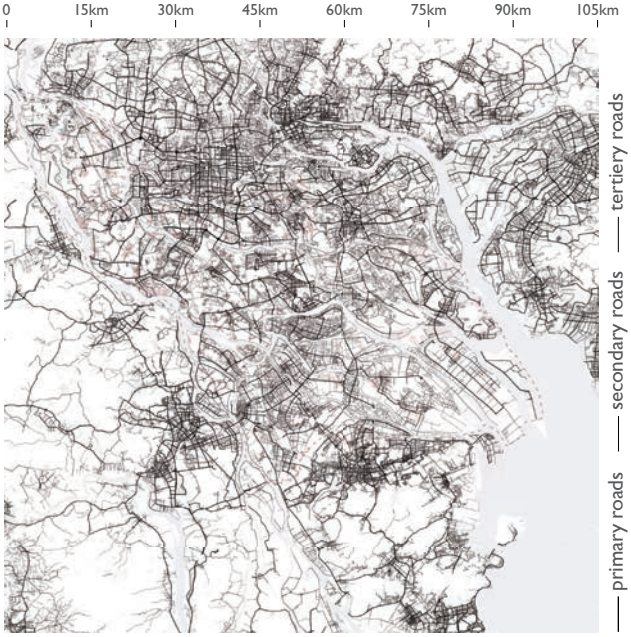
[Fig.5.42] Regional importance of culture, leisure and higher education POI; Source: author's own based on POI data



[Fig.5.43] Service scope (3000m) of public buildings (library and museum); source: author's own based on the POI data

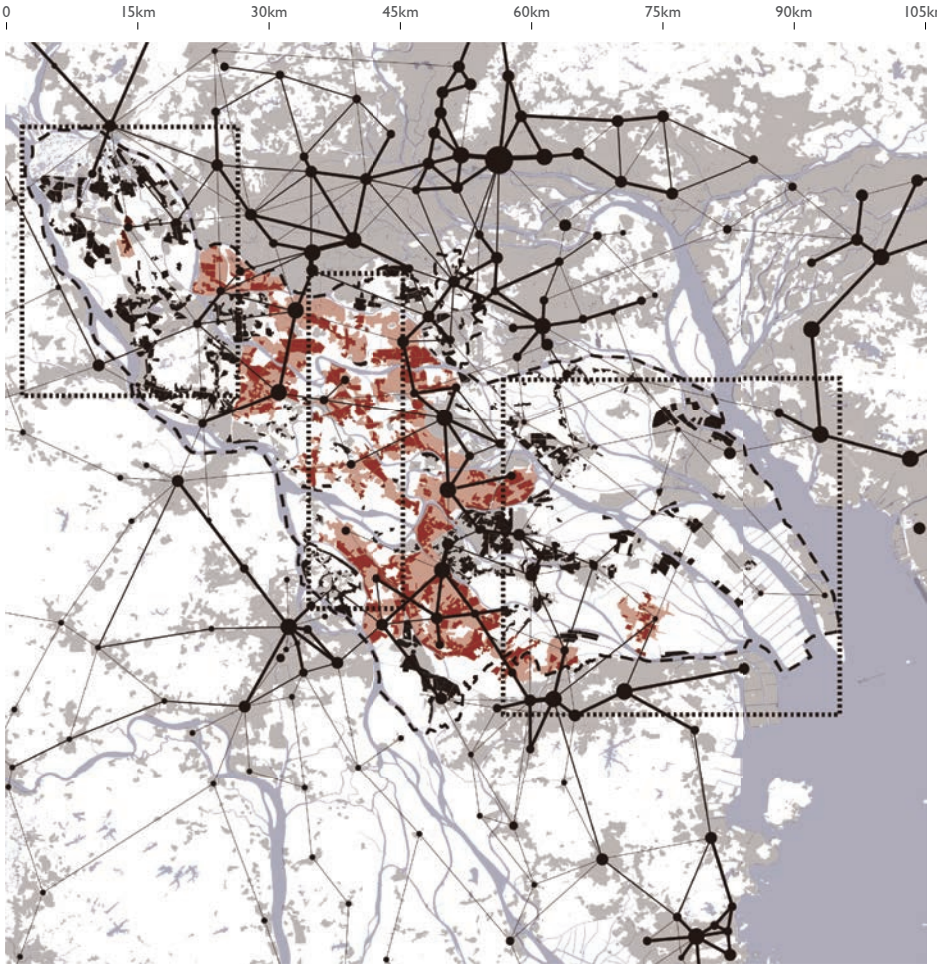


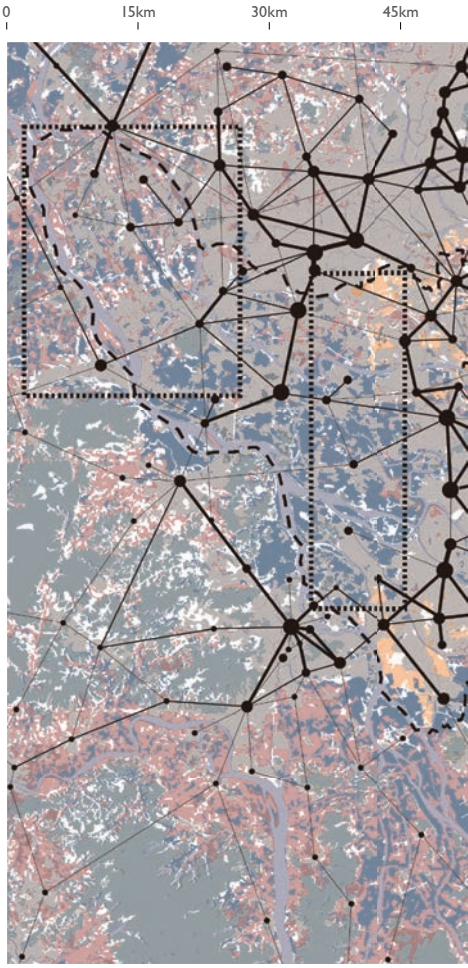
[Fig.5.44] Public transport of Metro lines and Rails; source: author's own based on OSM data



[Fig.5.45] Local street network of primary & secondary & tertiary roads; author's own based on OSM data

5.8 The Feature of Morphological and Physiological Network





LEGEND OF THE DESAKOTA NETWORK

waters | project perimeter | settlement patches | XL-node | L-node | M-node | S-node | XS-node | strong connections | lighter connections

LEGEND OF THE INDUSTRY LAYER

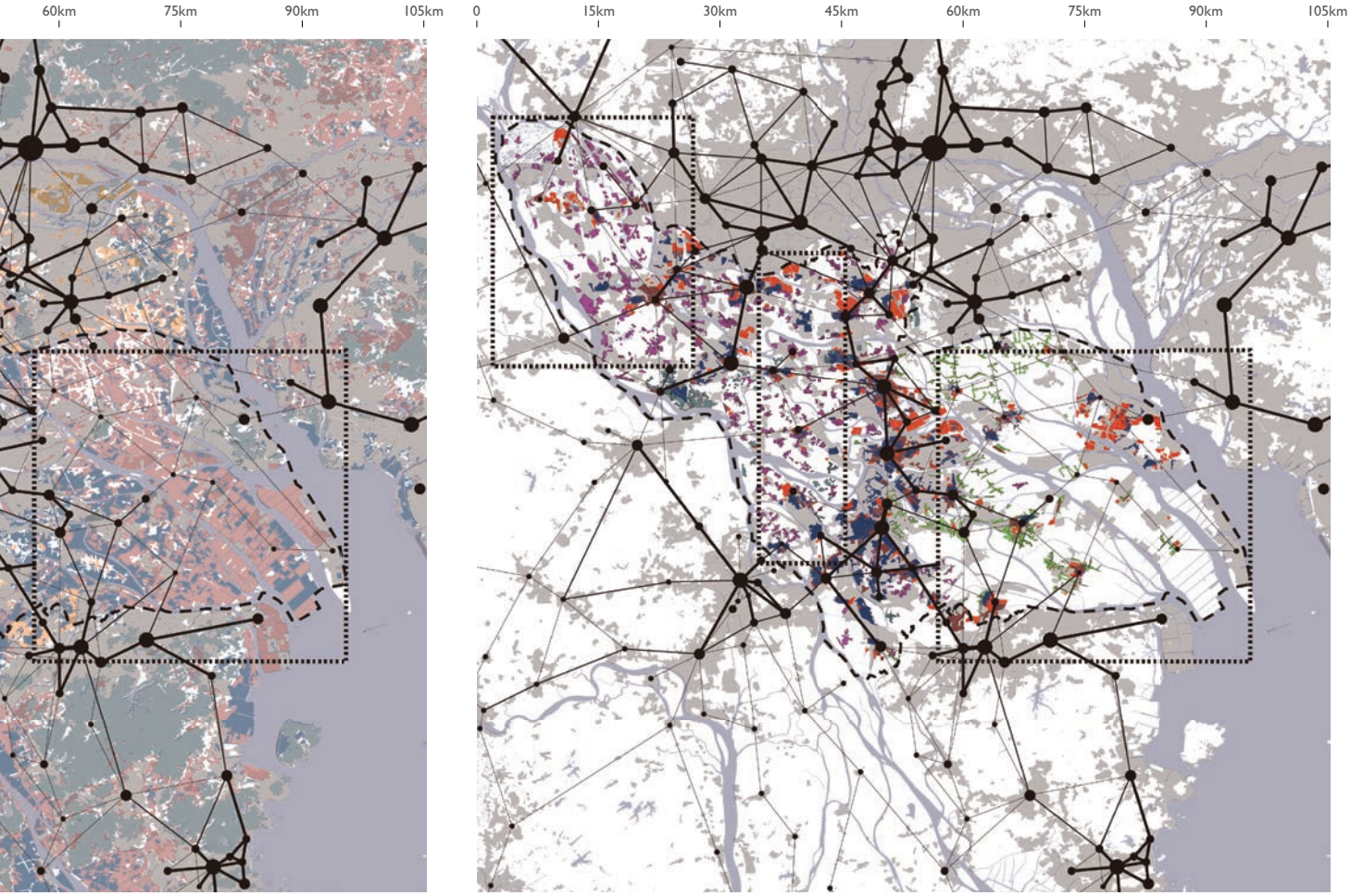
industrial areas of manufacturing | active industrial areas of manufacturing | patches related to active industrial areas

LEGEND OF THE OPEN SPACE LAYER

dike-fish pond | dike and arable land | ho

[Fig.5.46] The Industry layer in the Desakota network; source: author's own

[Fig.5.47] The open space layer in the Desakota



physical connections
three zones

rticulture
forest

network; source: author's own

LEGEND OF THE RESIDENCE LAYER

A: dike-pond village
B: linear village
C: populated village
D: superblock
E: urban village
F: enclosed community

[Fig.5.48] The residence layer in the Desakota network; source: author's own

5.9 Current Desakota Structure and Potential

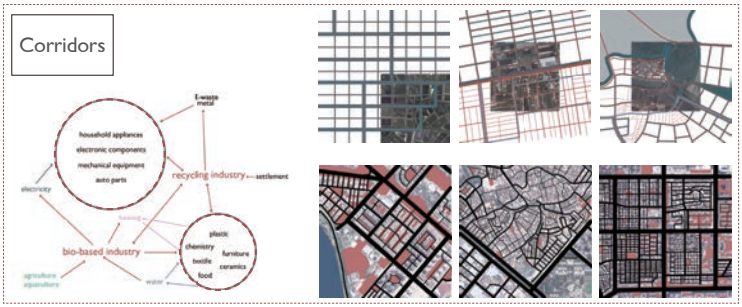
A synthesis of previous research on the network and the elements leads to the following conclusion about the Desakota structure:

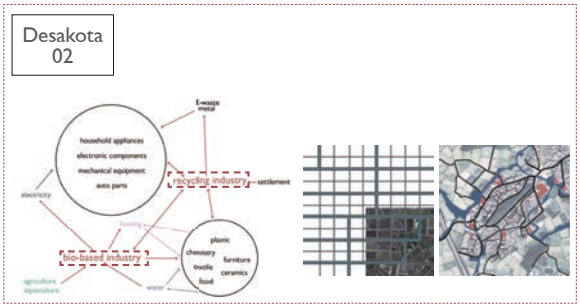
The L and M nodes constitute two development corridors connecting with metropolitan areas. They have evolved from Desakota areas and formed features that lie between the urban and Desakota. Morphologically, the nodes exhibit a centralised form and predominantly follow an urban lifestyle. Due to their development from traditional Desakota regions, there is considerable redundancy in the industrial sectors, necessitating transformation and providing potential room for public space. These nodes operate multiple large industrial parks with a small amount of aquacultural and horticultural activities, which can potentially form two symbiotic clusters.

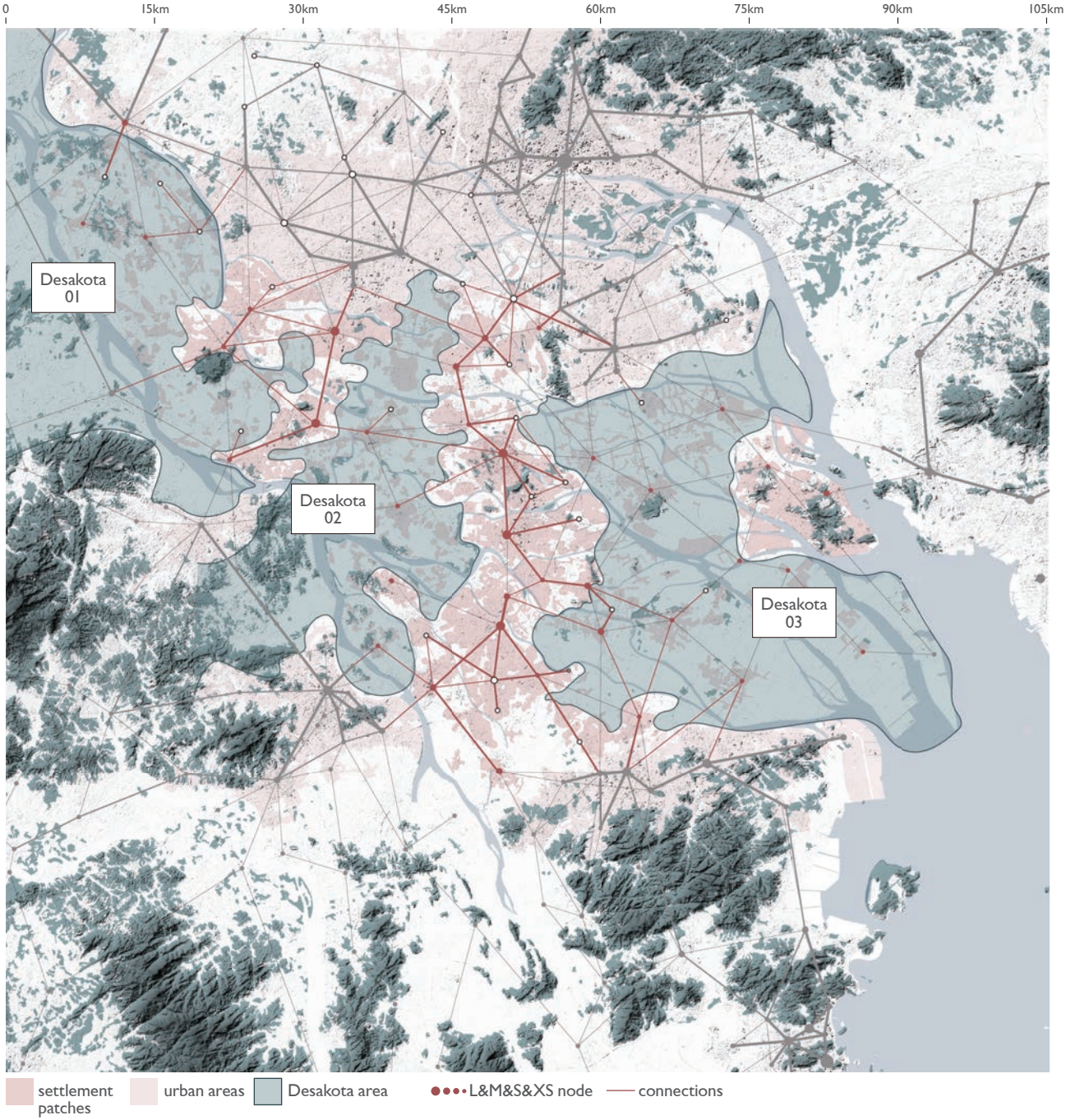
The S nodes are usually located outside the development corridors but connected to them. They comprise a concentrated urbanised area and dispersed villages, which are densely distributed in the Desakota 02 region, primarily featuring pond landscapes. Their industrial activities are more active compared to other Desakota regions, providing low-end and diverse products and establishing cooperation with both development corridors. Consequently, industrial sectors in this region can seek cooperation from local aquaculture which help diversify the monoculture of pond landscape and also have the potential to join the regional symbiotic network.

The XS nodes comprise dispersed villages, productive agricultural landscapes, and small concentrated areas with a few industrial activities. These nodes are widely distributed in the Desakota 01 and 03 regions, making these two Desakota areas more suitable for maintaining high-productivity agriculture and diversifying livelihoods through some concentrated industrial activities. Their development potential within the network structure is not high, so these two areas will not be the focus of subsequent research.

In conclusion, the two development corridors and the Desakota 02 region have the potential to form a symbiotic industrial network, with the adaptation of landscape system and the improvement of living environment.

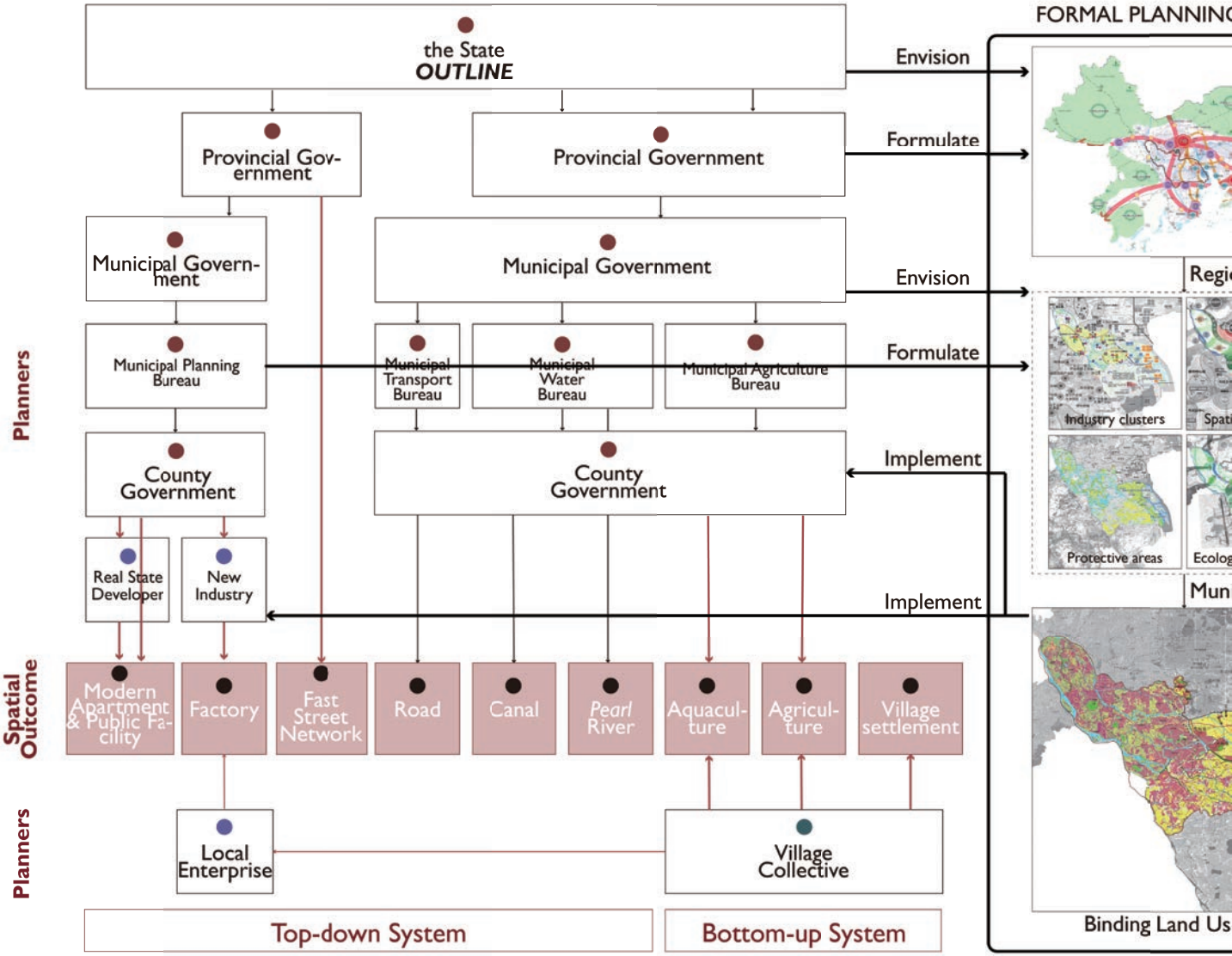






[Fig.5.49] Current feature of Desakota structure; source: author's own

5.10 Current Planning System & Projection

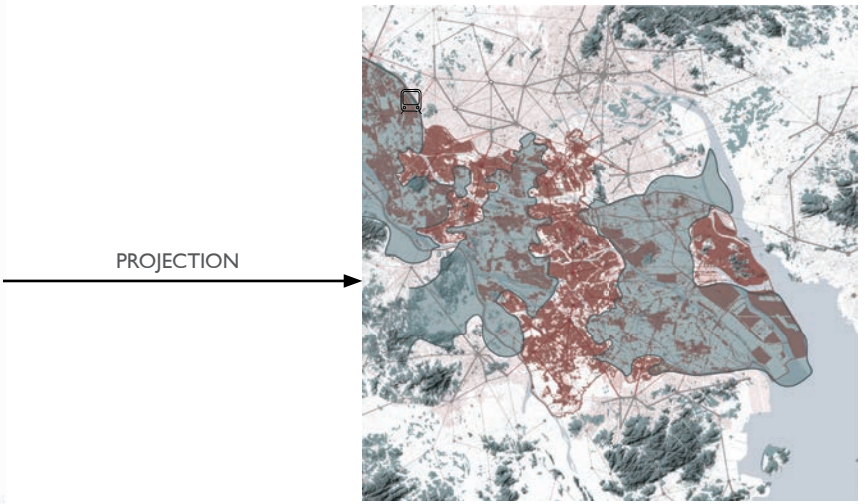


[Fig.5.50] Current planning structure and its corresponding planning products; source: author's own based on the government documents; images are integrated by government documents fromGuangdong Province/Guangzhou/Foshan/Zhongshan/Jiangmen regional planning

The current planning system is a centralised governance structure, shown in the diagram 5.50. According to the projection, this planning system will drive the development of the Desakota region into urban areas. Specifically, the two development corridors will expand into the Desakota region, with the L, M nodes, and their adjacent S nodes forming a continuous urban area. New transportation nodes will be established in the high-productivity Desakota 01 and 03 areas, accompanied by the new industrial zones and development areas. This result, combined with the planning process, shows that the Desakota region has some practical challenges and opportunities that the planning system cannot effectively respond to, including:

1) the planning relying on land-use plan tools is not able to realise the potential of industrial symbiosis, landscape restoration, cooperation between agriculture and industry, and the identification of nodes. 2) Blueprint-oriented planning focuses more on the future rather than present conditions. For example, the proposed industrial zones and urban areas in Desakota 01 and 03 areas did not consider the existing landscape system and residential environment. Industrial planning introduces new industries, but their connection to the current facilities and production aptitudes is weak. 3) Despite having an integrated strategic plan for the GBA region, municipal governments still formulate practical planning. As a result, the Desakota region has implemented four sets of city-level plans, lacking coherence between planning products; thereby the potential for landscape continuity and industrial networks mentioned earlier may be difficult to achieve.

Based on these challenges, further research will explore how to leverage the Desakota structure and propose strategies for the existing planning system.



[Fig.5.51] Projection of the land-use plan and planning of new infrastructure; Source: author's own based on the government documents

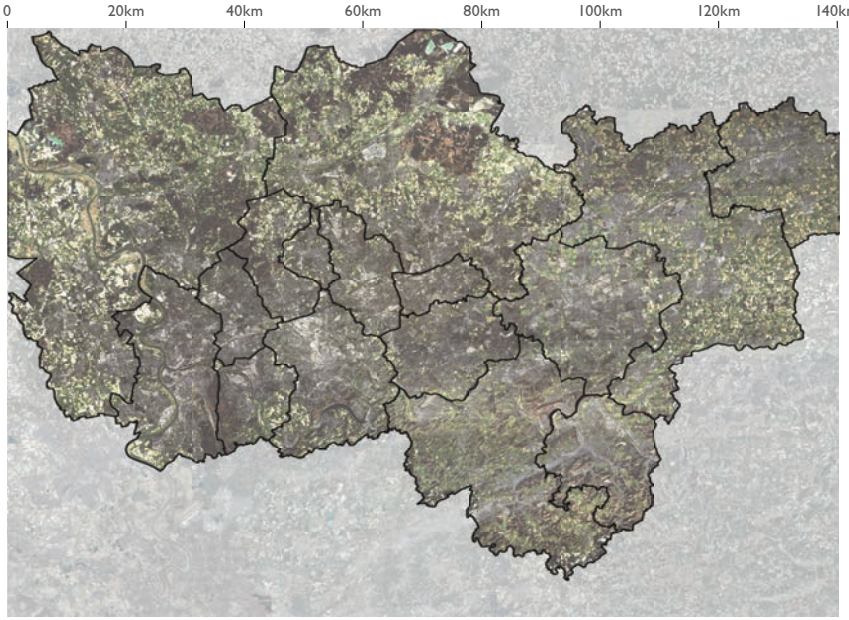
5.11 Reference Projects Analysis

To further investigate the structure and corresponding planning adjustments, the second phase of the analysis aims to conduct a study and reflection on planning precedents. In selecting the cases, they need to contain the following references: 1) proposing structures that consider dispersed urbanised areas, 2) having strategies for industrial conversion, 3) providing corresponding planning strategies, and 4) diversity and applicability, including cases from Asia. In accordance with the criteria, the Ruhr Metropolis in Germany and the Shanghai Metropolis in China have been selected to study their industrial development, landscapes, living environments, and planning strategies. It is important to note that the purpose of comparing these cases is not to judge their superiority or inferiority but to explore these structures' potential in addressing the challenges of GBA Desakota and to identify valuable experiences that can be drawn upon.

The Ruhr area is located in the North Rhine-Westphalia region in Germany, consisting of 11 independent cities and 4 administrative districts (Ruhr, n.d.), as shown in Figure 5.52. Historically, the region was characterised by coal mining and steel industries and has undergone structural changes. Today, the Ruhr area manifests a post-industrial landscape shaped by a series of successful planning strategies. The regional picture is presented through decentralised urban landscapes connected by a regional green infrastructure as well as rich cultural and other public facilities. In the industrial transformation process, the Ruhr Metropolis focused on core issues, such as regional ecological environment and social culture, implementing corresponding action plans (Regionalkunde Ruhrgebiet - Die IBA, 2003). Although these experiences cannot be directly applied to the Chinese context, they are valuable for reflection in Desakota.

Shanghai is located in the eastern centre of China and has 16 districts. Since the 18th century, the region has been one of China's most important industrial and commercial centres, with its industrial sector being most mature in light industry (Shanghai Light Industry Journal, 1996) and serving as a base for heavy industry product development. However, in the 1980s, industrial competitiveness in the GBA region rose, posing challenges of marginalisation for Shanghai's industries. Since 1990, Shanghai has been transforming toward high-end manufacturing, such as machinery manufacturing, through new town planning and industrial relocation (Twenty Years of Reform and Opening up in Shanghai, 1998). Shanghai shares many similarities with the GBA region regarding industrial foundation and transformation policy. Furthermore, based on the planning trend of urban-rural integration in China, Shanghai has proposed a hierarchical cluster development structure, which can assist in contemplating planning in similar GBA Desakota region.

Ruhr Metropolis



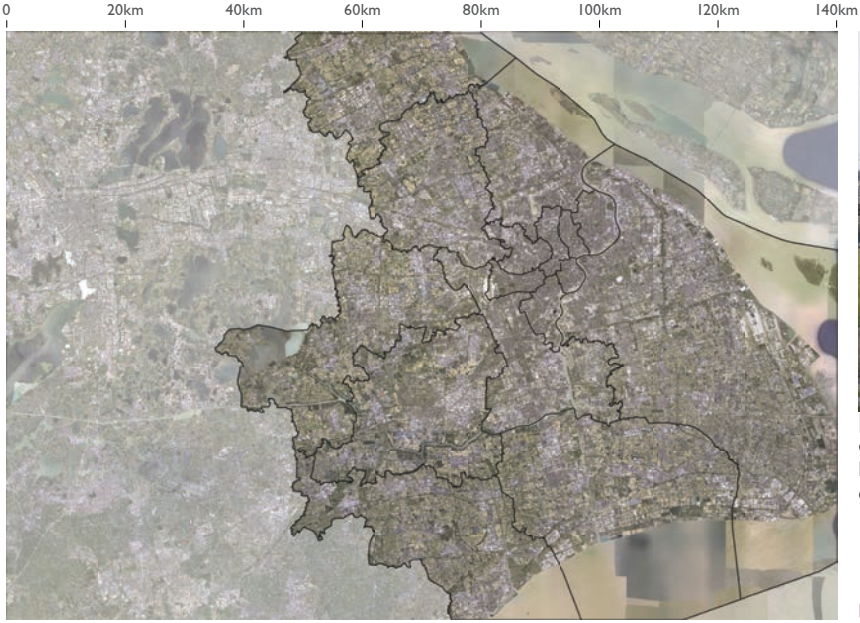
[Fig.5.52]Ruhr metropolis and Industrial conversion; source: author's own based on ESRI Satellite Map and OSM data; image from website (Internationale Bauausstellung | IBA, 2019)

4435 km2

5.1 million

€167 billion

Shanghai Metropolis



[Fig.5.53]Shanghai metropolis and suburban development; source: author's own based on ESRI Satellite Map and OSM data; image from essay (Dcun, n.d.)

6340 km2

263.2 million

€595.3 billion

RUHR METROPOLIS - A GREEN TRANSITION

The changing image of the Ruhr region mainly owes to the well-known IBA Emscher Park. This large-scale initiative for conversing old industrial areas (as shown in Figure 5.55) is aimed at social, economic, and ecological revival. It was operated by a private planning law company and governed by a semi-governmental steering committee (comprising representatives from national ministries, municipal governments, enterprises, trade unions, planning, architecture, nature conservation, and scientific experts), serving as a binding decision-making body between the state and municipal governments. This planning approach focused on small-step projects in five specified themes of action, including 1) regional green infrastructure, 2) landscape regeneration of the Emscher system, 3) repurposing of old industrial buildings and areas, 4) works in the park, and 5) experimental living space (Regionalkunde Ruhrgebiet - Die IBA, 2003).

The success of IBA was built upon a series of preceding planning actions, such as the concept of a regional park network proposed under the regionalised structural policy (Regionalkunde Ruhrgebiet - Die IBA, 2003). Prior to this, spatial planning in the Ruhr area fell under the function of the state government but had limited influence on regional development. To adapt to a more self-organised trend, regional planning in the Ruhr area was undertaken by the RVR (Regionalverband Ruhr), and initiatives like the Project Ruhr aimed to enhance the competitive industrial sectors in each urban node and establish collaborative networks between nodes (as shown in Figure 5.56). Subsequently, RVR issued a series of strategic plans to be implemented through various tools (depicted in Figure 5.57); but its current actions mainly focus on developing cultural networks and regional green infrastructure, so the effectiveness of this regional planning is unclear(Keil et al., 2013).

Overall, the Ruhr area has become a successful example of decentralised transformation in traditional industrial regions, particularly notable that the industry conversion has always assumed social and ecological responsibilities.

[Fig.5.55] IBA Emscher park; source: ir

1960: started to mitigate the social impacts of the structural change by structural policy measures

1968: Development Program Ruhr: proposed a spatial structures rationalisation and a new industrialisation

1979: Action Program Ruhr: conceptualised the centralised structural policy and aimed at allocating innovative industries (technology centers)

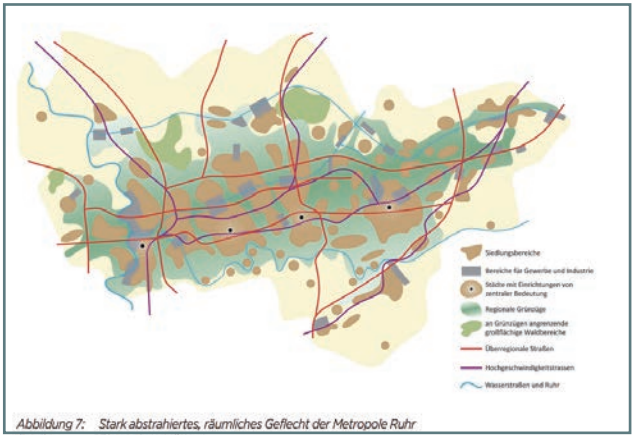
1986: Coal and Steel Regions Initiative for the Future: to use and expand the potentials the existing companies and other players were more integrated in the region

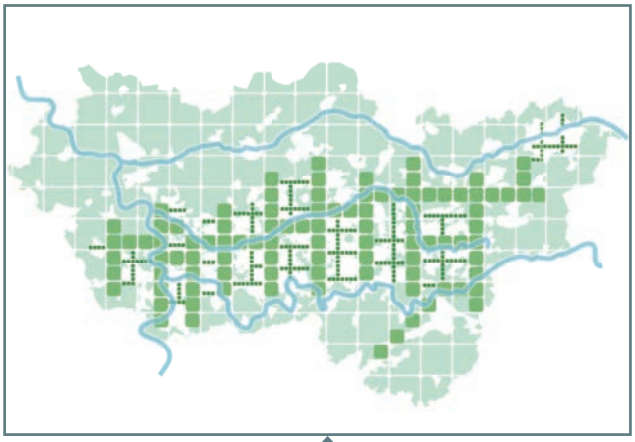
1989-1999: IBA Emsche designers): a large-scale newal of an old industri comprehensive ecologic cial revitalization of the

a regionalized structural policy

[Fig.5.56] Distribution of the industrial professional fields in the Ruhr: image from RVR report (Keil et al., 2013)

[Fig.5.57] Spatial network of Ruhr & Strategic planning of regional green infrastructure; source: images from RVR website (https://www.rvr.ruhr/)





mage from RVR website (https://www.rvr.ruhr/)

2007: Economic Promotion Metropoleruhr GmbH: RVR who comprises urban and rural districts of the Ruhr plays a key role in the regional planning

A diverse community

r Park (independent
program for the re-
al region; pursued a
al, economic and so-
Emscher zone

2000-2006: Project Ruhr: the core instruments are twelve fields of industrial aptitudes

a self-organised structural policy

[Fig.5.54] Diachronic study of industrial conversion and its planning strategies in Ruhr Metropolis; source: this diagram is illustrated referring to the RVR report (Keil et al., 2013)

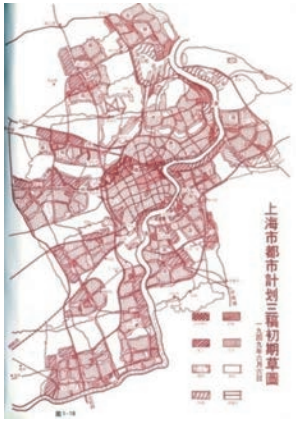
SHANGHAI 2035 - AN GLOBAL CITY OF INNOVATION, HUMANITY AND SUSTAINABILITY

The planning approach in Shanghai adopts a blueprint-style method, which pictures a structure of a "networked spatial system" characterised by "multicentre, cluster, and compactness" with key transportation corridors as the framework, and applies town clusters to promote integrated urban-rural development (Shanghai Government, 2018).

In this cluster vision, the core concept involves establishing a hierarchical structure between urban and rural areas based on administrative units, including "main cities - new cities - core towns - general towns - villages." The new cities and core towns are envisioned to accommodate more concentrated industrial and public functions, thus driving the socio-economic development of surrounding towns and villages.

Compared to Desakota, there are some differences in the planning system of Shanghai: 1) Shanghai's planning is based on integrated considerations of structure, industries, landscapes, and living environments, so the planning products and governance system are consistent; 2) With the development of dispersed areas, the governance scope of Shanghai's metropolitan area has expanded. As a reflection, in order to maintain the consistency of planning and governance, the responsibility of regional planning should be assigned to specific higher-level institutions of the municipal government for the development of the GBA Desakota region; 3) Although both are blueprint-style planning approaches, Shanghai's concept of a hierarchical structure aligns with its long-standing planning ideology, where the establishment of satellite cities provides conditions for the formation of the hierarchical structure rather than creating entirely new development areas.

[Fig.5.58] Diachronic study of p
information from Shanghai 2035
2035 website (https://www.supe



1949: For the post-war reconstruction and revitalization, Greater Shanghai Metropolitan Plan was formulated, which introduced the concept of "functional zoning" and proposed a strategy of developing neighbouring new urban areas,

a centralised policy

1959: The planning scope wa
ver the entire metropolitan a
lopment of satellite towns an
the periphery.

a regionalised structur

lanning development in Shanghai Metropolis; source: this diagram is illustrated referring to the
website; images are from Shanghai planning department which are also shown in the Shanghai
dri.com/2035/).

2017-2035: The hierarchical city-town-village structure combines multiple development axes from the centre.

as expanded to co-
area, with the deve-
d industrial zones in

al policy

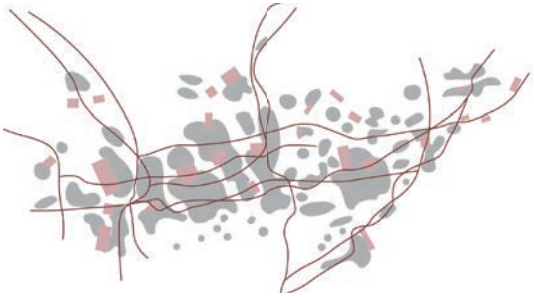
1986: The urban structure is divided into four levels: the central city; industrial suburban towns and satellite cities, where urban functions are fully developed; suburban counties; and rural small towns, scattered between satellite cities and suburban counties.

In 1999, in addition to the hierarchical structure, the planning structure formed a regional configuration consisting of the central city, axes, and core towns.

A global city

Integrated planning

RUHR METROPOLI: A DECENTRALISED STRUCTURE



Transformation of coal industrial zone

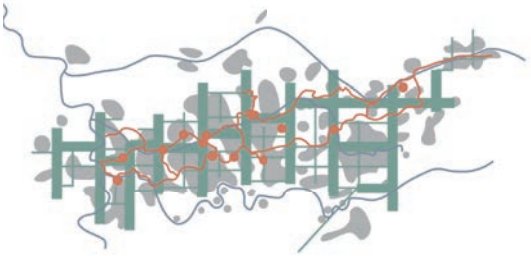
Potential field of competence, networking and clustering

Networking of knowledge and industry

Promote environmental economy and knowledge economy

Regional Green Infrastructure

Landscape Regenaration of the Emscher river



Regional mobility (slow traffic)

Reuse of industrial buildings

New Linving - local settlement culture

Tourism hotspots and routes & Cultural events and networking

IBA Emscher park: a semi-governmental steering committee and independent planners
Project Ruhr: multiple municipal governments
Regional planning & stractegic planning: RVR

A SELF-ORGANISED STRUCTURAL POLICY

DESAKOTA

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STRATEGIC ANALYSIS OF THE RUHR METROPOLIS

Here is an analysis of how Ruhr's decentralised structure responds to different problem fields that must be addressed in the GBA Desakota region. The following four points correspond to aspects of industrial development, open space, public facility, and planning strategies.

1) Each node is enhanced in its specialised field with comprehensive supply chains. With the assistance of RVR, cooperation networks between nodes are also established through regional transportation. But this network does not consider energy, waste recycling, and other facilities.

2) Efforts are made to restore polluted rivers and promote iconic regional green infrastructure, providing a high-quality living environment for the polycentric areas. This practice demonstrates the feasibility of regional governance and cooperation between nodal cities.

3) The reuse of industrial heritage into landscape parks and the establishment of a polycentric cultural network are characteristics of the Ruhr's identity. This is achieved through small-scale projects with high feasibility and local relevance. However, they are highlighted projects, while other public facilities may not be adequately considered.

4) The transformation in the Ruhr area was facilitated through ongoing practices, including diversification of planning tools, expansion of planning scope, and adjustments in governance structures. Planning strategies are evaluated periodically and adjusted as necessary (Scheck et al., 2013). The ability to adapt to changes and correct mistakes is a key characteristic of the planning system, and this feature can also help Desakota address complexity and uncertainty.

STRATEGIC ANALYSIS OF THE SHANGHAI METROPOLIS

Here is an analysis of how Shanghai's hierarchical structure responds to different problem fields that must be addressed in the GBA Desakota region. The following four points correspond to aspects of industrial development, open space, public facility, and planning strategies.

1) The hierarchy entails a high level of dependence accompanied by the small towns/villages relying on the demand of new cities and providing products at the lower end of the industrial chain.

2) The green corridors can restore the natural water network and provide shared ecological and public spaces between town clusters.

3) Concentrated public resources, services, and new housing are primarily located in the new cities, meaning people from small towns and villages must commute or relocate to access these services, leading to social crises in dispersed areas. The standardised construction of new housing reduces the diversity of settlement culture in dispersed regions.

4) Shanghai's blueprint planning involved the collaboration of multiple neighbouring governments, departments, design firms, and research institutions. However, the limitations of blueprint planning and land-use tools have been demonstrated in the previous projection.

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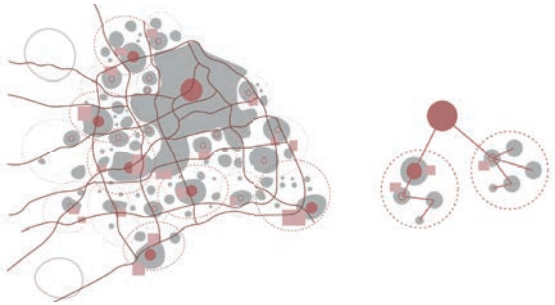
SHANGHAI 2035: A HIERARCHICAL STRUCTURE

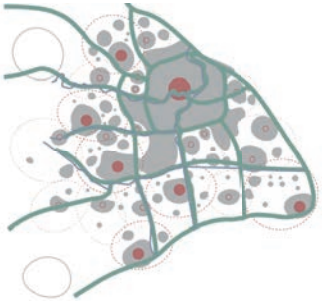
Relocation and suburban agglomeration of manufacturing in new cities and core towns

Innovation centres combined with residential communities and service platform



Green & blue network with public spaces and slow traffic routes

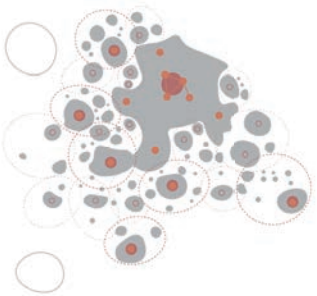
Network structure of parks



Preservation and reuse of historical heritage (city branding)

Centralised public service in the new cities

New apartments in the suburban districts



A REGIONALISED AND CENTRALISED STRUCTURAL POLICY

Blueprint: the state & Shanghai government & Other governments in the Delta Urban Agglomeration
Land-use plan: planning bureau

6. Towards a Sustainable & Liveable Desakota

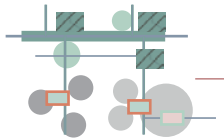
6.1 Design Principles

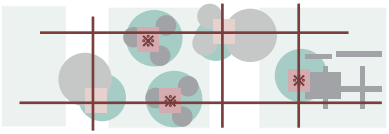
Based on the reflections of reference projects and the potential of Desakota, the decentralised development pattern is better suited for the Desakota region in the GBA due to the following reasons:

1) Landscape strategies should be tailored to local issues and characteristics, focusing on restoring water pollution and enhancing connectivity. Strengthening the green and blue network based on rivers allows for potential nature restoration in-between town nodes, creating shared natural spaces and connecting Desakota ecological zones. In addition to the restoration of main rivers, controlling pollutant discharge requires the treatment of ditches. Ditches collect wastewater from different nodes. The sources of pollutants in different nodes vary, so the natural restoration measures will also differ. Hence, regional guidelines and decentralised landscape strategies should be integrated to promote the restoration strategy. To sum up, the landscape structure under the decentralised model exhibits continuity, shared competency, diversity, and problem-oriented approaches.

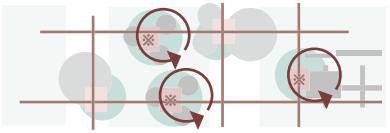
2) The Desakota region now has more potential for industrial parks to form a decentralised network, which can facilitate the independent circular development of nodes and form a symbiotic network. This is because the scale and morphology of settlement nodes do not relate to the current distribution of industrial areas, as even dispersed village settlements may operate industrial parks. However, at the local scale, industrial areas should be more concentrated as eco-industrial parks to promote industry symbiosis. In this transformation, recycling hubs are crucial as core facilities, enabling the circular utilisation of resources within nodes. There is a high symbiotic correlation between different nodes; therefore, these recycling hubs can flexibly form exchange networks through the current infrastructure.

3)The core advantage of the decentralised development model in improving the living environment lies in the ability of each residential node to access comprehensive public services within its own borders or neighbouring areas. Moreover, when providing design guidelines for institutions, facilities, and public spaces, the adaptation of residential and public life patterns can base on local culture, industrial redundancy, and interactions with green spaces. As proposed, all nodes under the decentralised pattern have the potential to form a diverse regional community, and this diversity promotes regional identification.

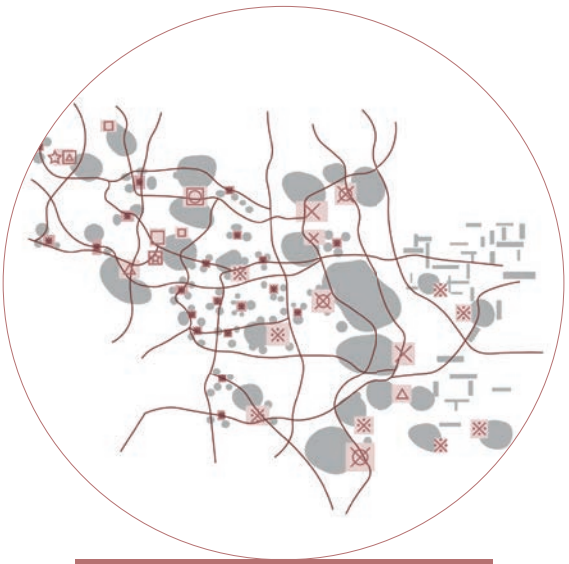




Collaboration of Industry and agriculture to increase the degree of self-sufficiency



Circular cascading of nutrients & energy in agricultural & auqacultural & industrial landscapes

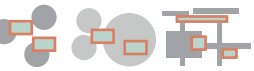


A DIVERSE, DECENTRALISED STRUCTURE WITH SHARED GREEN & BLUE NETWORK

and share of green & lue network

ncement of the & blue network

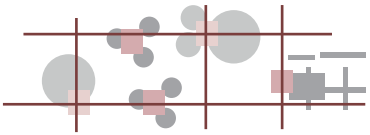
restoration of main rivers, ditches



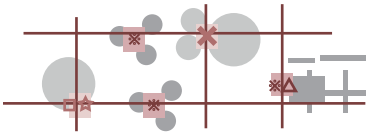
nprovement of Desakota public space & public institutions & facilities

Identification of local settlement culture and nature through site-specific renewal strategy

Symbiotic industrial network of eco-industrial parks



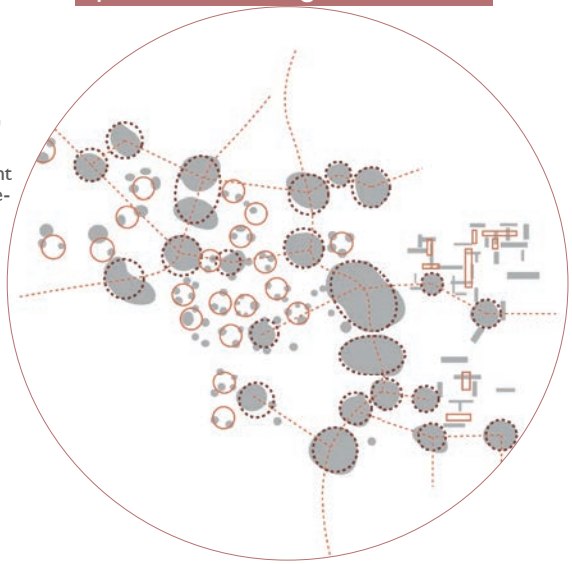
Decentral and synergic recycling hubs



Promotion of competence field of industry and industry symbiosis based on the circular & bio-based transformation of waste, water, energy and raw material network

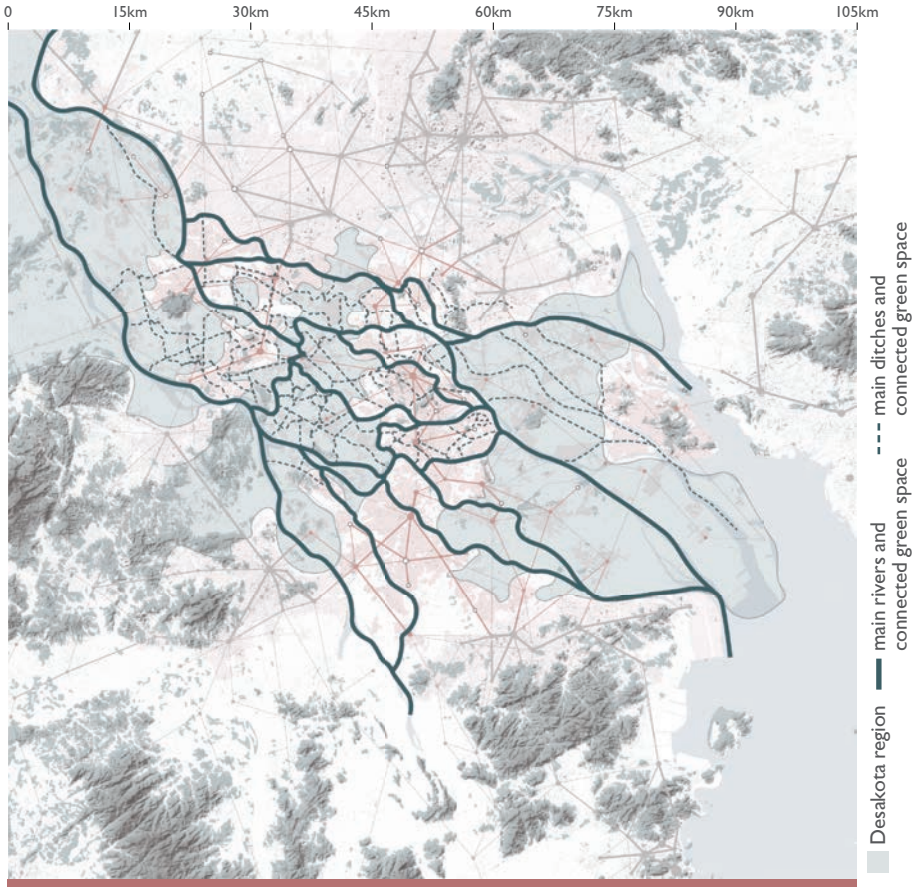
Diversification of planning tools and empowerment of local governments (township) and village collectives

Identification and just metropolitan publicness of living environment



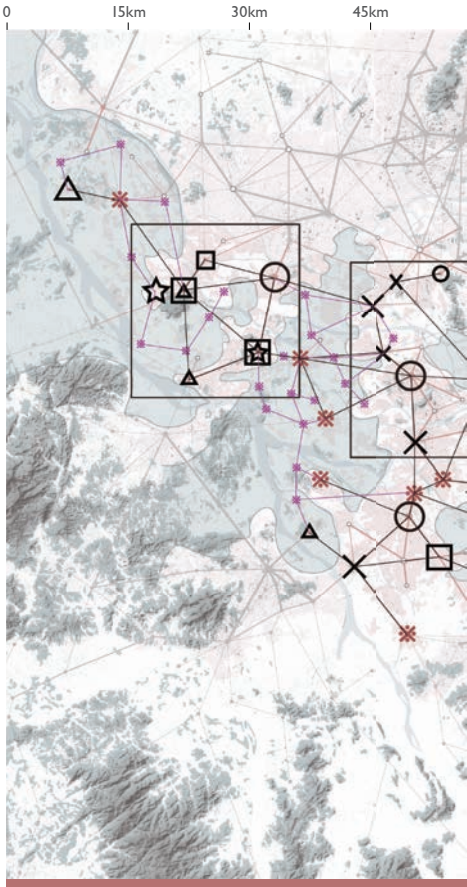
[Fig.6.1] Three design principles and interrelated goals

6.2 Proposals of Network Structure



Principle 01: Ensure the continuity and share of green & blue network

Goal: Improve ecosystem service of the current landscape system, including restoring water pollution, reinforcing biodiversity, protecting from flooding and other climate change risks, preserving cultivatable land, and providing the cultural landscape for the public.



Principle 02: Develop symbiotic indus parks

Goal: Ensure the sustainable developm more independent industrial developn local competence, decreasing negative increasing the circularity of resources.

strial network of eco-industrial

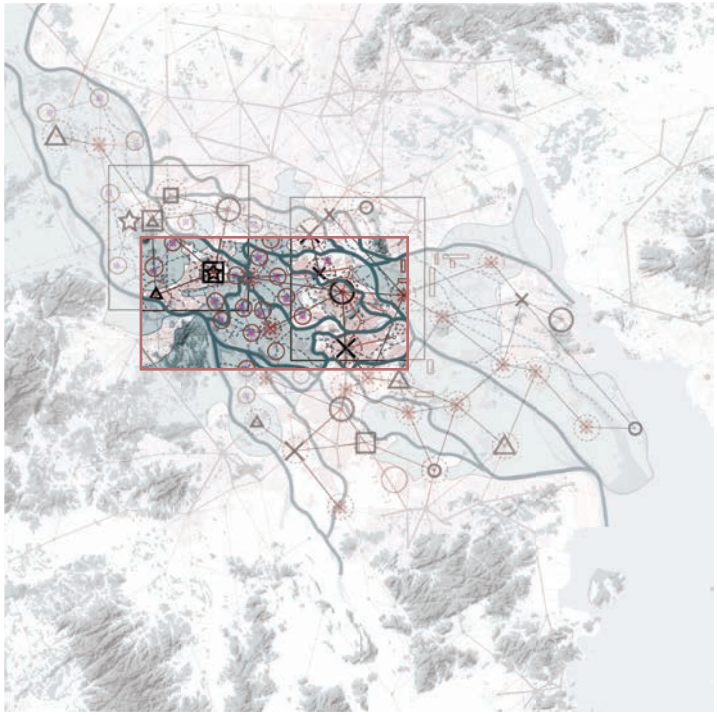
Principle 03: Facilitate identification and just metropolitan publicness of living environment

nent of society and ecology, including
ment opportunities, leveraging
e impacts on the environment, and

Goal: Encourage diversity and undertake comprehensive tasks for institutions & facilities serving the wider public interest in a decentralised settlement network, each node with different settlement culture, competence field, nature, and mutually complementary public service.

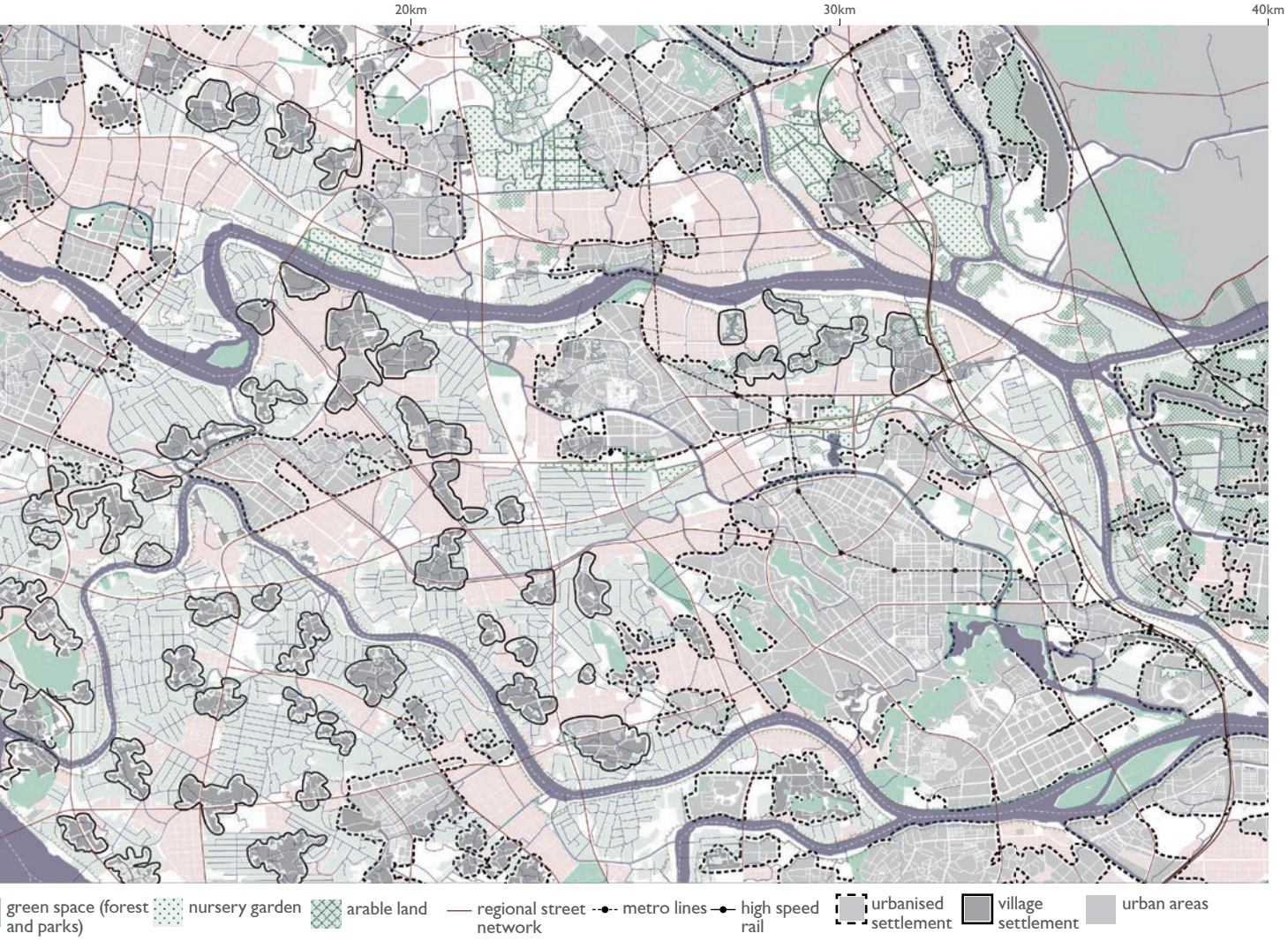
6.3 Structure Plan: Current Situation

Figure 6.2 shows that the three design principles of network structure will be demonstrated within the selected scale. This scope includes two development corridors and the Desakota 02 area between them, where the symbiotic industrial network is proposed. The current area (as depicted in Figure 6.3) comprises elements from three layers: dispersed industrial parks and regional infrastructure; fish ponds, arable land, nursery gardens, green spaces forests and water networks; and urban residential areas in town nodes as well as dispersed concentrated villages. The following pages will show the transformation of these elements to form the proposed industrial, living environment, and landscape systems, guided by the decentralised network structure.



[Fig.6.2] The showcased area of decentralised development structure

[Fig.6.3] Current situation of the showcased area, includi



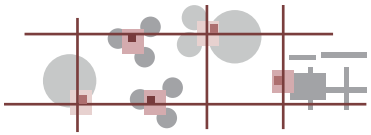
ng industrial/landscape/residential layers

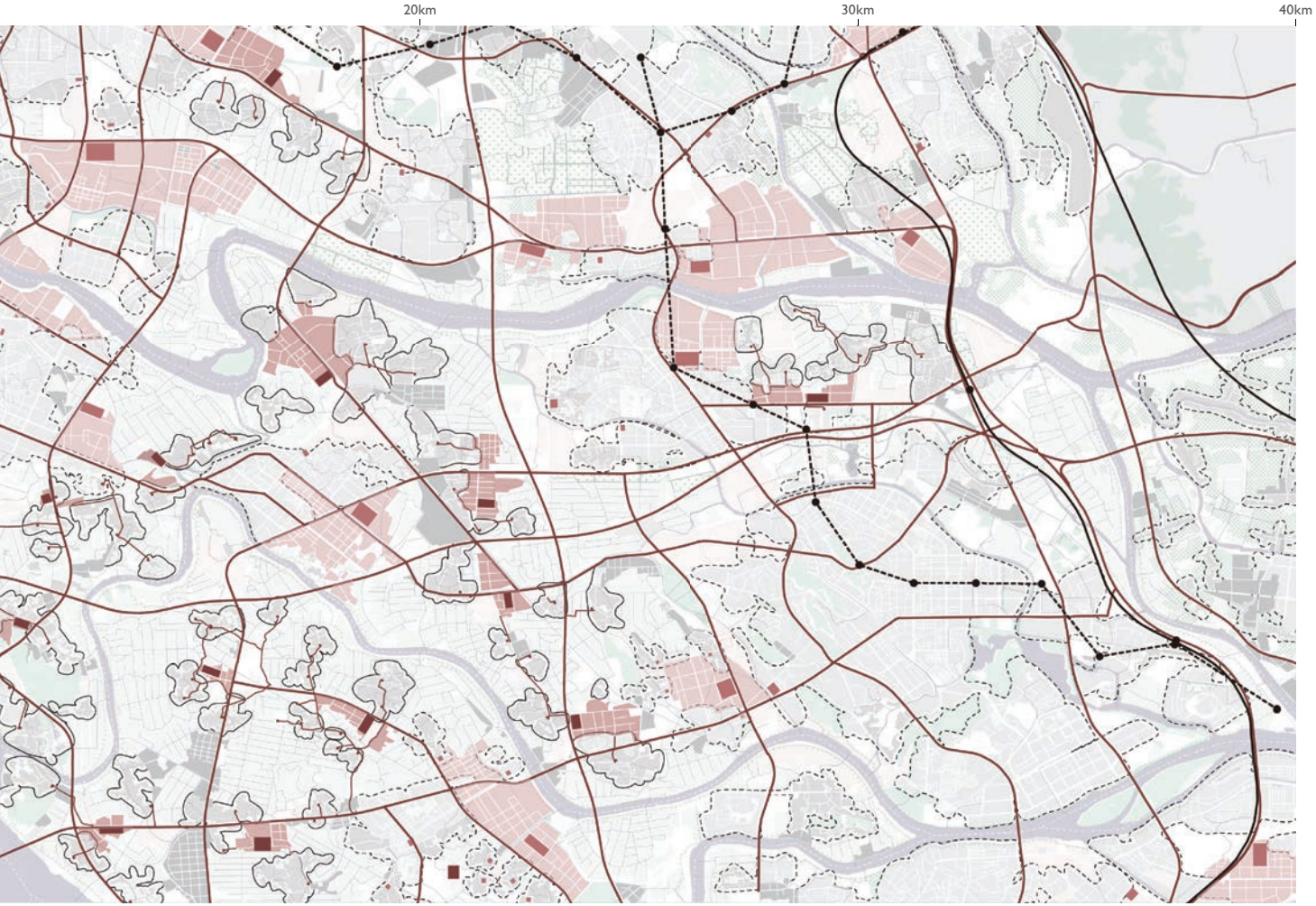
6.4 Structure Plan: Proposed Industrial System

Dispersed industrial parks at the regional scale will be evaluated to determine their suitability to be transformed into eco-industrial parks. In the town nodes along the corridor, centralised large-scale industrial areas are chosen to facilitate clustering of other factories from the same node, thereby enhancing the efficiency of industrial symbiosis. These industrial areas will develop their specialised industrial chains. The strategy in the thesis focuses on the circularity of basic materials, energy, and biomass transformation rather than proposing specific industries. The selection criteria for industrial areas are primarily based on (1) their existing industrial capabilities, facilities, and logistics; and (2) government policies that involve demolishing or transforming most small-scale industrial parks. In this context, such areas will be considered spaces for improving the socio-ecological environment rather than for further industrial intensification.

In the Desakota area, industrial areas connecting with several villages will be selected as decentral recycling nodes. These core industrial areas can establish circular networks with multiple villages, preventing ecological impacts caused by excessive dispersion of industrial activities. Moreover, industrial nodes within Desakota are better positioned to establish cooperation with local fish farming and agriculture, making them suitable for developing bio-based industries. On the one hand, they can provide raw materials for bio-based transformation in town nodes; on the other, they can increase self-sufficiency. Under this strategy, the landscapes surrounding the decentral nodes will also change, but the biomass production scheme needs to be zoomed in and analysed locally.

[Fig.6.4] Proposed eco-industrial parks and their spatial c





rest
nursery garden
arable land
regional street network
high speed rail
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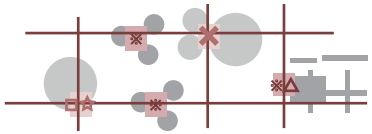
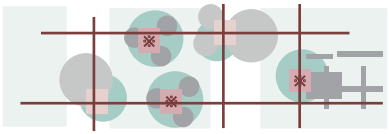
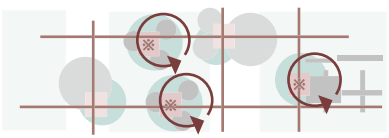
urbanised settlement
urban areas
other industrial parks
eco-industrial parks and recycling hub (township-running)
eco-industrial parks and recycling hub (village-running)
communications



Promotion of competence field of industry and industry symbiosis based on the circular & bio-based transformation of waste, water, energy and raw material network



Collaboration of Industry and agriculture to increase the degree of self-sufficiency



Circular cascading of nutrients & energy in agricultural & auqacultural & industrial landscapes

6.5 Structure Plan: Proposed Living Environment

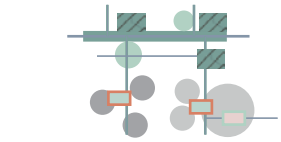
Settlement development prioritises utilising industrial redundant spaces rather than expanding into ecological spaces. Under the premise of compactness in industrial nodes, there are two transformation strategies for other industrial redundancy within the nodes:

1)Reserved space for future development: Some spaces can be set aside as potential areas for future industrial expansion, allowing for flexibility and adaptability to changing needs.

2)Transformation into parks and public facilities to enhance the quality of life: The specific plans and design guidelines should be based on the local quality and residential culture.

For the redundancy in the Desakota region, their priority is to be transformed into shared public facilities, such as schools, providing residents with access to these services within walking distance. From a planning perspective, the development of each settlement node should be more self-organised. Therefore, local decision-making entities, such as township governments or village collectives, should be empowered to the involvement in planning.

[Fig.6.5] Proposed nodal settlement with the respective i



Reuse of industrial redundancy for landscape regeneration and publicness

Improvement o space & publi fac

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arable land
regional street network
high speed rail
metro lines
village settlement
urbanised settlement
urban areas
other industrial parks
eco-industrial parks and recycling hub (township-running)
eco-industrial parks and recycling hub (village-running)

ndustrial repurposed areas

f Desakota public
c institutions &
ilities

Identification of local settlement culture and nature through site-specific renewal strategy

Diversification of planning tools and empowerment of local governments (township) and village collectives

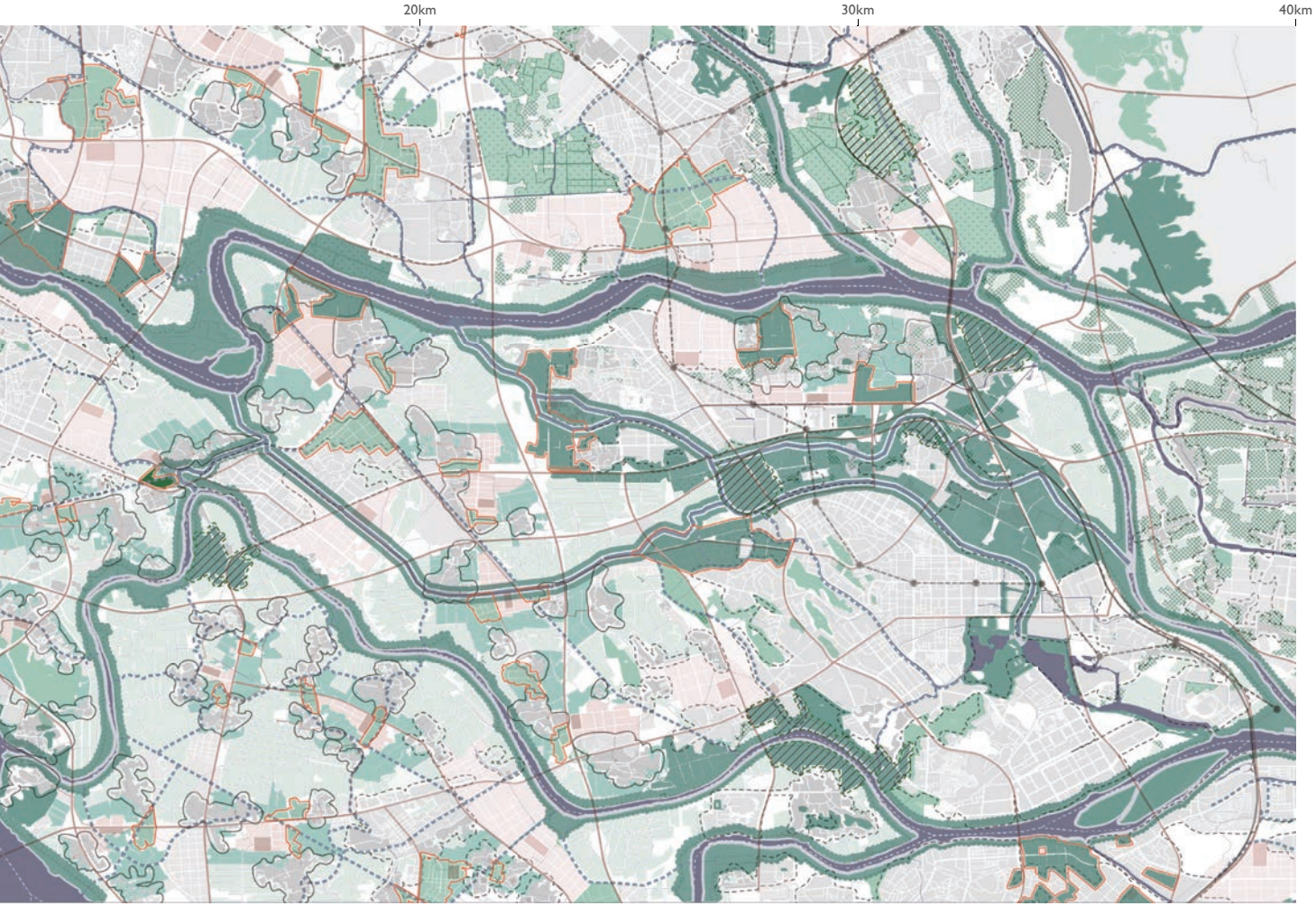
6.6 Structure Plan: Proposed Landscape System

The enhancement of the green & blue network relies on the natural restoration and connectivity of the water network. The map shows that the main rivers in the water network serve as the backbone that strengthens the continuity. This network provides shared natural spaces for dispersed nodes and connects the ecological areas of the three Desakota regions. Therefore, industrial spaces located on connective green spaces causing landscape fragmentation are transformed into landscape parks or restored green areas.

In addition to the main rivers, the ditches within the dikes collect water flows from agricultural, industrial, and residential areas, connecting with the main rivers. These ditches are also integral to the green & blue network, requiring natural restoration. Apart from transitioning towards biomass production, the agriculture landscapes should address the eutrophication pollution in fish farming, ensuring that the waters flowing into the ditches do not compromise the ecological value.

Furthermore, the proposed landscape system exhibits a more decentralised and diverse landscape due to the changes in these production landscapes.

[Fig.6.6] Proposed green and blue network combined wit



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nursery garden
arable land
regional street network
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village settlement
urban areas
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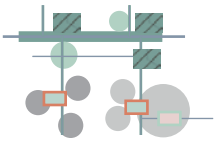
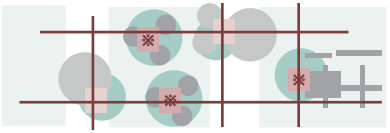
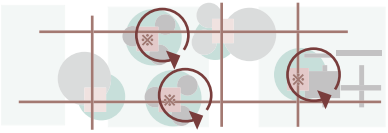


Reuse of industrial redundancy for landscape regeneration and publicness

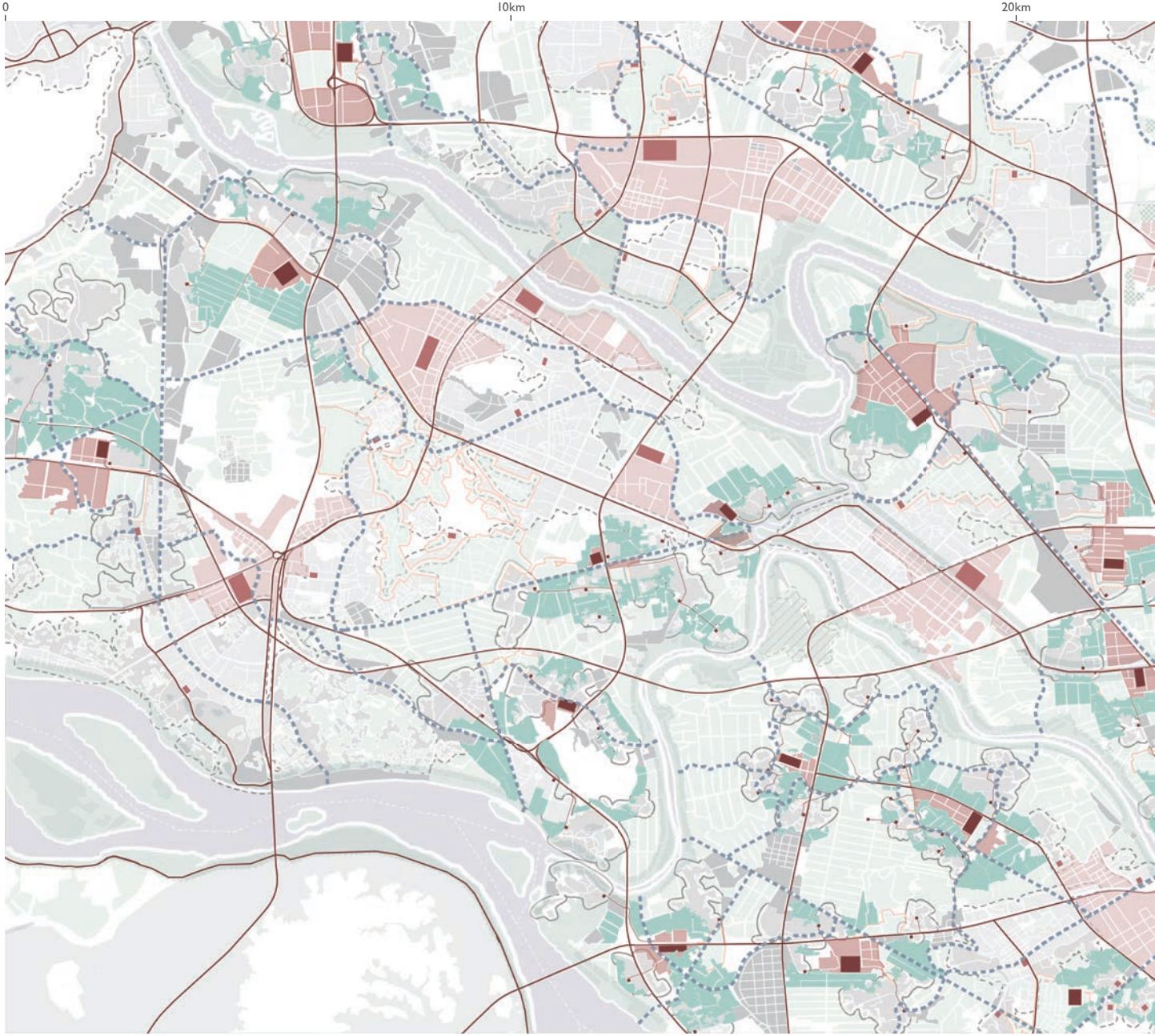


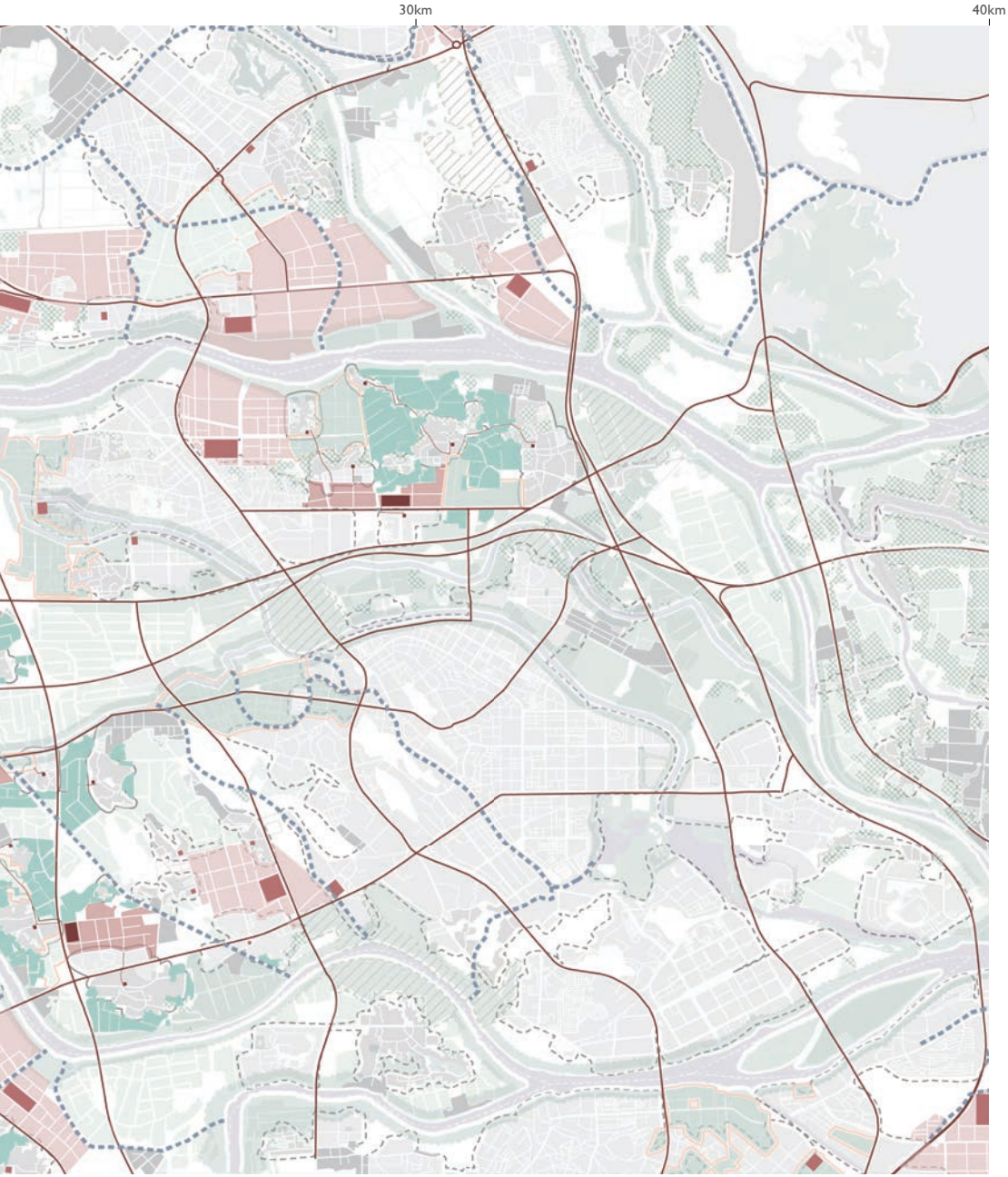
Collaboration of Industry and agriculture to increase the degree of self-sufficiency



Circular cascading of nutrients & energy in agricultural & auqacultural & industrial landscapes

6.7 Proposed Structure Plan





[Fig.6.7] Proposed structure plan

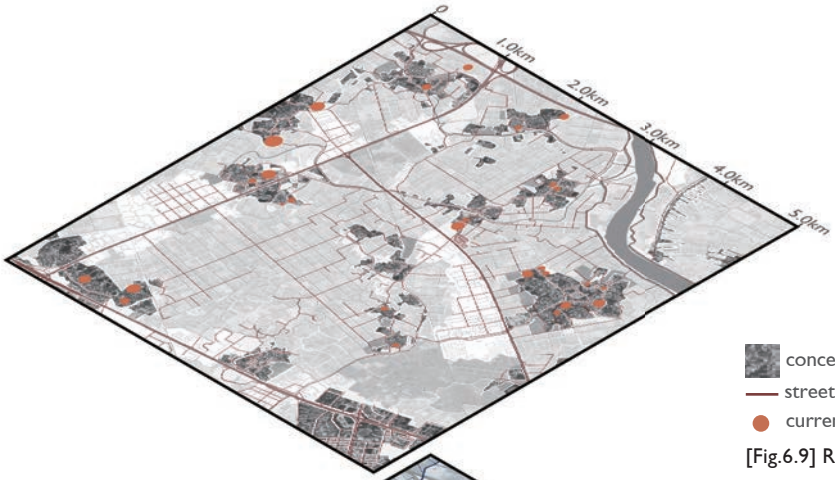
6.8 Design Project: Introduction and Goals

The design project is selected within the decentralised network in Desakota to illustrate the process from the regional-scale structure plan to local-scale design guidelines. The existing spatial elements included in this location are depicted in Figure 6. 9 & 6.10 & 6.11.

Following the structure plan, the predetermined principles for this project are as follows:
1)Select an industrial park that is adjacent to multiple residential nodes and transform it into an eco-industrial park as a recycling hub. Establish resource circular flows between the hub, villages, fish farming, and arable land.
2)Choose appropriate industrial spaces to enhance the quality of life; Set up sufficient public institutions; Preserve the location's distinctive characteristics
3)Restore the ecology of rivers and main ditches, address fish pond pollution, and select suitable spaces for biomass cultivation. Ultimately, these landscapes will contribute to enhancing a continuous green-blue network.
4)Ensure the operation of circularity by empowering local stakeholders to participate in the design and management processes.

The next phase of the research will focus on how this location's spatial quality supports achieving these objectives.

[Fig.6.8] Location of the design project

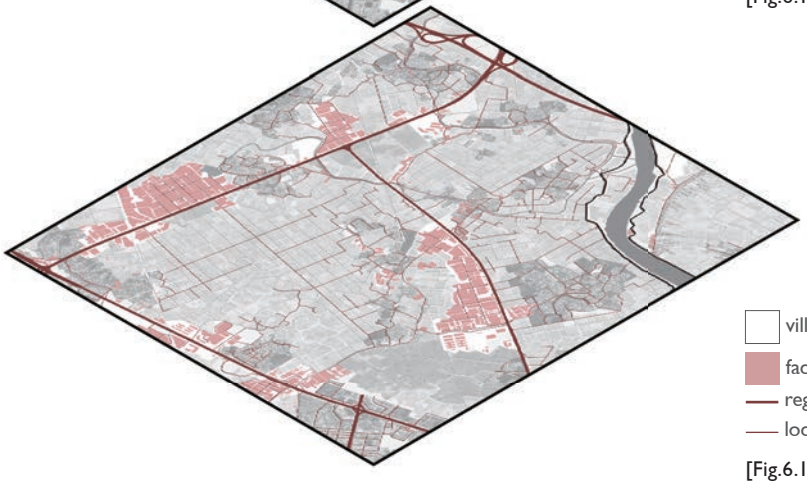


concentrated villages
street network
current public institutions

[Fig.6.9] Residential elements

rivers and ditches
fish ponds
vegetable gardens
abandoned fish ponds

[Fig.6.10] Landscape elements



village industrial park
factories
regional street network
local street network

[Fig.6.11] Industrial elements

6.9 Design Project: Spatial Exploration

ELEMENTS OF OPEN SPACE LAYER

The landscape elements in this location mainly include 1)rivers with dikes, 2)main ditches, and 3) dike-pond systems with 10-12 ponds as a water discharge unit. The water from the ponds is discharged into the ditches through underground pipelines(Sun et al., 2019). Due to the high-density fish farming, each pond requires the installation of aerators to prevent eutrophication. 4)At the edge of the villages, vacant spaces along the fish pond or Feng Shui ponds are used as vegetable gardens.

[Fig.6.12] Hardened dike of the rivers

[Fig.6.13] Dike- fish pond system

[Fig.6.14] Axis view display of landscape elements

[Fig.6.15] Ditches between fish ponds

[Fig.6.16] Vegetable garden along the fish ponds

[Fig.6.17] Vegetable garden in the village

ELEMENTS OF RESIDENCE LAYER

The villagers have autonomy over their own buildings, resulting in dense communities without a unified architectural style. Typically, narrow streets lead to the entrances of each house, which serve as the daily public spaces. Cultural buildings (such as ancestral halls) and vegetable gardens are also used as public spaces. The only relatively large sports ground and square are combined with parking lots and located on the outskirts of the villages.

[Fig.6.18] Residential building

[Fig.6.19] Corner space for outdoor activities

[Fig.6.20] Axis view display of residential elements

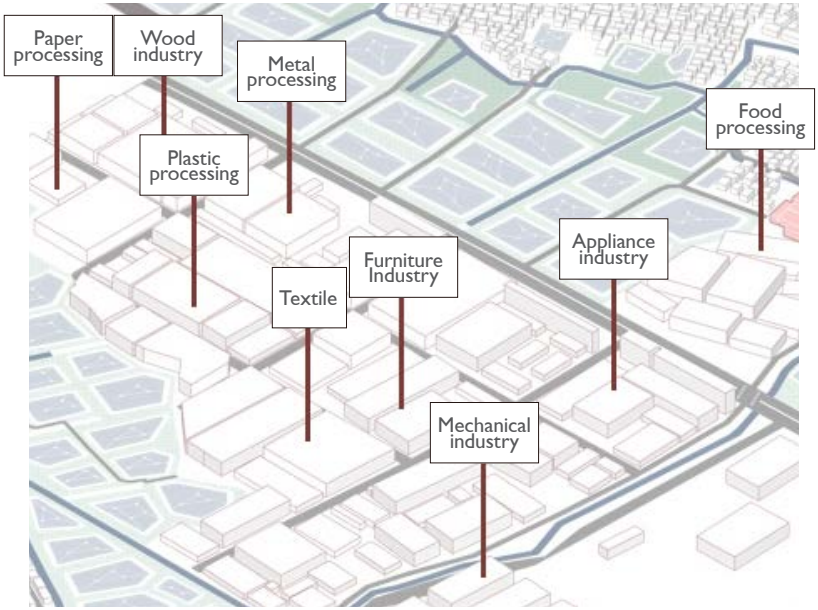
[Fig.6.21] Cultural building used as leisure place

[Fig.6.22] Vegetable garden around Fengshui pond

[Fig.6.23] Sports ground and square

ELEMENTS OF INDUSTRY LAYER

The local industrial products are diverse but primarily low-end, and they may cause chemical and metal pollution to the water. Some industrial activities are scattered within the villages. These industrial areas are connected to the regional transportation network through motorised streets.



[Fig.6.24] Axis view display of the industrial park

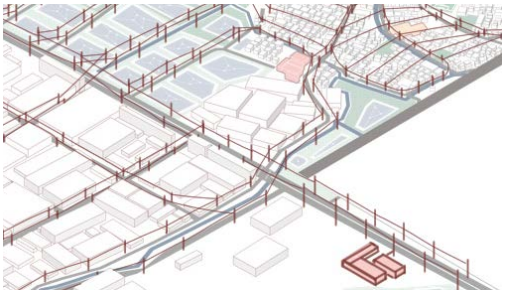
[Fig.6.25] Street in the industrial park

[Fig.6.26] Village factories and motorised street

[Fig.6.27] Regional street

Household waste is collected at centralised points in the villages, then transported to the transfer stations in the town nodes, and finally sent to the city's outskirts for centralised sorting and landfilling (Gao et al., 2012).

[Fig.6.28] Axis view display of the household waste transporttation



[Fig.6.29] Power supply network and substation

Regarding the local energy network, the main energy consumption is electricity that is supplied by the centralised (coal/hydropower/nuclear) power station. Only a few industries require heating, which is provided by boilers installed in the factories. The cable network has already formed decentralised because each pond requires electricity to support the aerators. Generally, the industrial, agricultural and residential power grid is a common network with decentralised substations.

[Fig.6.30] Cable setting in the factories

[Fig.6.31] Cable setting in the fish pond

[Fig.6.32] Cable setting in the village

[Fig.6.33] Sewer and water pipes

Industrial and village wastewater is transported through underground pipelines to the town nodes for centralised treatment. However, these efforts by the government are recent, so prior to this, direct discharge of industrial and domestic wastewater has caused severe pollution in the ditches. Additionally, the eutrophication of pond water is directly discharged into the ditches, leading to water pollution.

[Fig.6.34] Polluted ditches around the factories

[Fig.6.35] Domestic sewage pipes laid under the street

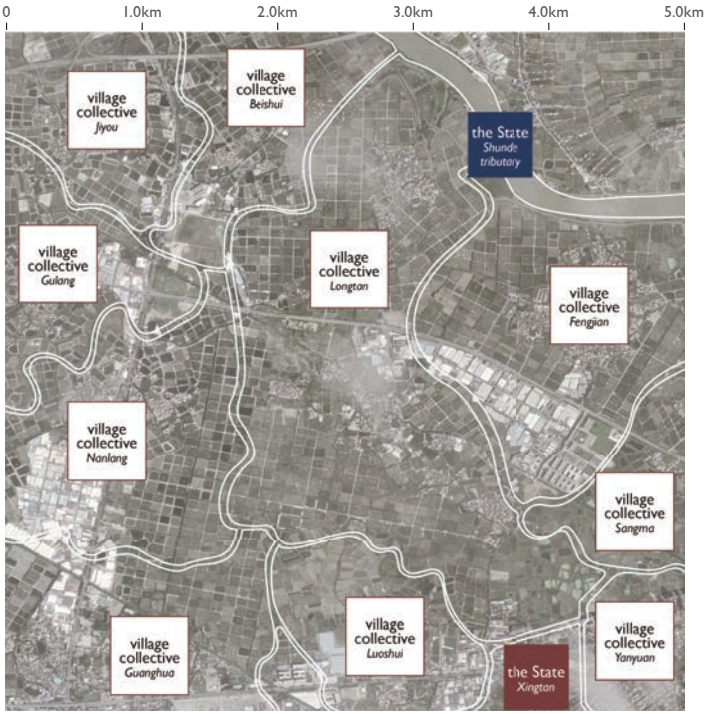
[Fig.6.36] Ditches connected to the fish ponds

6.10 Design Project: Governance Analysis

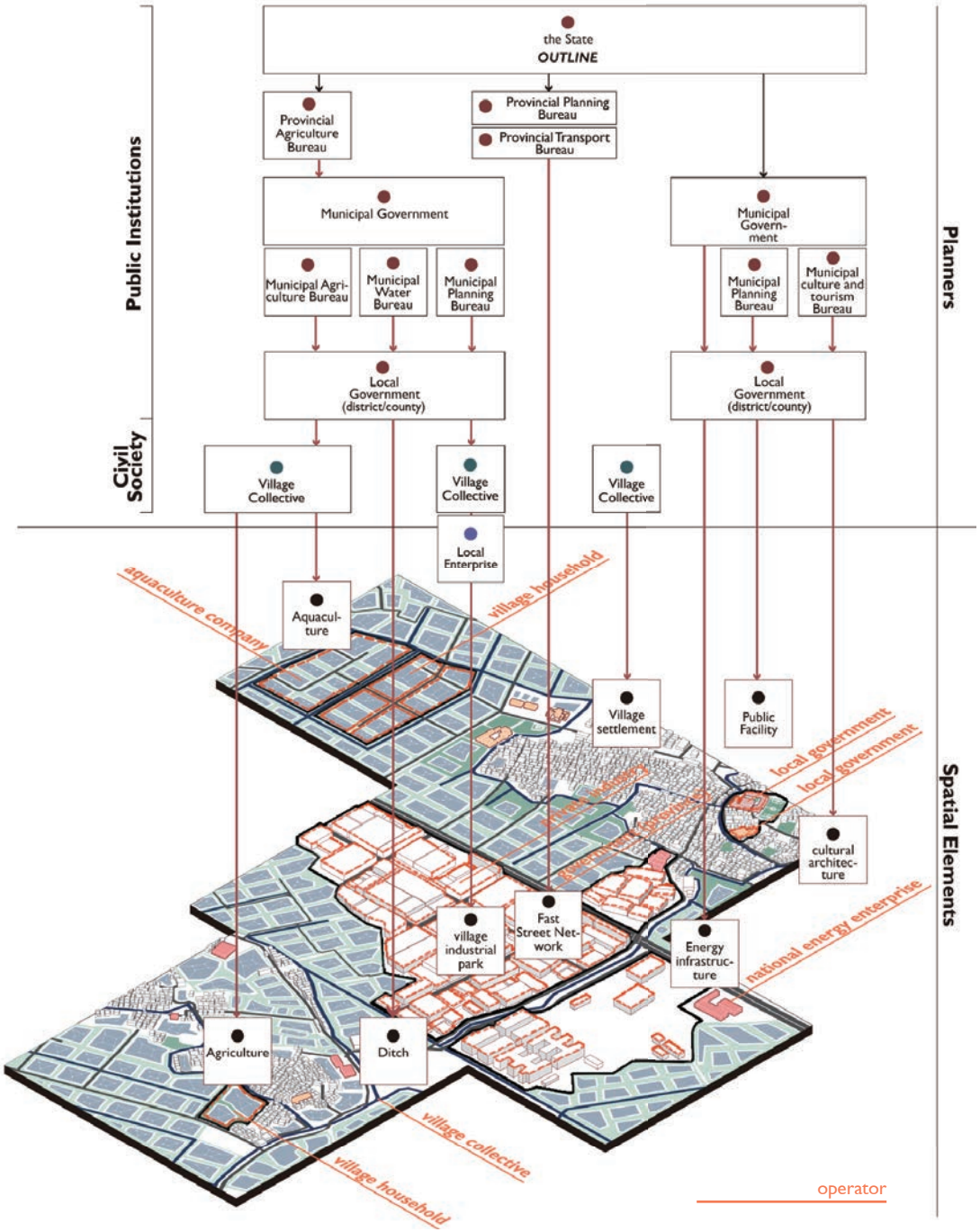
The ownership of rural land belongs to the local village collectives, which means that decisions are made through democratic deliberation by village representatives. As shown in Figure 6.37, an industrial park belongs to 2-3 village collectives, and this spatial configuration may have considerations for convenient operation and shared use of regional infrastructure. This characteristic provides the potential for the collective operation of a recycling hub. Similarly, vegetable gardens, fish ponds, and residential areas belong to collective land.

To establish a circular flow, the operators of different elements also need to be studied (as shown in diagram 38). A fishpond unit is usually operated by 2-3 farmers or an aquaculture company, with each household able to manage 1-2 ponds (Chen et al., 2021). Although the village collective manages the industrial parks, they are only responsible for collecting rent and not for maintenance. Local industries operate their industrial activities independently. In the village, the village collectives operate the rest except for public facilities, such as primary schools and important cultural buildings, which are planned and managed by higher-level governments. Therefore, when conceptualising design strategies, the capabilities of these operators and the responsibilities they should assume will be considered.

In the current planning system, the government can only transform state-owned land. The transformation of rural land mainly relies on 1) purchasing, 2) substantive actions (such as assisting in constructing underground pipelines), and 3) restrictions (land use plans, environmental zoning). Most decision-making power lies with the village collectives, but their planning capacity is insufficient. Therefore, in governance strategies, considerations should be given to how the local government and other groups can provide support.



[Fig.6.37] Land ownership; source: author's own based on the government document



[Fig.6.38] Governance diagram of the site including the actors of operation and planning

6.11 Design Project: Morphological Strategy

To achieve the four goals proposed and considering the local spatial quality, the spatial vision for the location is as follows:

1)Three industrial parks are selected as recycling hubs and converted into bio-based industries. Logistic routes are strengthened between the industrial parks and villages' waste collection points. The industrial parks have already been connected through the existing regional network, allowing for cooperation.

2)Some of the fish pond landscapes surrounding the industrial zones are transformed into artificial wetlands or energy crop cultivation to provide biomass. The vegetable gardens around the villages are adapted into food forests (agroforestry), providing biomass, ecological landscapes, and leisure opportunities.

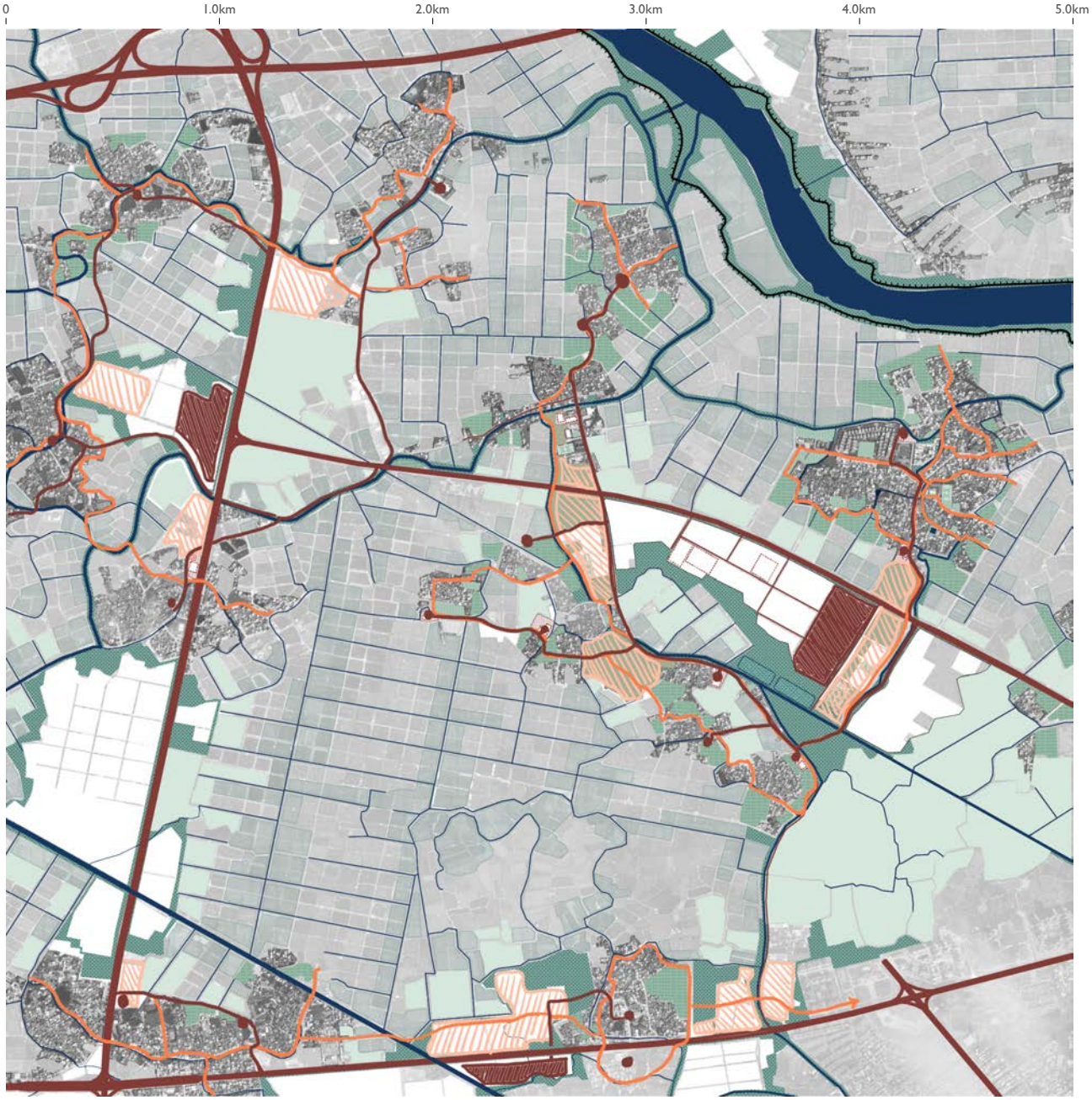
3)Industrial spaces between villages are transformed into public spaces and institutions. Their accessibility to residential areas and village public spaces (including food forests, cultural buildings, and Fengshui ponds) is enhanced through improved pedestrians.

4)Ecological restoration is carried out in the riverbanks and main ditches, forming a network that connects fish ponds, new farming, food forests, and public green spaces.

[Fig.6.39] Proposed industrial network

[Fig.6.40] Proposed public network

[Fig.6.41] Proposed landscape network



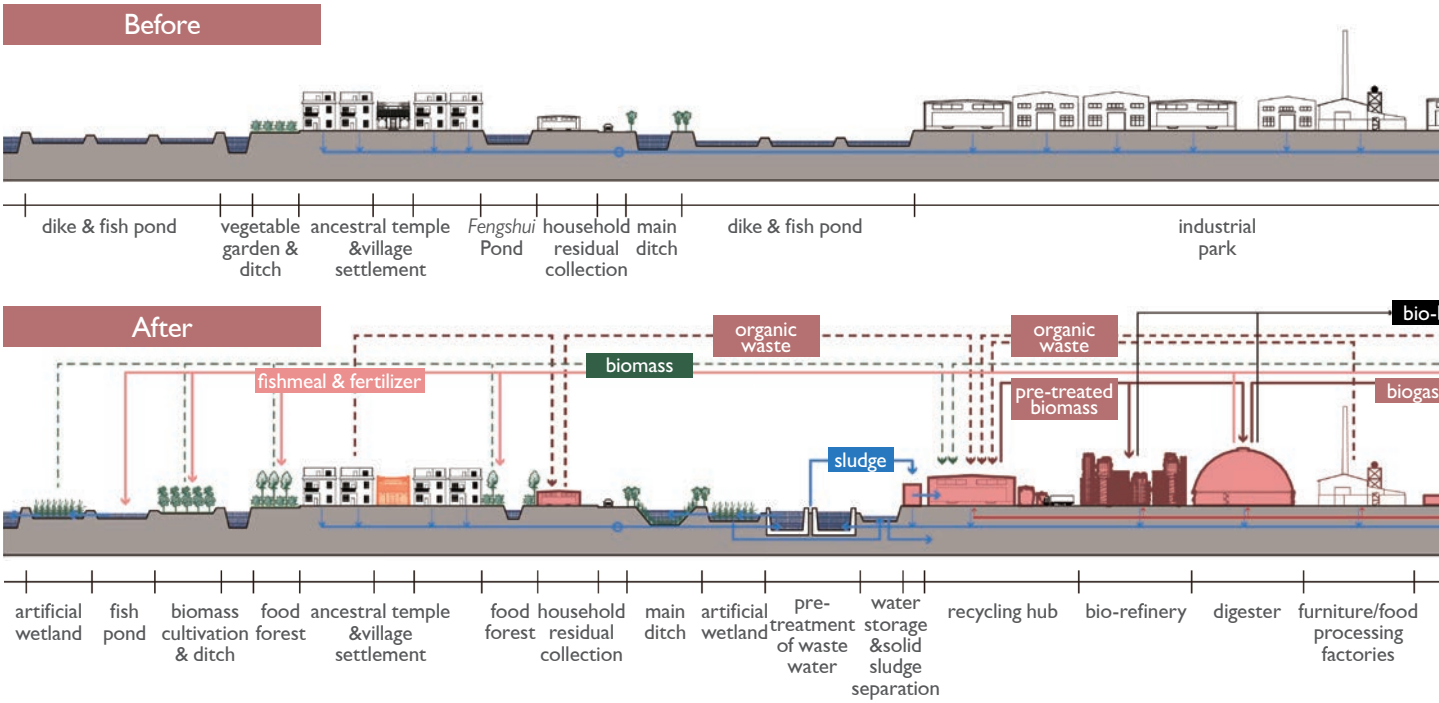
[Fig.6.42] Proposed morphological strategy

6.12 Design Project: Physiological Strategy

The proposed physiological strategy revolves around the operation of recycling and bio-based industries, as shown in section 6.

Biomass is sourced from 1) the cultivation of energy crops, 2) reeds and other vegetation in artificial wetlands that absorb excess
from food forests, 4) organic waste from household trash, 5) organic waste from other industries within the industrial zones (su
and 6) organic waste from industrial and domestic wastewater sludge through solid-liquid separation.
The collected and categorised biomass in the recycling hub undergoes pre-treatment and is then used in biogas digesters or bi
products. Biogas, in collaboration with CHP (Combined Heat and Power) equipment, provides electricity and heating for the a
nodes. The remaining sludge from the biogas digesters is processed into feed or fertiliser and returned to farming. Treated
activities.
The recycling hub is not only used for nutrient cycling but also incorporates other wastes, such as E-waste, which are used in m

The following pages will present the morphological and physiological strategies to showcase the proposed spatial quality.



43.

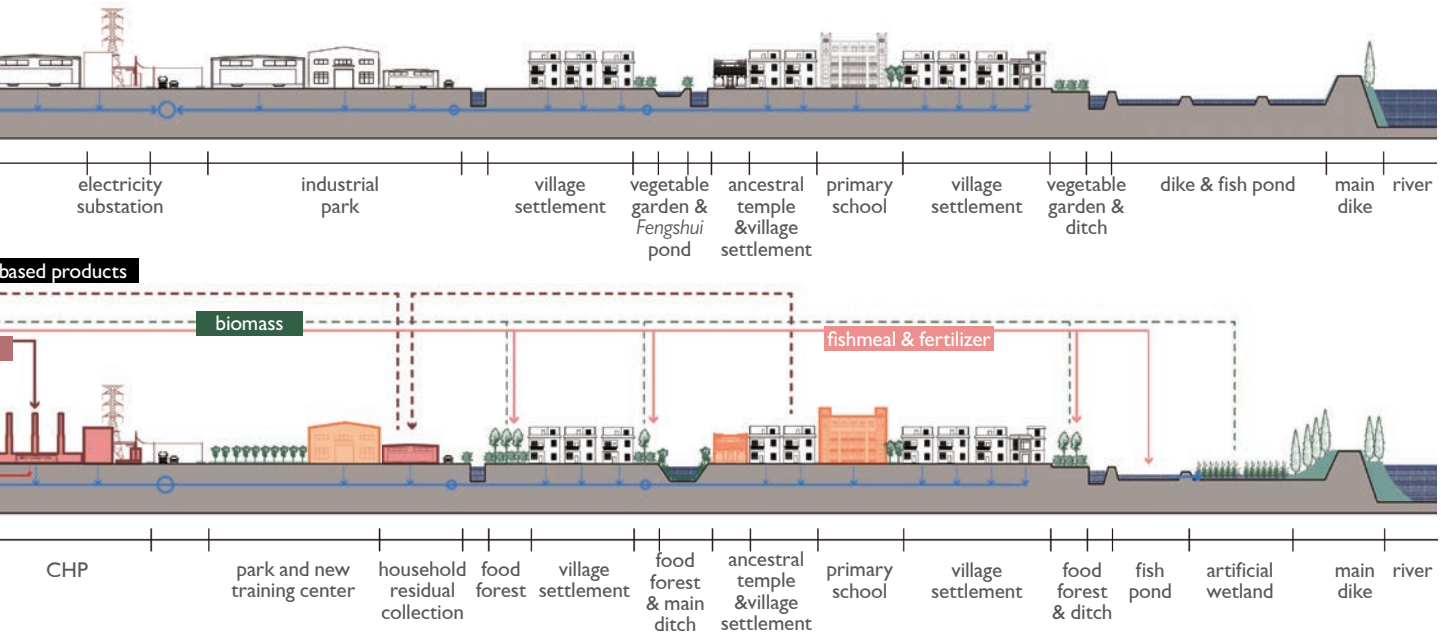
nutrients from fish ponds, 3) wooden biomass
uch as furniture and food processing factories),

io-refineries to produce biogas and bio-based
rea. Bio-based products can be sold to other
wastewater can also be reused for industrial

anufacturing.

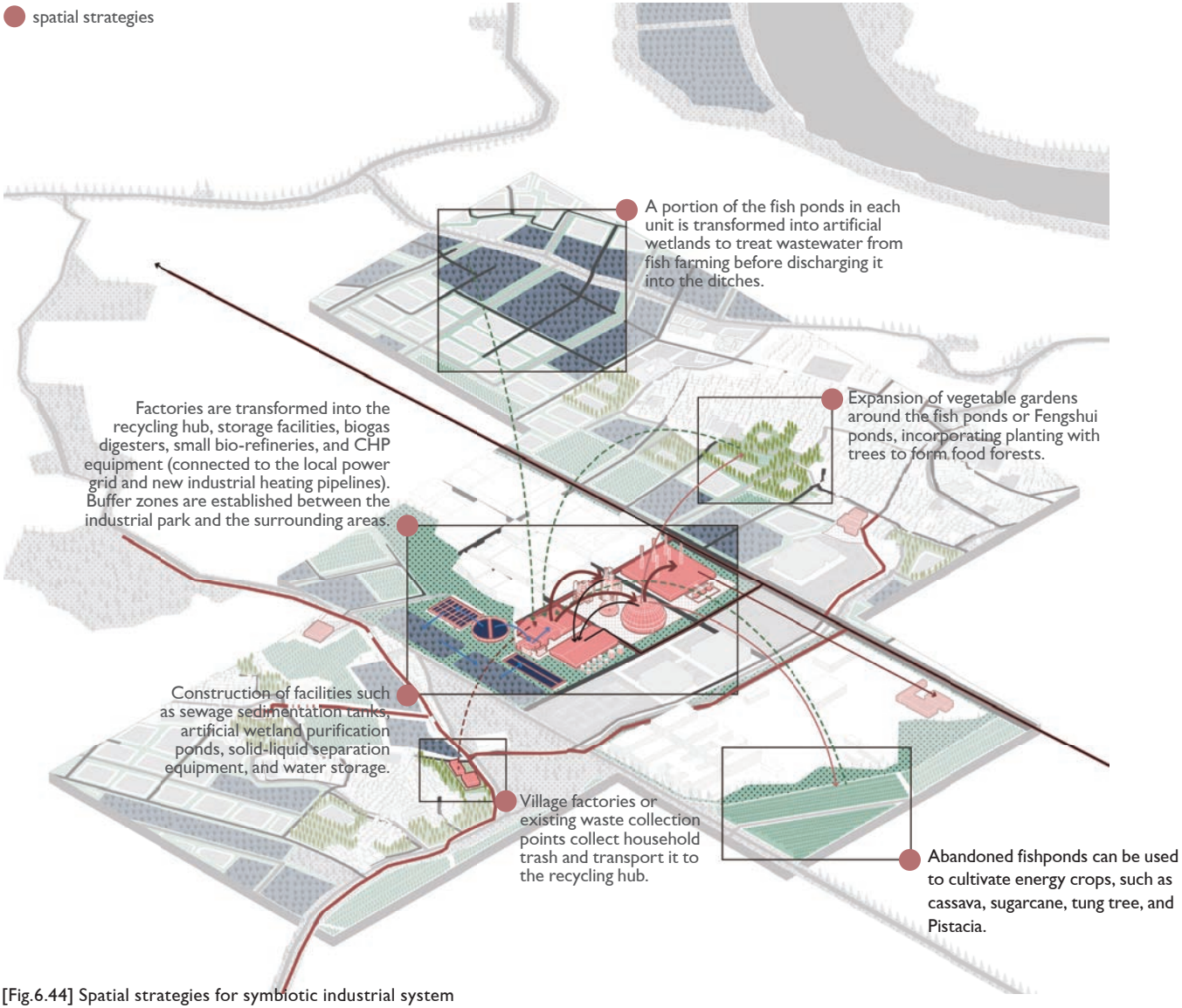
material flow of bio-based industries
flow of nutrients in waters
flow of biogas residue
main flow of biomass
flow of organic waste from household and industries
flow of heating
flow of bio-based products to other areas

[Fig.6.43] Proposed systematic changes

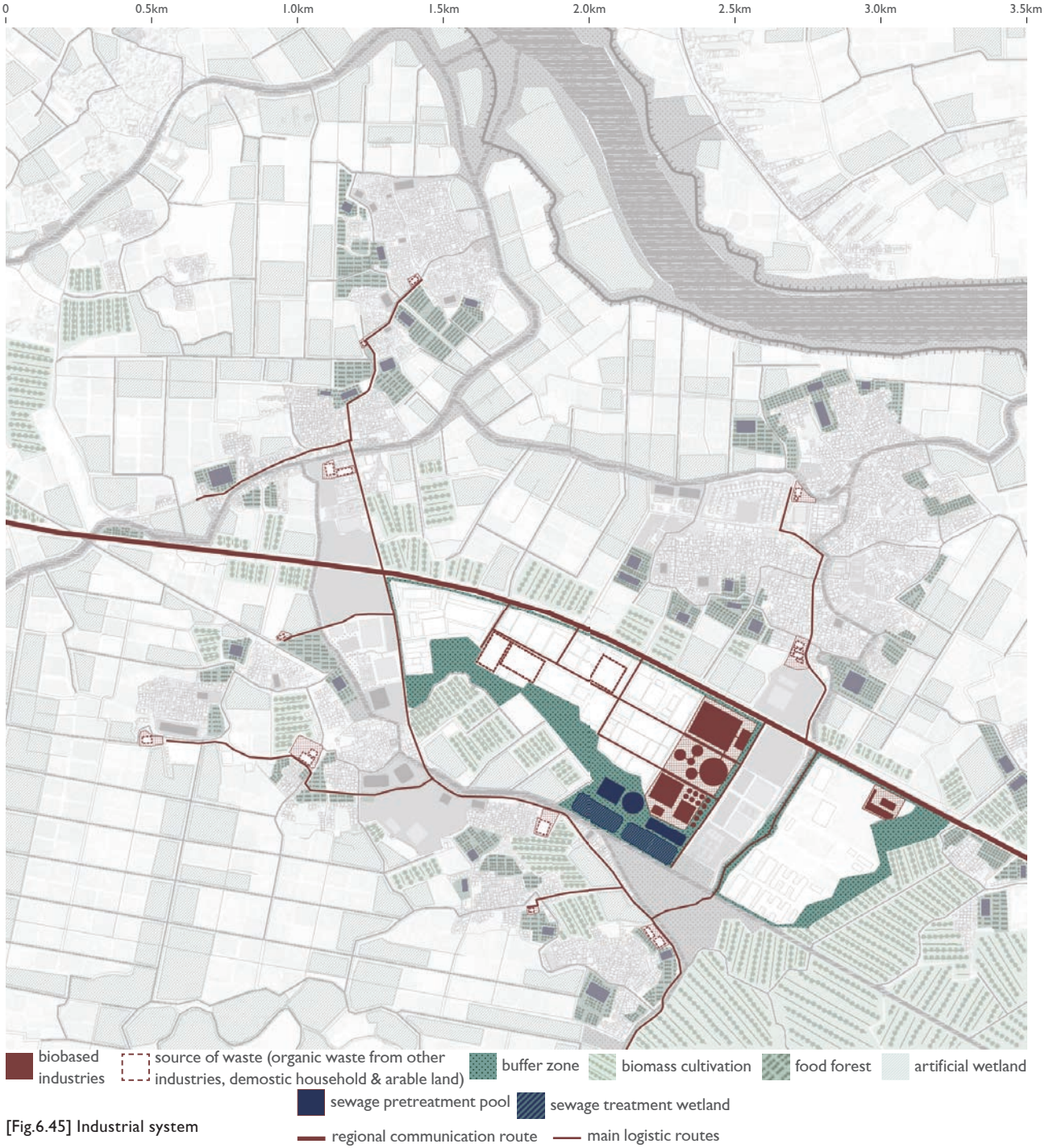


6.13 Design Project: Design Strategies Demonstration

GOAL 01: SYMBICTIC INDUSTRIAL DEVELOPMENT

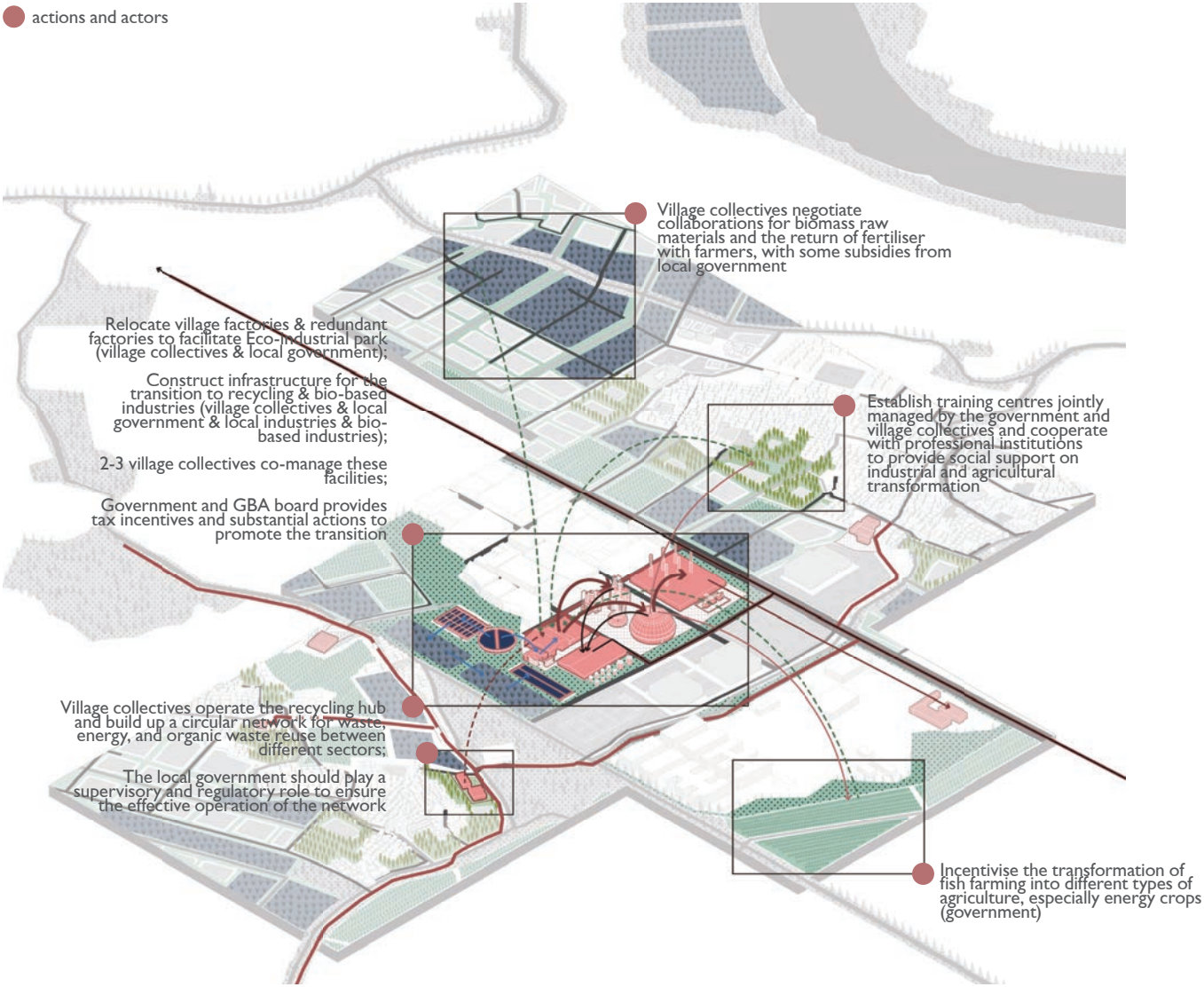


[Fig.6.44] Spatial strategies for symbiotic industrial system



[Fig.6.45] Industrial system

GOAL 01: SYMBICTIC INDUSTRIAL DEVELOPMENT



[Fig.6.46] Actions and governance strategies

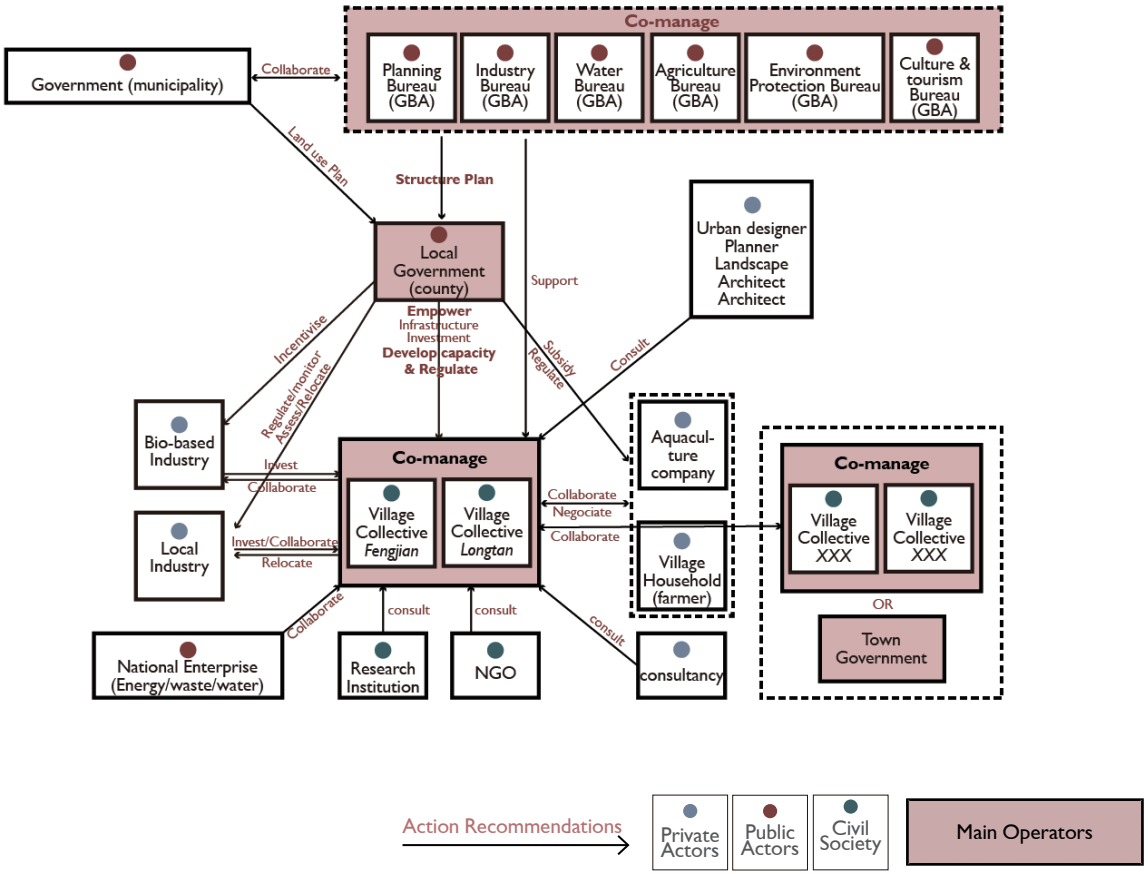
GOVERNANCE STRATEGIES

The specific actions and actors corresponding to each strategy are depicted in the diagram. The core planning strategy to drive these actions includes:

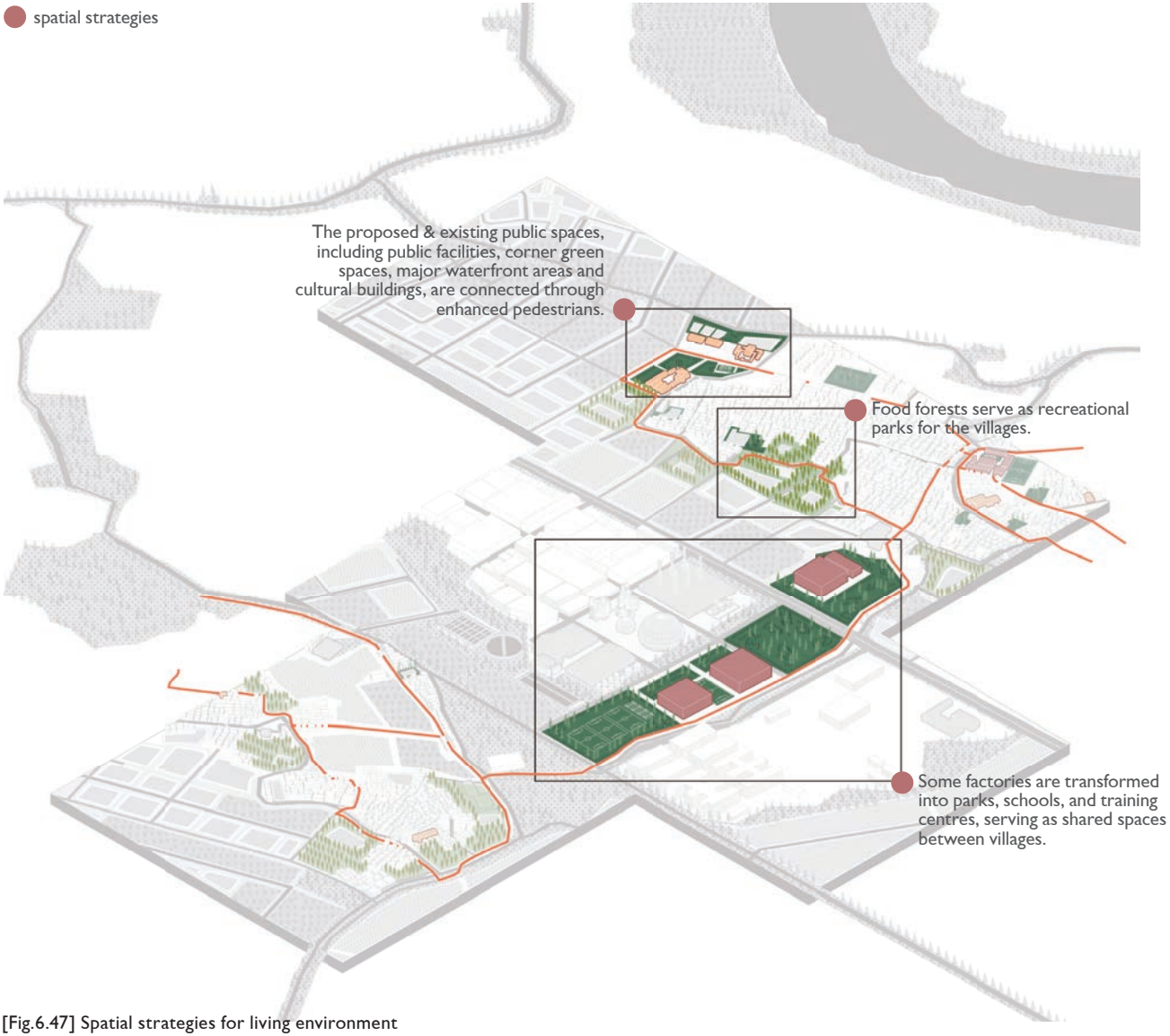
1)Empower village collectives to operate the centralised industrial hub and develop their collective management capabilities.

2)Establish circular networks that should be led by village collectives and negotiated in collaboration with residents (farmers) and industires. The role of the local government is to assist and regulate, primarily focusing on developing the capabilities of village collectives, such as infrastructure investment, network establishment, and providing training support. Incentive measures can also be implemented to promote agricultural and industrial transformation and regulate unsustainable activities.

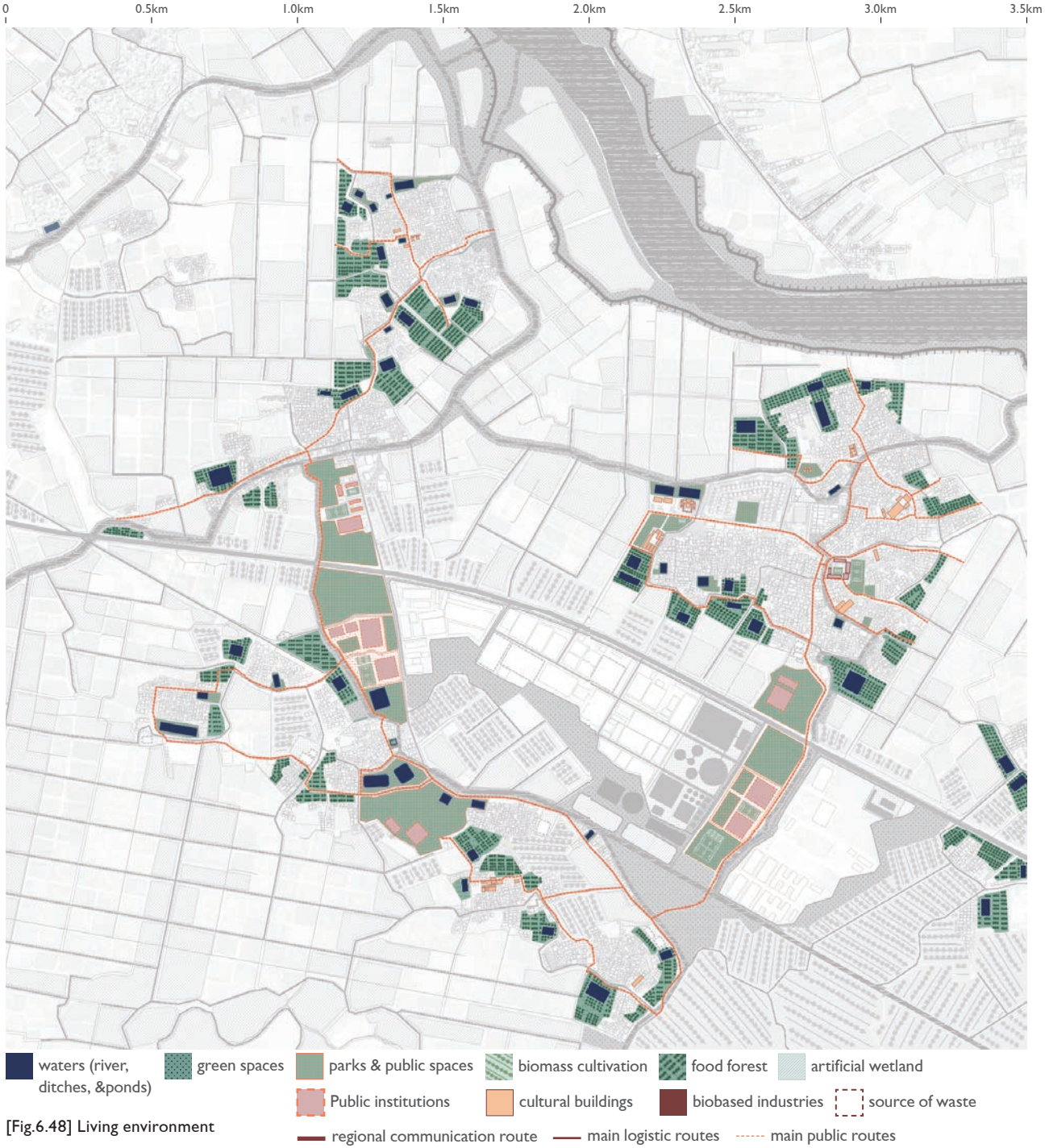
3)Localised morphological, physiological, and governance strategic planning is incorporated into the procedures of regional spatial framework.



GOAL 02: IMPROVEMENT OF PUBLIC FACILITIES AND PUBLIC SPACES

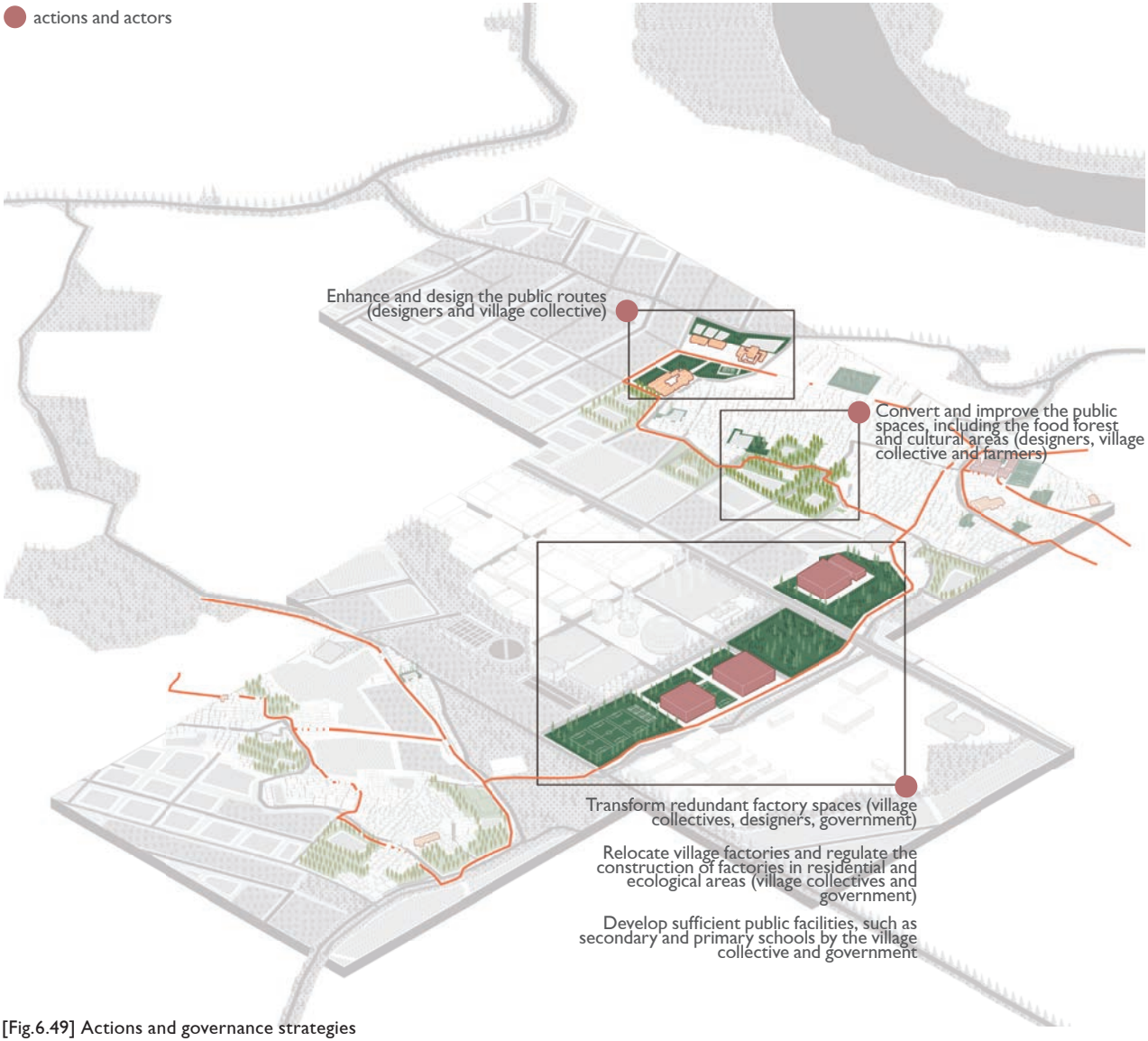


[Fig.6.47] Spatial strategies for living environment



[Fig.6.48] Living environment

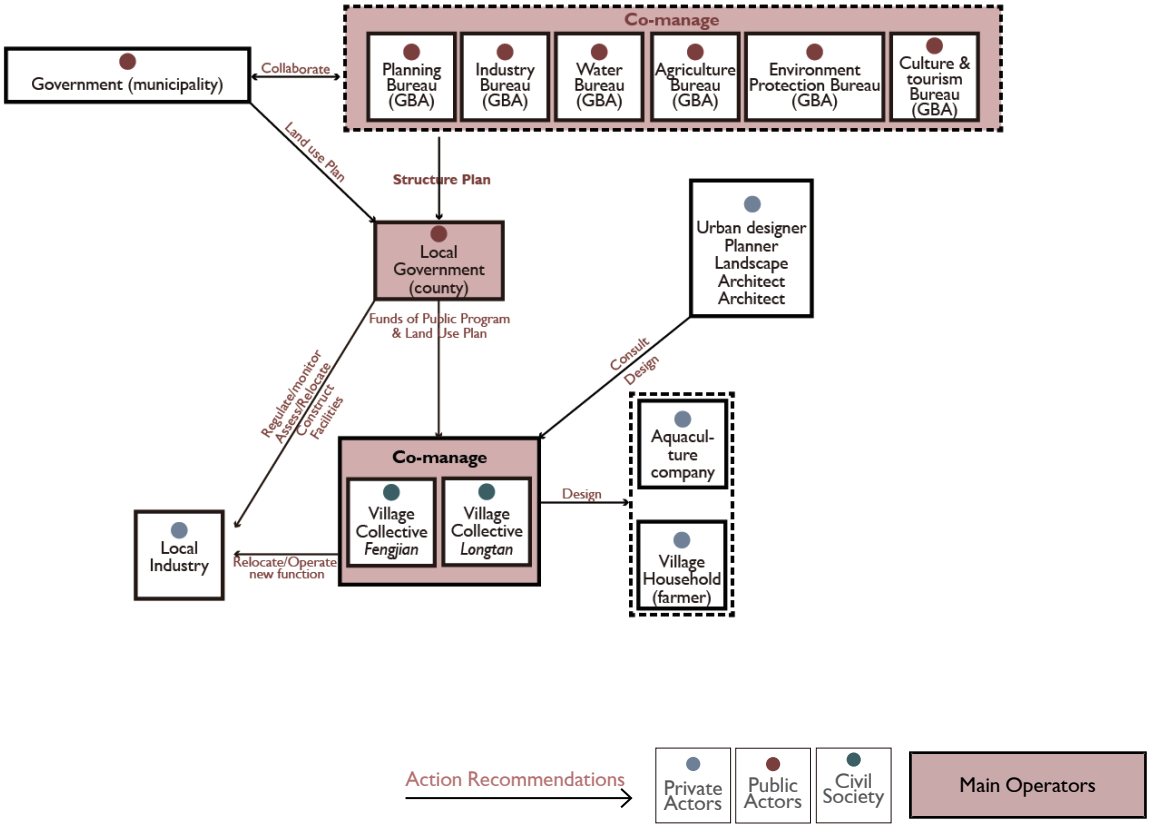
GOAL 02: IMPROVEMENT OF PUBLIC FACILITIES AND PUBLIC SPACES



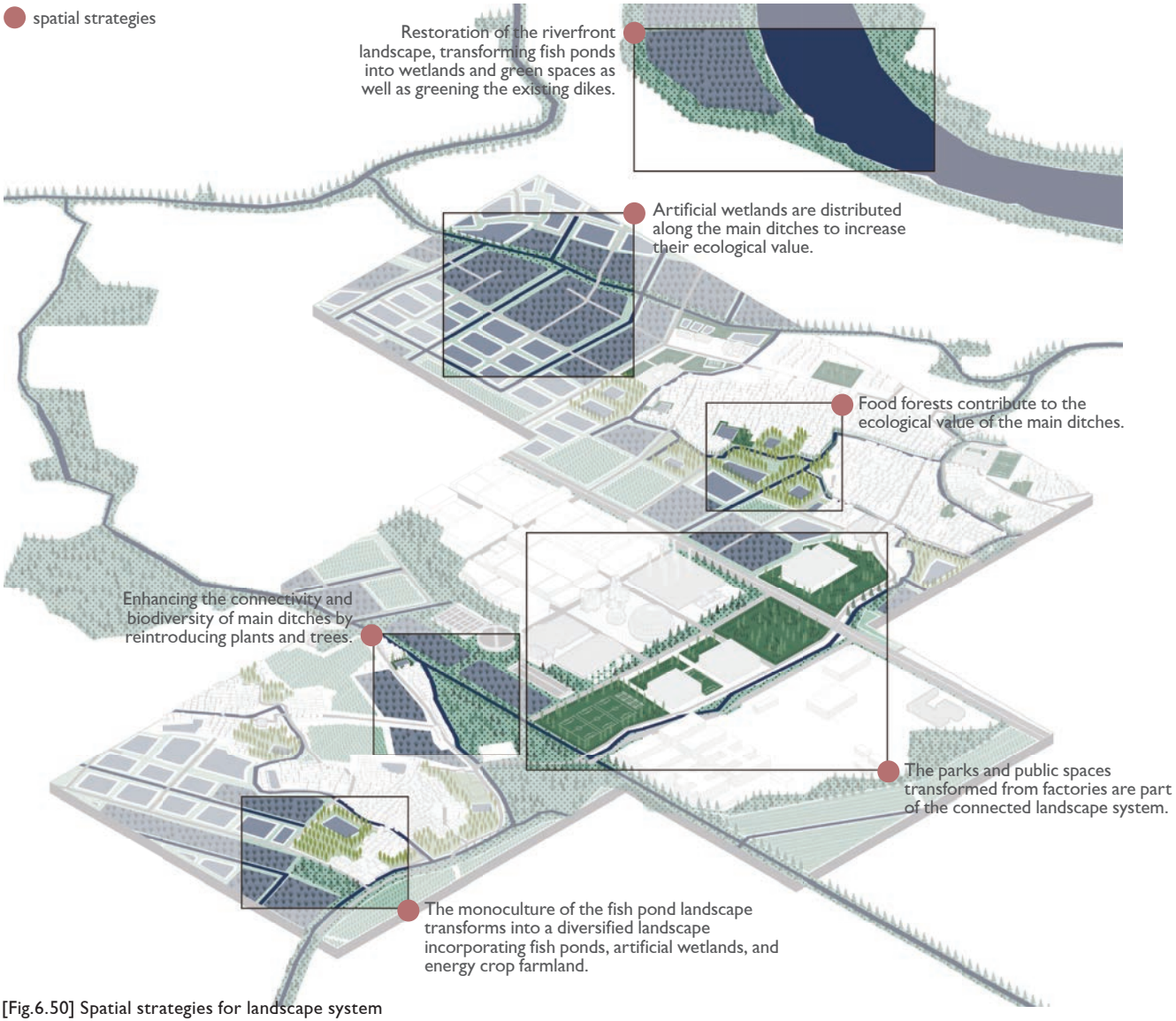
[Fig.6.49] Actions and governance strategies

GOVERNANCE STRATEGIES

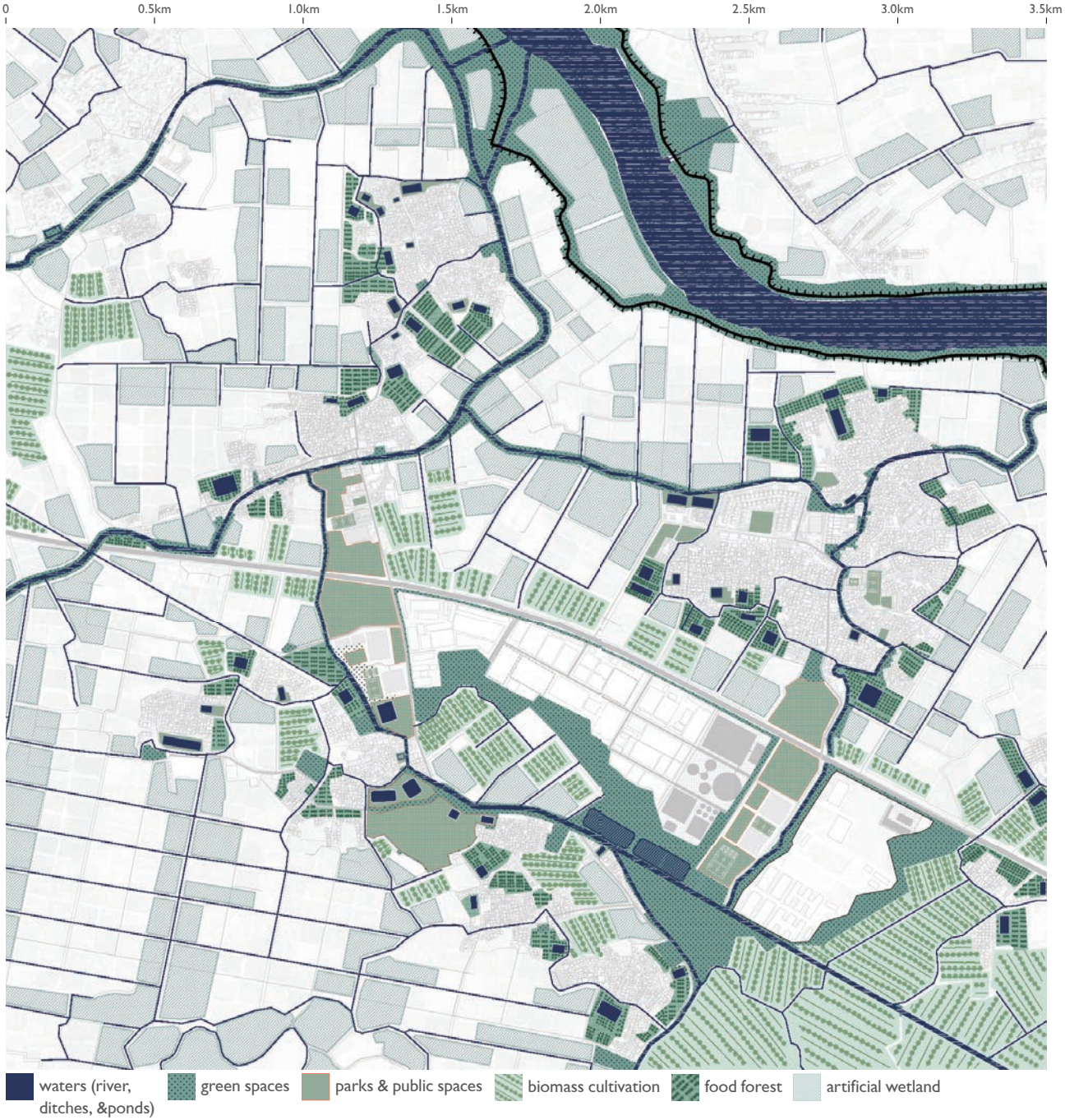
The core planning strategy to drive these actions includes:
1) The local government provides funding and public resources to ensure sufficient public facilities in villages, such as primary and secondary schools, training centres, etc.
2) The training centre is transformed from local industrial spaces and jointly managed by the local government and village collectives. Research institutions and NGO organisations provide social support.
3) Village collectives lead the transformation and enhancement of public spaces. This process requires governmental funding, the involvement of designers, and negotiation with farmers. Therefore, common lands like food forests can provide both social and ecological values.



GOAL 03: ENHANCEMENT OF GREEN & BLUE NETWORK

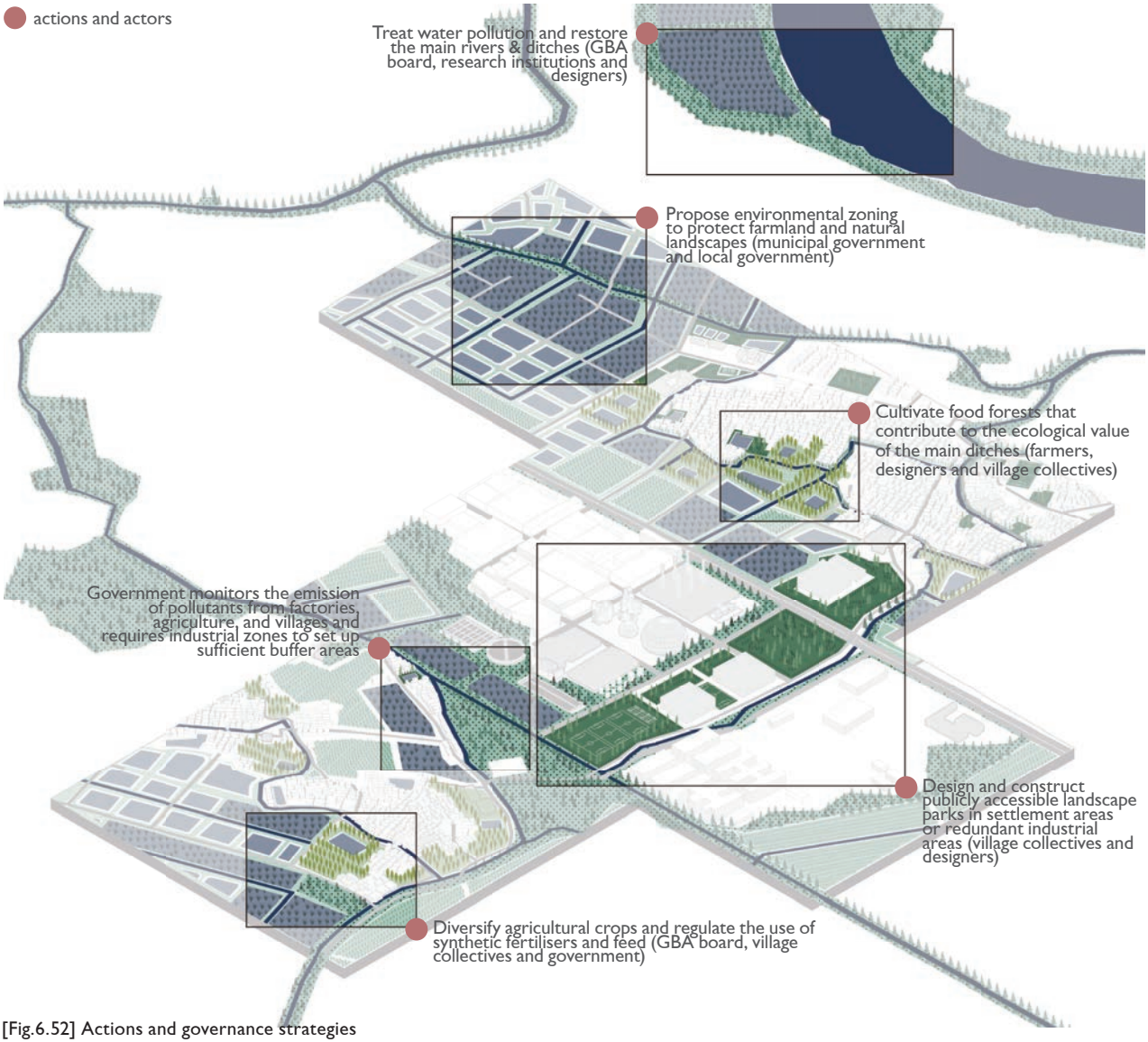


[Fig.6.50] Spatial strategies for landscape system



[Fig.6.51] Landscape system

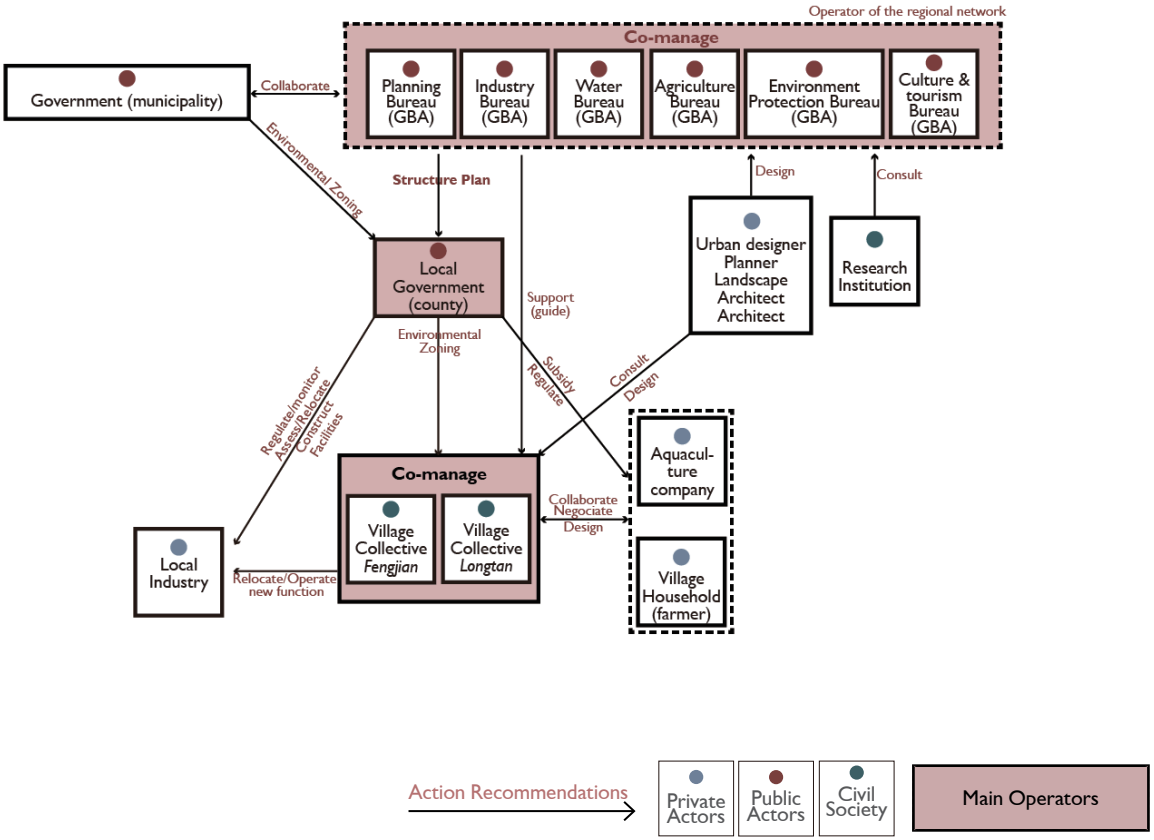
GOAL 03: ENHANCEMENT OF GREEN & BLUE NETWORK



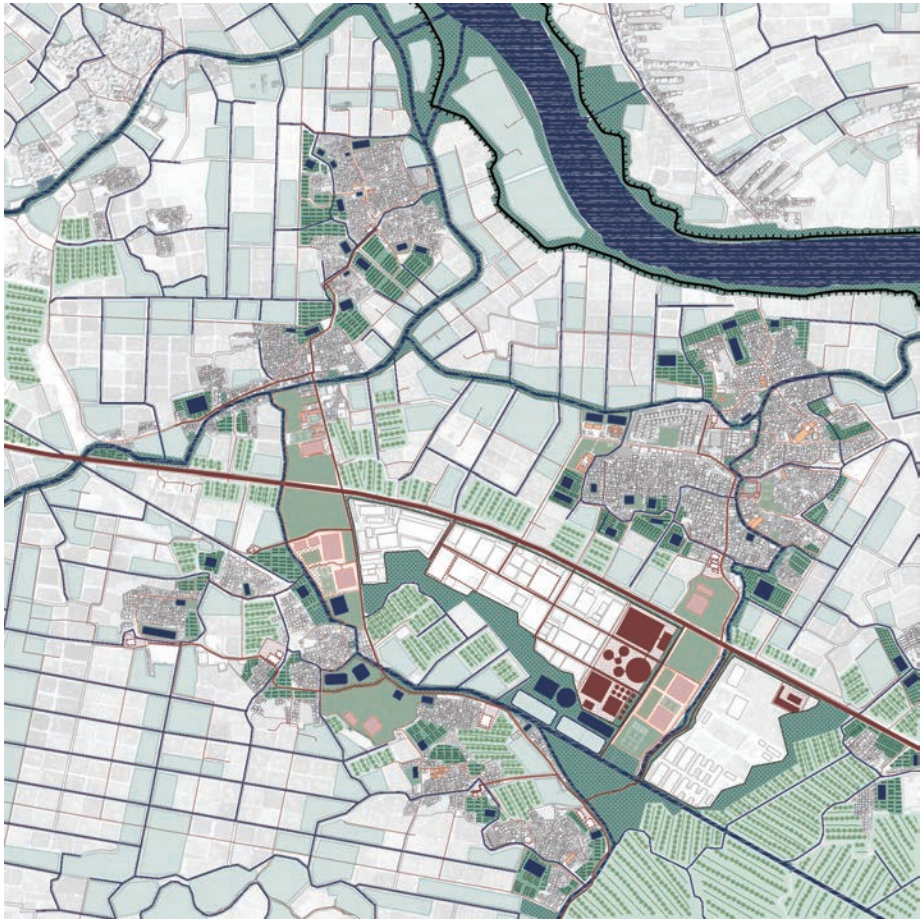
[Fig.6.52] Actions and governance strategies

GOVERNANCE STRATEGIES

The core planning strategy to drive these actions includes:
1) The restoration of major rivers and ditches relies on the actions of the GBA board and governmental policies, such as issuing environmental zoning. This action combines urban planning and landscape design, which goes beyond mere technical improvement.
2) The transformation of agriculture relies on the efforts of village collectives and local governments. On the one hand, the government establishes pollution emission standards and designates protected areas or provides incentives for transformation. On the other hand, village collectives, composed of local villagers who are the operators of agriculture, engage in internal negotiations and cooperation to promote the transformation of agricultural landscapes.



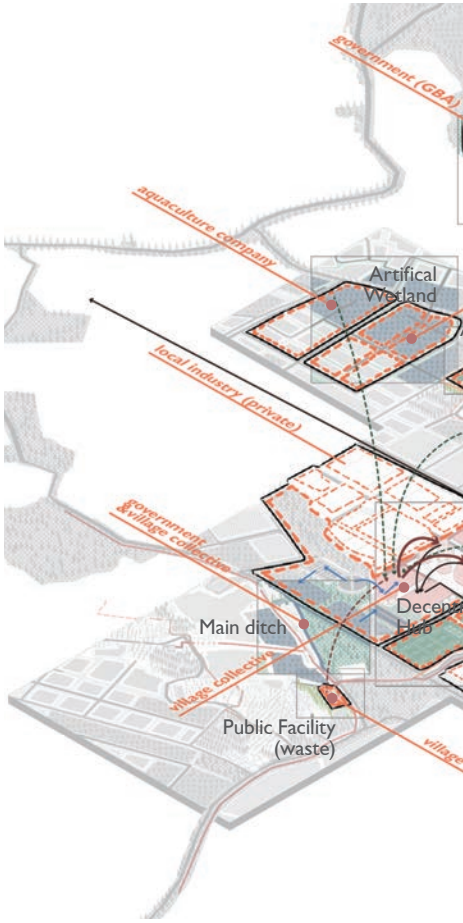
6.14 Design Project: Stractegic Outcomes



waters (river, ditches, &ponds) | green spaces | parks & public spaces | biomass cultivation | food forest
Public institutions | cultural buildings | biobased industries | source of waste
regional communication route | main logistic routes | main public routes | artificial wetland

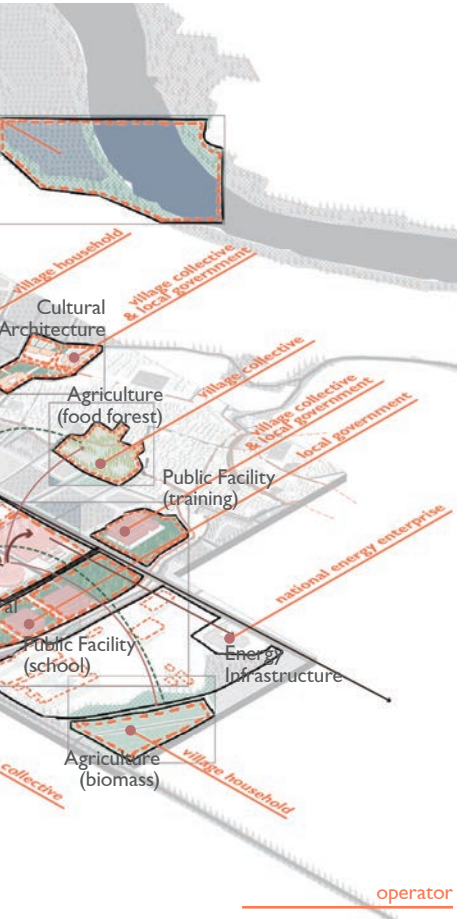
[Fig.6.53] Strategic planning 01 - master plan

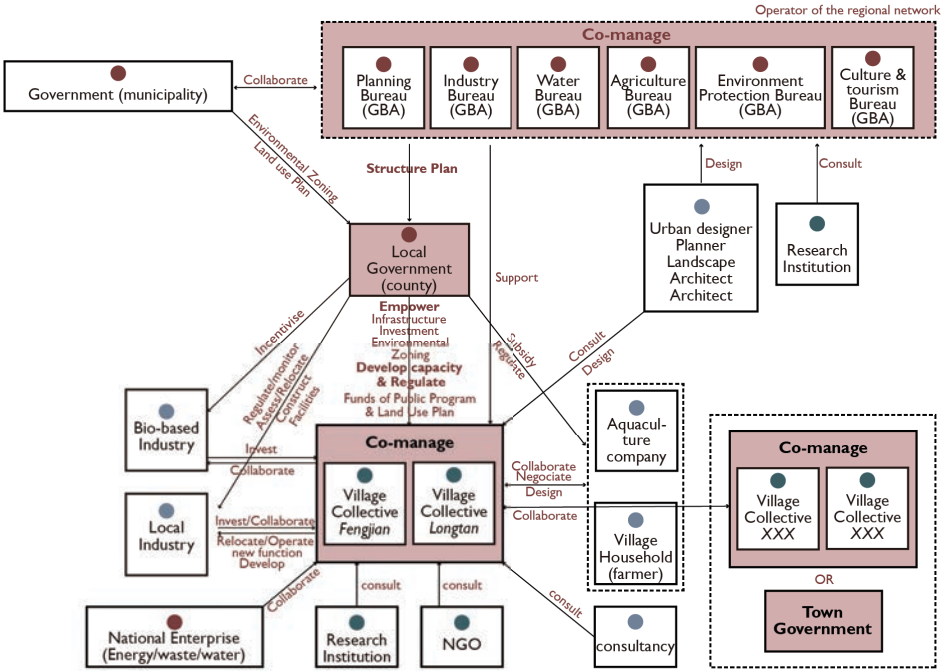
The master plan illustrates how the design strategies of the three systems can influence the current situation and be integrated into one comprehensive structure strategy. This structure transforms centralised industrial areas into providers of public services, economic opportunities, and improved ecology for surrounding villages. This design outcome can serve as a guide for providing land use plans, environmental zoning, and small-scale strategic projects.



[Fig.6.54] Strategic planning 02 - systematic diagram

The visualised systematic diagram is co
strategies. It provides action guidelines
physiological network, village collectives c
cantered around the hub represents t
resource exchange, which require corre
outcome can also be used to propose flo
Additionally, simple visual outcomes are e





[Fig.6.55] Strategic planning 03 - governance structure

oncluded from physiological and policy for the circular network. Within this co-manage the recycling hub. Each arrow he establishment of collaboration and esponding action plans and actors. This ows between nodes at the regional scale. easier to understand for different groups.

The governance strategies for the three systems are proposed within the same planning framework. A decision-making committee should be established between the provincial and municipal governments. It would provide Desakota's structure plan and design principles, which guide the local strategy and need to be continuously adjusted according to strategic projects. As the cooperative moderators, village collectives, town governments, and independent designers propose localised strategic plans (outcomes 1 & 2 or more) to develop the structure. These local planning will also facilitate adjustments to the structure plan.

6.15 Evaluation of Design Project

The outcomes at the local scale represent the final product of the research, planning, and design, which must respond to the initially set goals of identity, diversity, flexibility, resource efficiency, and degree of self-sufficiency. The evaluation is as follows:

1)Local identity is reinforced in the choices of strategies. All actions in the transformation process are developed based on the potential of local spatial quality. The involvement of village collectives as essential stakeholders in strategic planning fosters a bottom-up approach, resulting in a diverse regional community that contributes to the region's identification.

2)The landscape of Desakota itself consists of diverse landscapes. Building upon the design strategies, the diversity of landscapes is further enhanced. For instance, the agricultural landscape evolves from a monoculture of fish ponds to a mixed agricultural model incorporating fish ponds, artificial wetlands, and biomass production. Public spaces offer more choices beyond small corners on the streets. Additionally, the local industrial sector can focus on its original products and provide energy and biomass products based on bio-refineries, showcasing the strengthened feature of a diversified economic portfolio in Desakota.

3)Flexibility is primarily showcased in policy strategies, where comprehensive blueprints are avoided in favour of adaptive strategic planning that addresses actual problems. Additionally, the landscape strategy of selectively transforming fish ponds instead of making extensive changes also considers the need to adapt to flood variations.

4)Due to the limitations of local resources, the proposed strategies do not emphasise the complete transformation of the node into self-sufficient areas. They focus on increasing the proportion of self-supply and resource circularity. Collaboration within the regional network, such as selling excess electricity and bio-based products to other nodes, is also considered. This approach is a starting point for sustainable industrial development, and the specific quantification strategies require further research.

5)Resource efficiency is improved regarding physiological structure (materials, energy, water) and land resources. On the one hand, production and domestic waste is no longer directly landfill or incinerated but instead recycled for industrial production and agricultural activities. Moreover, these industrial activities can be carried out within local industrial facilities, reducing the need for distanced transportation, and thereby minimising losses and pollution from logistics. On the other hand, in terms of spatial structure, factories are concentrated in industrial areas to share electricity, by-products, and wastewater treatment, promoting industrial symbiosis. Reduced factory land in villages can be repurposed as shared public spaces for villagers, increasing efficiency.

In summary, the design project has effectively improved sustainability and liveability.

[Fig.6.56] The proposed future of Desakota

7. Conclusion

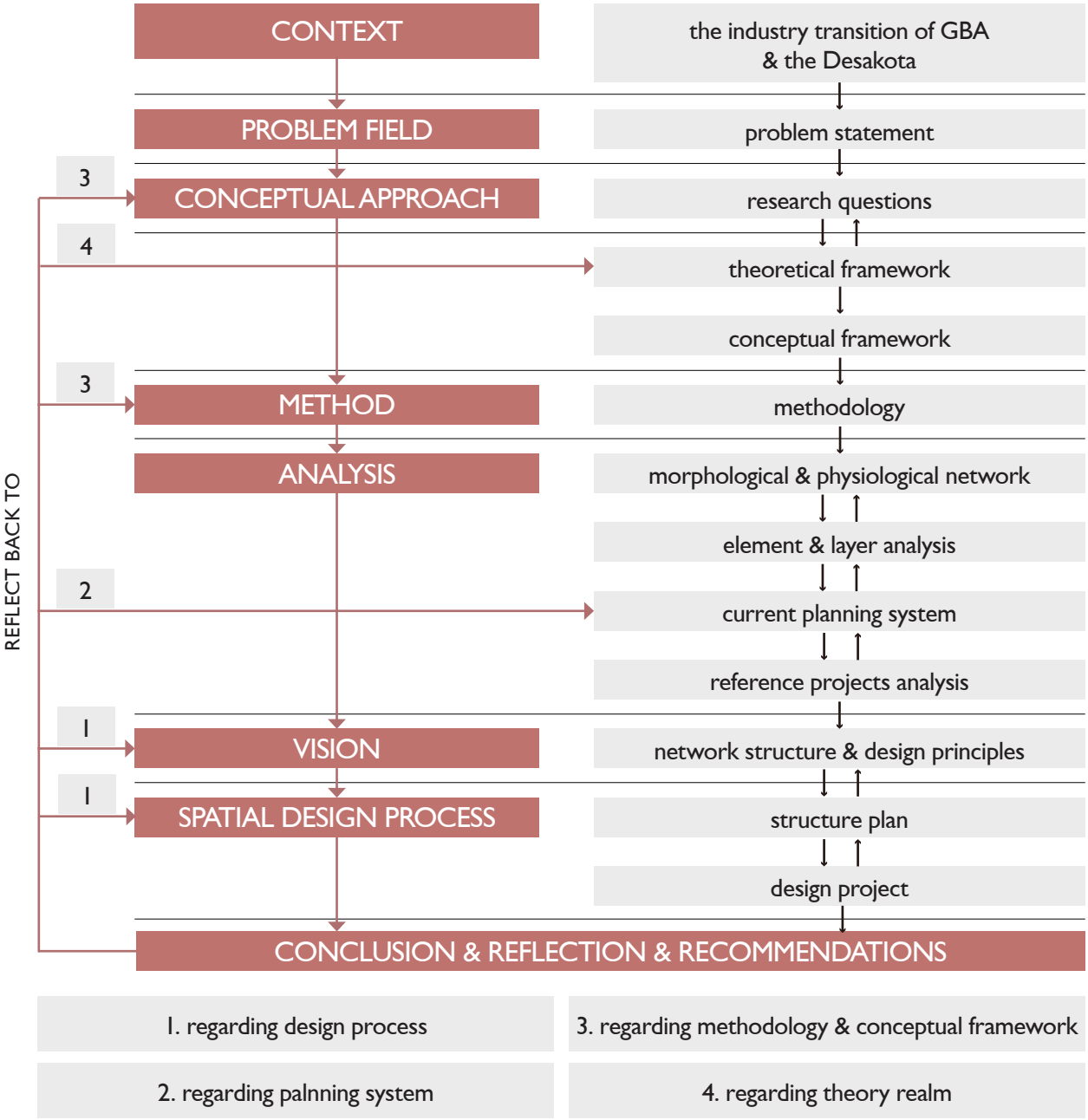
7.1 Conclusions, Reflections & Recommendations

OVERVIEW

This thesis presents a spatial strategy for achieving sustainable industrial transition in the dispersed areas of the GBA, addressing five key problems: unsustainable industrial activities, fragmented landscapes, insufficient public facilities, loss of identity, and ineffective urban-rural planning. Previous research has focused on descriptions and socio-economic discussions, lacking spatial exploration and methodological innovation. This thesis combines the Desakota and Netzstadt concepts to guide the methodology and achieve the following outcomes: defining the spatial and functional structure of Desakota, identifying elements for sustainable industrial transformation, improving structural features inspired by reference projects, showcasing a design project, and proposing a responsible planning system. These achievements are aimed at addressing the research questions proposed in this thesis, namely: What are the potentials of the Desakota pattern to be adapted in the proposed network of the Greater Bay Area megaregion for industry transition that supports sustainable and liveable urbanisation?

In the research and design process, the following transformation objectives of the GBA Desakota need to be considered, which are to preserve identity, embrace diversity, foster flexibility, promote self-sufficiency, and enhance resource efficiency. These objectives are used to evaluate the values of the design outcomes.

After the research and design process covered in the previous six chapters, the overall roadmap of the thesis is depicted in Figure 7.1. Chapter 7 will summarise the spatial design process and provide a planning framework to implement the strategies proposed in the thesis, serving as recommendations for future planning and design in the GBA Desakota region. Additionally, this chapter will respond to the main research question and reflect on the methodology and conceptual framework by integrating all the outcomes. From a scientific perspective, this thesis draws inspiration from the Desakota and Netzstadt concepts; thus, the thesis's transferability in the theory realm will also be summarised. The content will be divided into 1) spatial design process of adapting the Desakota network; 2) spatial planning framework of industry transition and adjustment of the planning system; 3) reflections on methodology, conceptual framework and limitations; 4) reflections on the theory realm.



[Fig.7.1] Research, design and reflection process of the whole thesis (including the five aspects of conclusion chapter)

1. SPATIAL DESIGN PROCESS OF ADAPTING DESAKOTA NETWORK

The process of transforming the Desakota network includes determining the network structure and design principles, proposing a structure plan for the test area, and showcasing a detailed spatial design process in the design project. The conclusion drawn from this process is: the research and design at different scales are mutually adaptive in the practical process.

Firstly, the network structure and design principles are reality-oriented and adjustable, which are not solely based on top-down decision-making but also include adjustments from the structure plan and design projects. Secondly, testing the structure plan is crucial because, at this scale, the spatial structure of the nodes can be roughly defined, which helps adjust the network structure and integrates with the design project for adaptive design. The proposed structure plan is a result that combines the regional vision and localised strategies. Thirdly, the showcased design project serves as an element within the structure plan, showcasing the design process and proposing the potential spatial qualities of industry, landscape, and public spaces in the Desakota region (as shown in Figure 7.2). As the final design product proposed in the thesis, it can respond to the initial conceptual framework. Additionally, this project facilitates reflection on the planning framework. Because due to the horizontality of the Desakota region, projects are similar but possess their local qualities, so the selection of showcases is without priority. Similar design processes can also be applied to other nodes in the structure plan.

Based on the three aforementioned processes, the following recommendations for adapting the Desakota network can be made:

1) Due to the complexity and uncertainties of Desakota, its research and design need to be conducted within a cross-scale and mutually adaptive framework.

2) The inclusivity of different node qualities should be considered. The combination of industrial, open space, and residential elements forms a specific spatial morphology and physiological flow, influencing the choice of spatial strategies to some extent. The regional planning system should accommodate such diversity by providing flexibility.

3) Localised spatial and physiological strategies necessitate the involvement of local actors for sustainable implementation. Therefore, in formulating governance strategies for the nodes, it is crucial to employ both top-down planning approaches (such as structure, strategic, and land use plans) and bottom-up practices through empowering village collectives and local governments. This approach diverges from the current trend where transformation relies solely on government intervention and financial subsidies.

In conclusion, an adaptive, inclusive, and more decentralised spatial design process should be ensured to achieve sustainability and liveability in the Desakota region.

[Fig.7.2] Research, design and reflection process of the whole thesis (including the six aspects of conclusion chapter)

2. SPATIAL PLANNING FRAMEWORK OF INDUSTRY TRANSITION

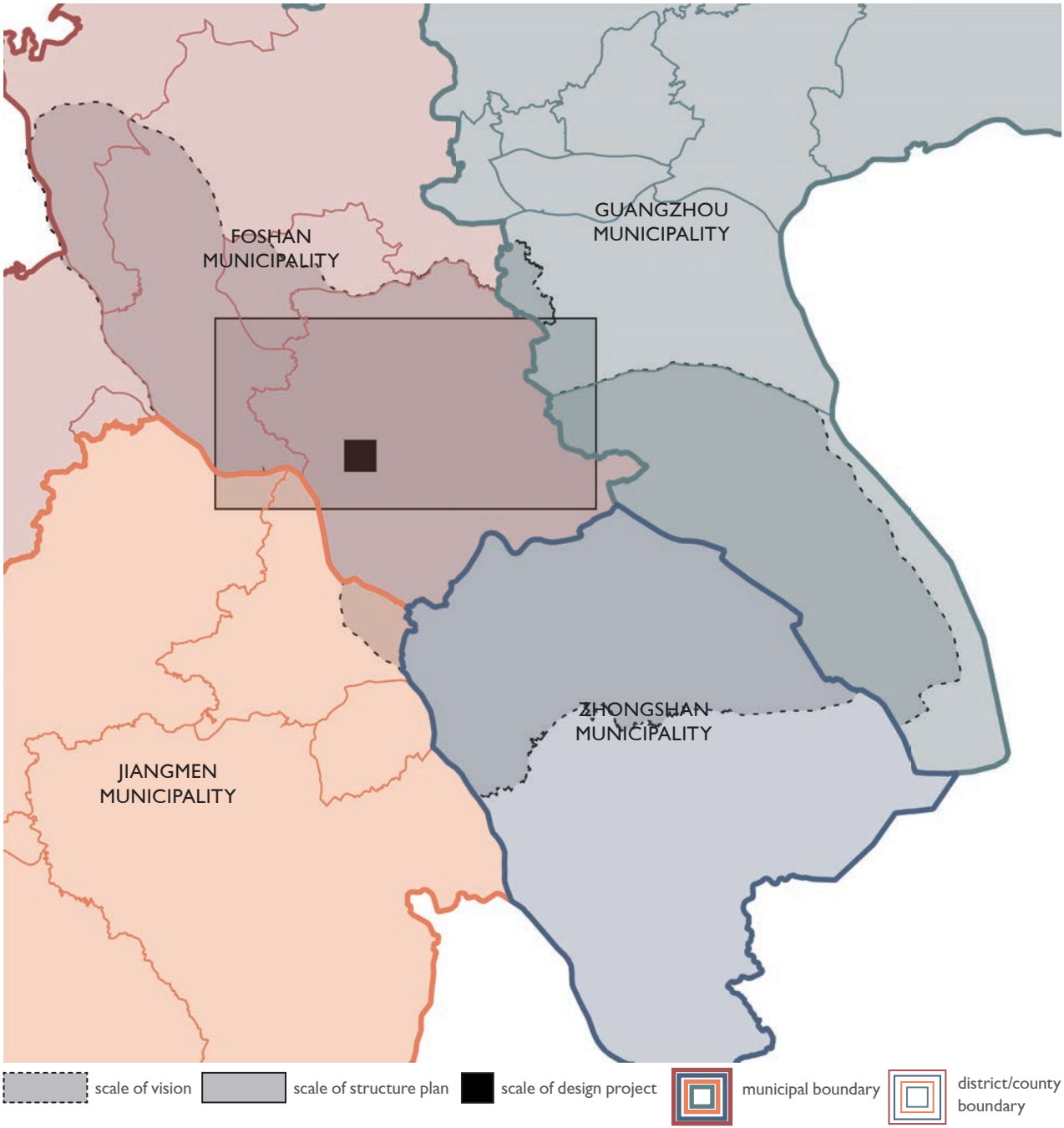
Figure 7.4 presents a reference planning pathway for realising the Desakota vision based on adaptability, inclusivity, and decentralisation principles. This spatial planning framework also considers the actors to engage at each stage.

As depicted in Figure 7.3, the Desakota region spans multiple administrative boundaries of municipalities. According to the conclusions drawn from the reference projects analysis, a regionalised institution positioned between the provincial and municipal levels should be empowered to lead the Desakota transformation. There are existing action groups of GBA, primarily responsible for economic cooperation and infrastructure blueprint planning. As recommended, they should have a dedicated branch, referred to as the GBA board in Figure 7.4, responsible for spatial planning and endowed with decision-making power. Additionally, the GBA board should collaborate with independent planners and research institutions to address challenges in different topics. The GBA board plays a crucial role as a key development player within the entire planning framework and coordinats stakeholders at multiple levels.

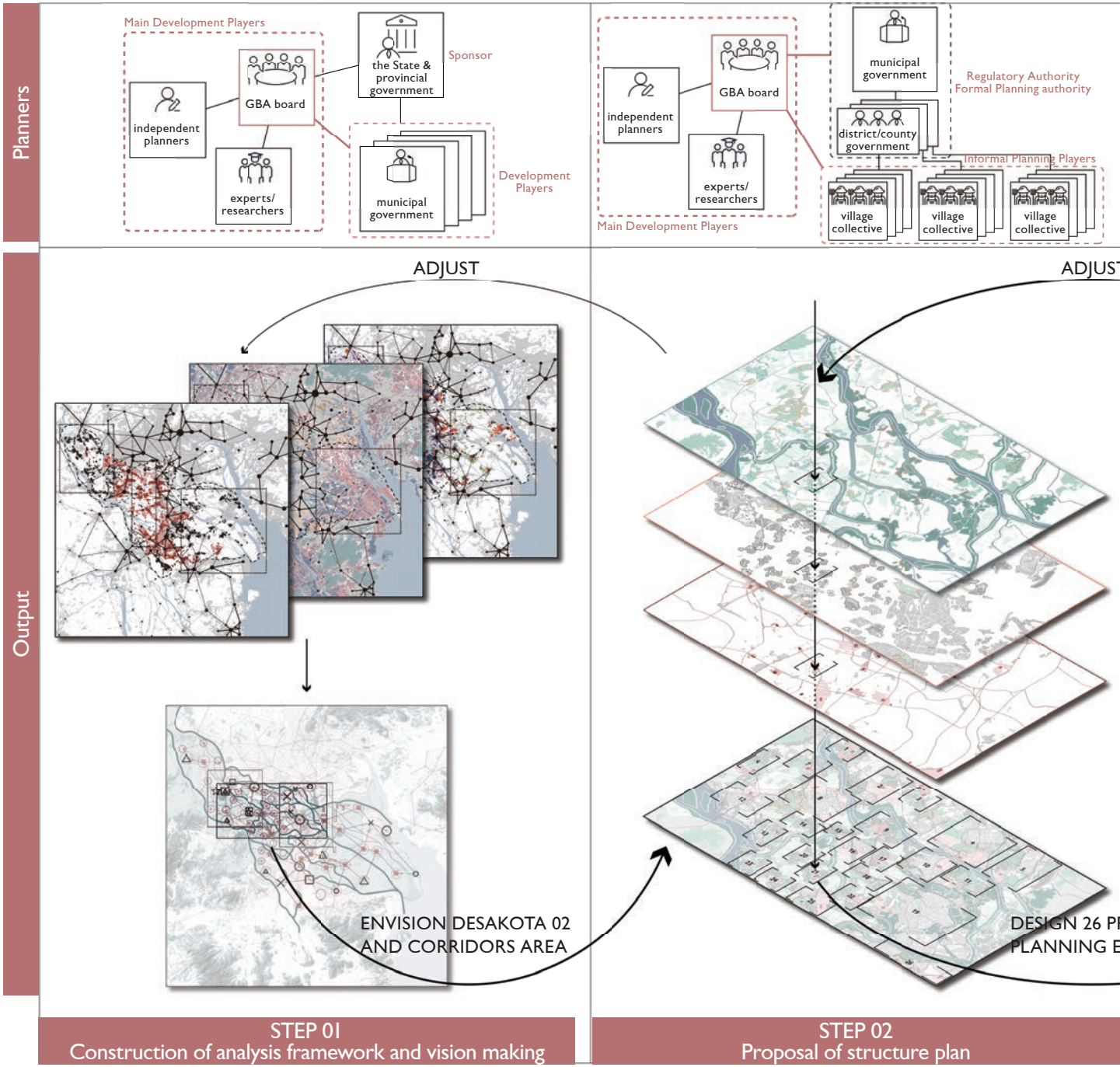
This spatial planning framework for sustainable industry transition mainly consists of four steps. The first step involves establishing a profile and vision-making, corresponding to the analytical framework in the thesis that analyses the Desakota network and its elements to identify the challenges and potentials. As shown in Figure 7.3, the research and design scope encompasses four municipalities in the GBA region. This area is also integral to the development of GBA and requires consultation with the state or provincial level. Therefore, this step requires collaborative efforts from the four municipalities, the province, and the GBA board.

The second step involves the development of a structure plan guided by the vision and design principles. As recommended in Conclusion 1, this plan is developed in conjunction with the design projects, emphasising their mutual adaptability. Therefore, Steps 2 and 3 are conducted simultaneously. In detail, the GBA board and the government propose a decentralised development structure and envision its landscape, public, and industrial systems. As feedback, each project's spatial explorations and specific strategies complement and adjust the regional structure. In each project's design, the GBA board serves more as a guiding and supporting role, while the decision-making entities for the decentralised nodes are village collectives or town governments. Overall, the 26 projects in the structure plan serve as elements to fulfil the structure plan.

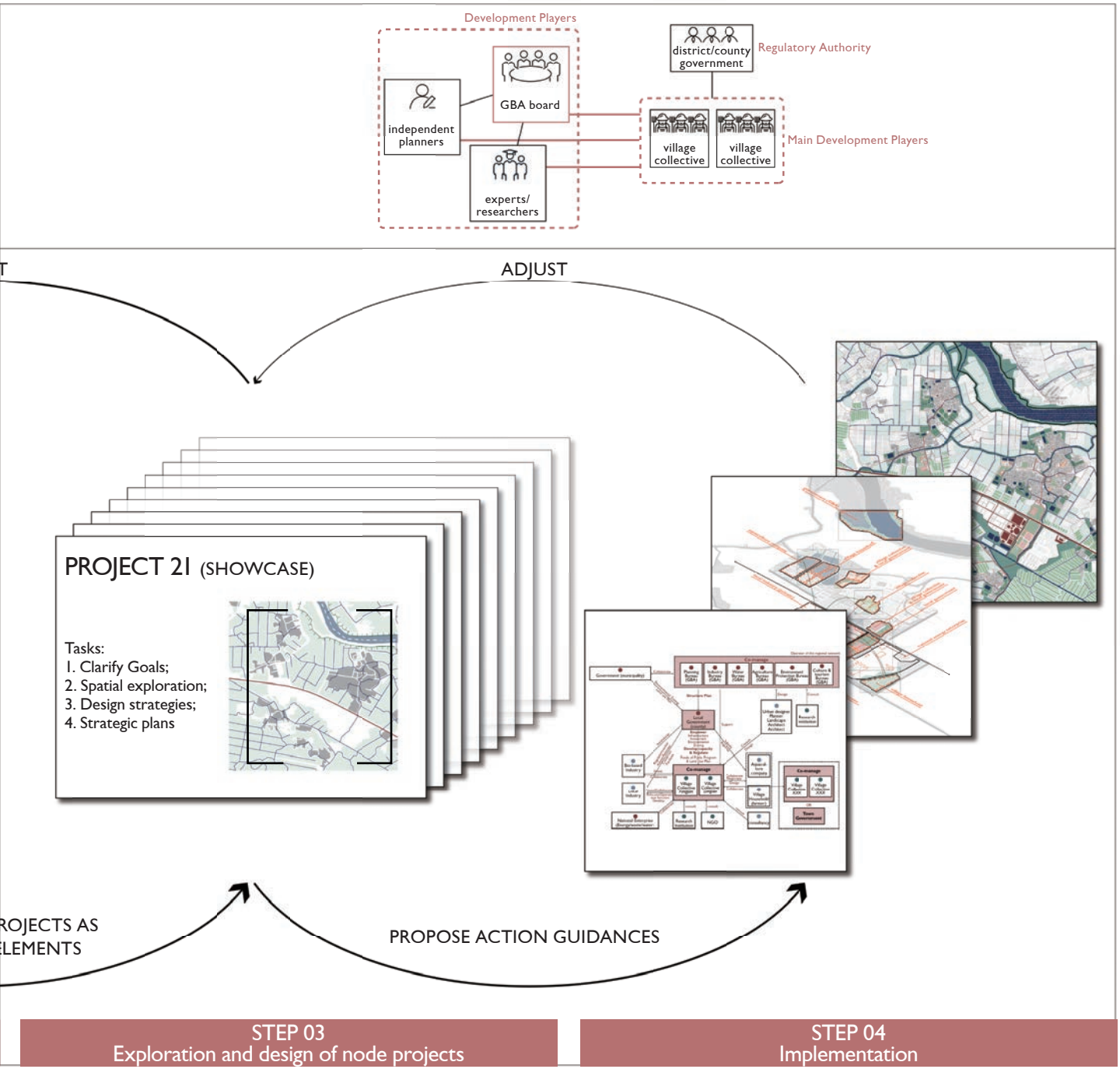
The final step is implementing spatial strategies, specifically illustrated in Figures 7.5 and 7.6. The design project showcases the specific land uses, envisioned flows and operators, and governance strategies. They serve as guidelines to facilitate the implementation.



[Fig.7.3] The administrative scope of the three scale design results



[Fig.7.4] Proposed spatial planning framework of sustainable industry transition in GBA's Desakota areas



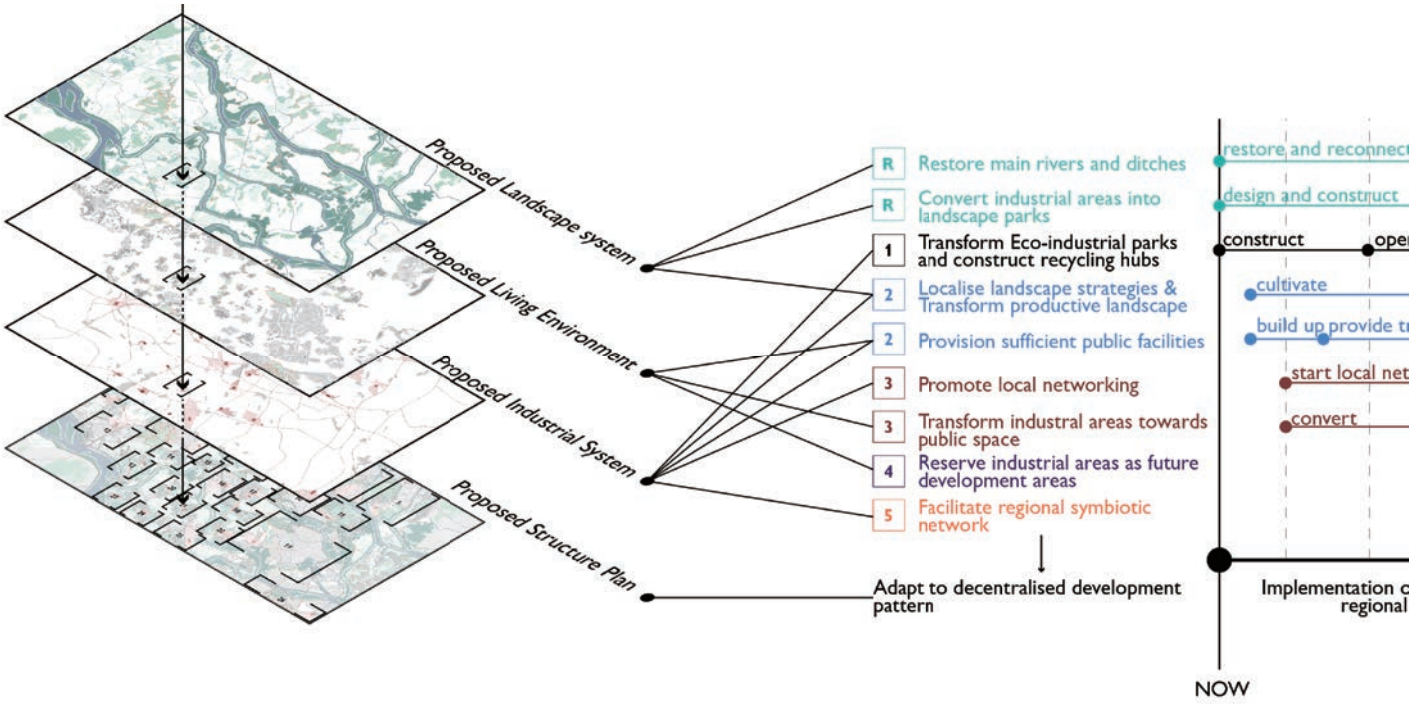
STEP 03
Exploration and design of node projects

STEP 04
Implementation

IMPLEMENTATION

The implemented action plan is shown in Figure 7.5. Firstly, the vision of the structure plan with three systems is divided into tasks with priority. This priority is determined by combining the construction time range, time range of building up operational capability, and importance. Before explaining this priority, it is necessary to clarify that the implementation actions are divided into regional and project-based actions. The former aims to restore rivers and improve regional landscape systems with identified areas. This action requires a regionalised institution, namely the GBA board, to act as an operator. The latter involves specific actions to be taken at each node.

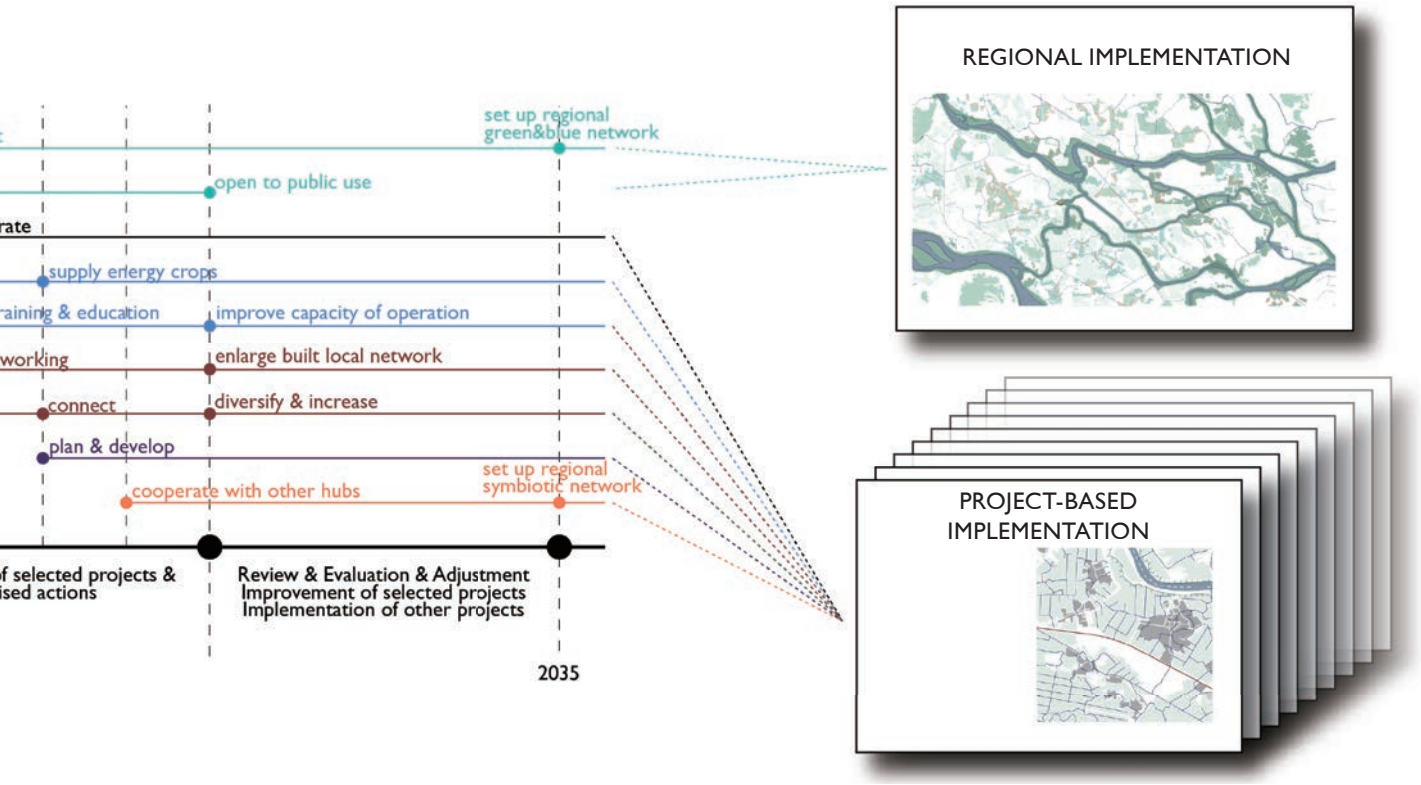
The content of this action plan is as follows: 1) the restoration of major waters and the conversion of landscape parks start within a relatively long timeframe. During the same period, actions to transform eco-industrial parks and establish recycling factories must be executed to provide operational facilities. 2) After determining the facilities to be constructed and the direction of transformation, local landscape strategies can also be defined, and the cultivation of necessary crops can begin. At the same time, some factories are transformed into training centres and put into use within 1-2 years. Therefore, before the operation, villagers can improve their capacity. 3) Local collaborations, such as negotiations and investments between village collectives, local factories,



[Fig.7.5] Action plans of implementation

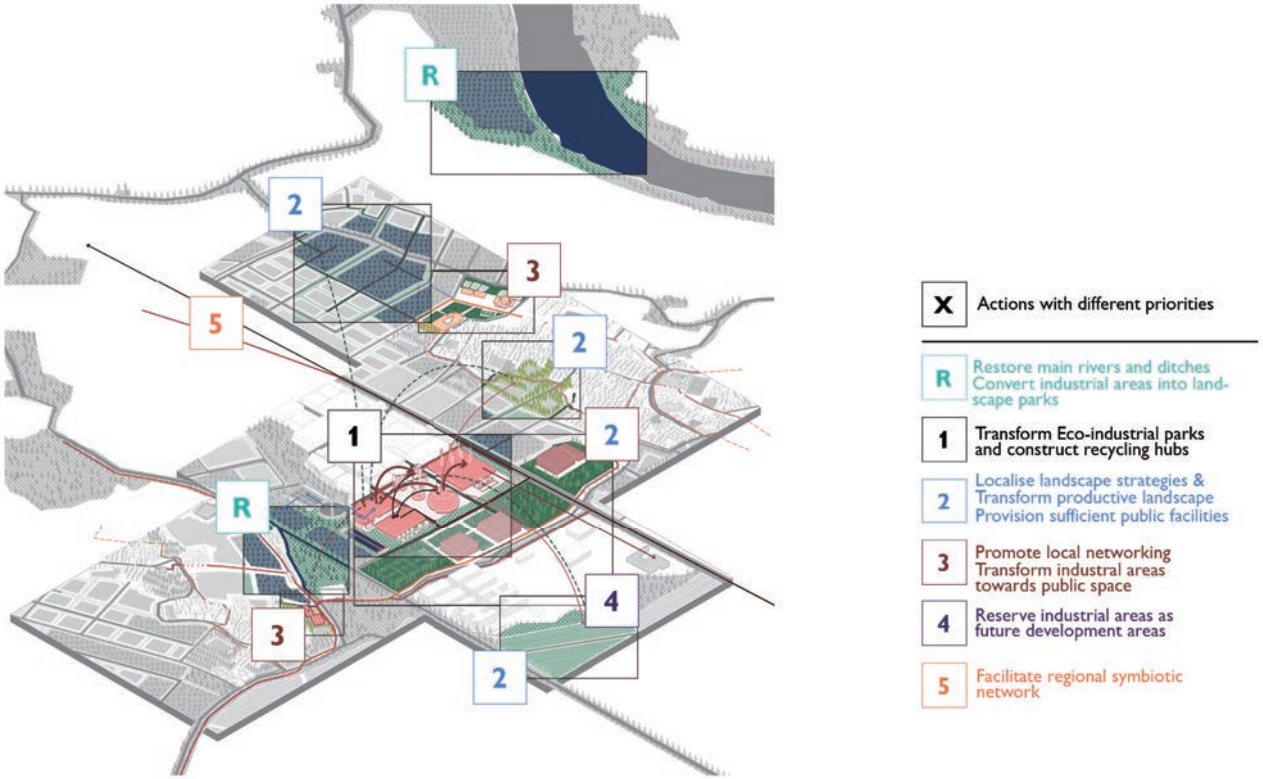
and bio-based factories, can be initiated during the facility construction process. The government does not solely drive these actions; village collectives and factories can also autonomously promote cooperation. Additionally, redundant industrial spaces can be transformed into public functions. 4) Once essential public needs are met, industrial spaces can also be considered new development areas. 5) Finally, when the facilities, operational capabilities, and local collaborations have developed to a certain extent, redundant products can be exchanged between nodes within the region, initiating regional symbiotic cooperation.

To ensure the flexibility of the strategy, the spatial strategies and implementation progress need to be reviewed and evaluated after a certain stage of development (which could be 5-7 years based on the Chinese policy environment and GBA's development situation). This is done to adjust the new cycle of the structure plan and testing design projects. The new results also guide other projects to start the implementation. The current planning framework sets the milestone at 2035, referencing existing planning systems. Considering the future uncertainty, new planning frameworks may need to be changed as the Desakota area develops, which cannot be predicted at present.

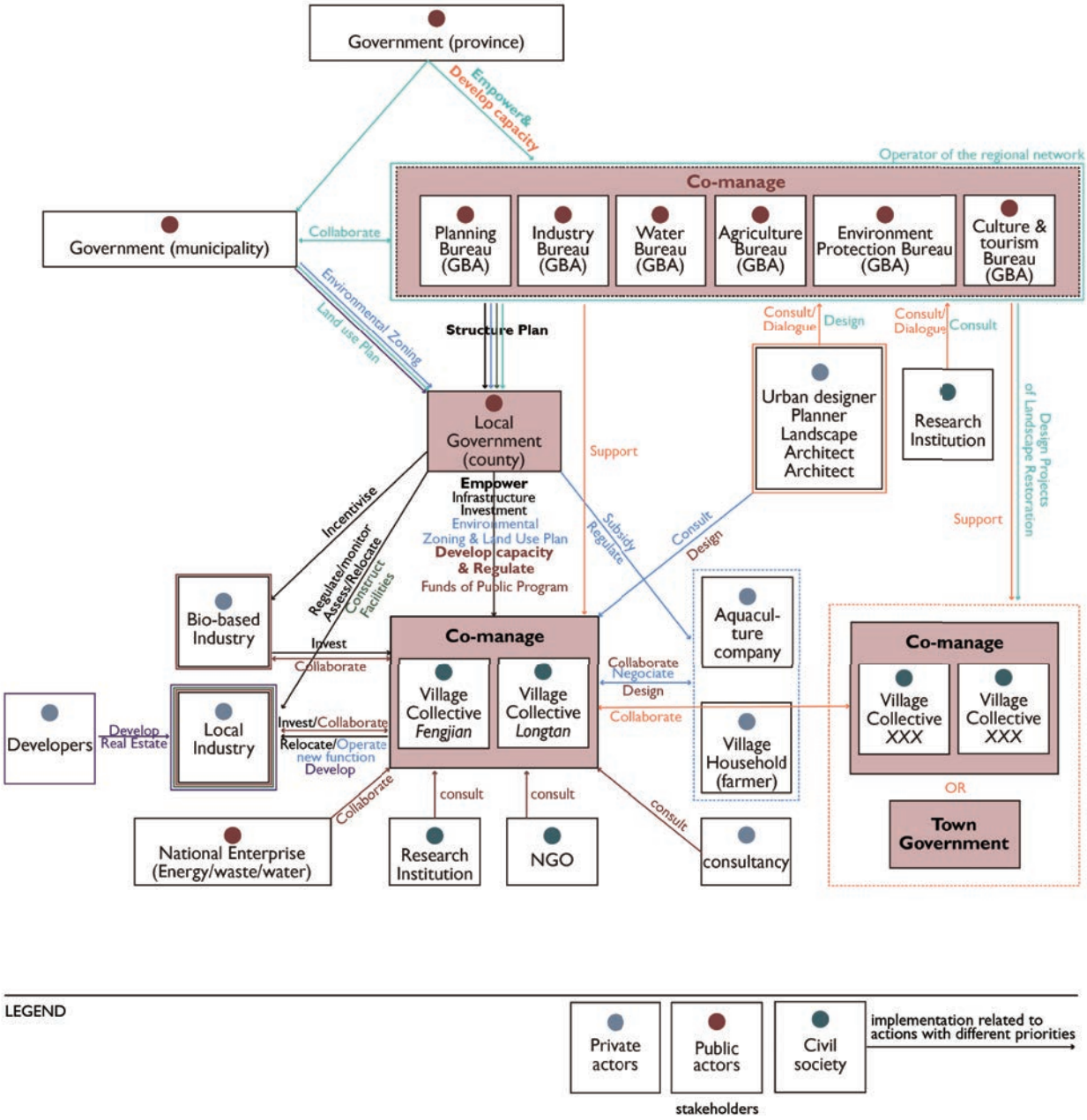


Based on the action timeline defined by the structure plan, more specific measures are implied at the project scale, as shown in Figure 7.6. Each measure involves different stakeholders, as illustrated in Figure 7.7. These stakeholders' actions are differentiated by the colour representing priority.

The specific actions have been described in Chapter 6. What needs to be added is that the GBA board implements the regional action plan, with municipal governments participating in plan formulation and issuing official regulatory documents such as environmental zoning and land-use plans. County governments, as implementers, oversee the actions of village collectives and private actors. Furthermore, the majority of strategies are accomplished through informal planning practices.



[Fig.7.6] Localised actions in the showcased project



[Fig.7.7] Guidance for the actions of different actors with priority

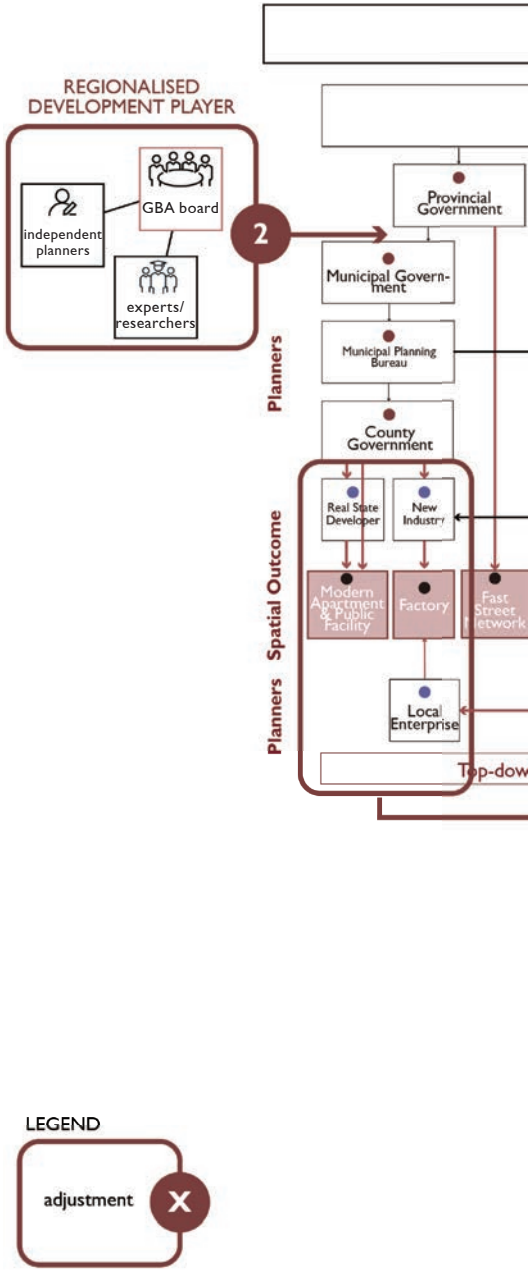
ADJUSTMENT OF THE PLANNING SYSTEM

The reflection on the above planning framework suggests three adjustments to the existing planning system:

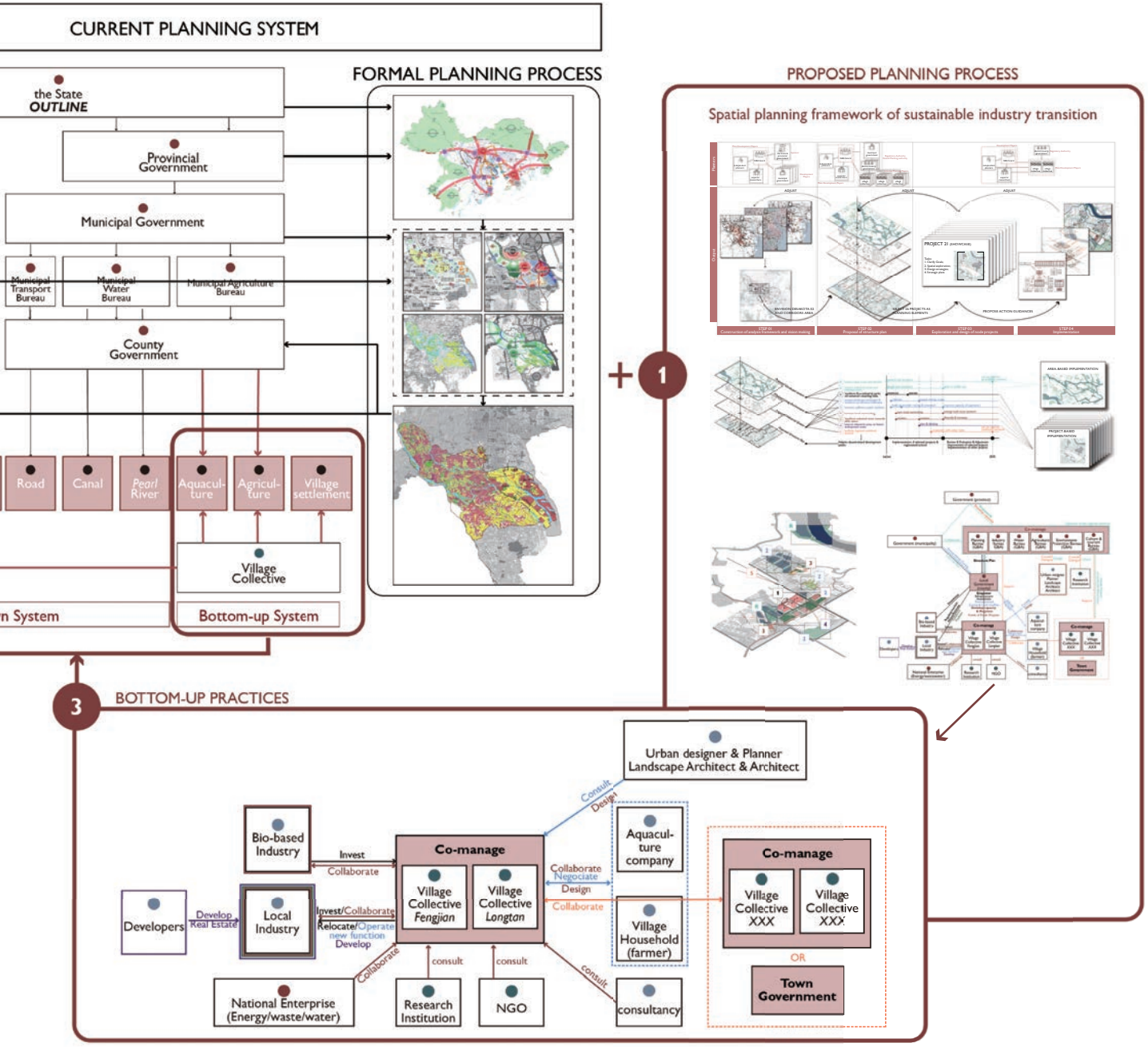
1) The recommended planning framework can be treated as a special plan to address the industrial transformation of the Desakota region. This plan runs parallel to formal planning documents and maintains consistency. Furthermore, promoting this special plan does not require a detailed blueprint for every future step. Instead, strategic planning should be developed based on current realistic problems and potentials. These strategic plans involve changes in land use, physical structures, and governance. Drawing inspiration from successful planning strategies in the Ruhr region, such as exhibitions, networking of industrial projects, and the promotion and networking of culture, the proposed planning system should employ specific planning tools to address different strategic goals. This also implies that as the Desakota region develops, planning tools and action themes are not limited to those in the thesis. This planning approach, with a set of tailored planning tools, is well-suited to cope with the uncertainties and complexity of Desakota.

2) Regionalised decision-making bodies and development players, specifically the GBA board, should be empowered and pay more attention to the Desakota region.

3) The governance of the planning system should grant more autonomy to local actors, especially in the Desakota region. This change allows for better integration and management of both top-down planning and bottom-up practices. In the proposed governance strategies, many actions (as shown in Figure 7.8), including cooperation among village collectives and factories, consultations with farmers, collaborations with real estate developers, and cooperation between different nodes, are independent. The government primarily assumes a regulatory and supportive role. This is made possible by the strong power of village collectives concerning rural land. Allowing village collectives to participate autonomously in the transformation process is more feasible than implementing industrial transformation solely through government actions. However, the premise for these strategies is that recommended point 1) can be effectively implemented. Effective action guidelines and supporting formal planning processes can prevent negative impacts from the informal practices of village collectives.



[Fig.7.8] Three planning recommendations to adjust the cur



rrent planning system

[Fig.7.9] This thesis envisions a series of strategic planning initiatives that facilitates the opportunities to realise Desakota's potential of diversity, high ecological value, agricultural-industrial cooperation, and sustainable informal practices; source: image by @ZhouMini in Xiaohongshu

3. REFLECTIONS ON METHODOLOGY & CONCEPTUAL FRAMEWORK

This thesis attempts to envision the GBA Desakota's industrial transformation and planning process by exploring its industrial, landscape, and residential potentials. The goal is to promote its potential characteristics, such as diversity, ecological value, sustainable industrial & agricultural activities, and active informal planning. For these objectives, the initial conceptual framework proposes corresponding tasks, including proposing sustainable industry transition, liveable settlement patterns, and a specific planning framework. These tasks have been, to some extent, realised through proposals.

1) The sustainability of industrial transformation is primarily reflected in the design strategies, including the Desakota network's green, circular, symbiotic, and independent development. Green industrial transformation is ensured in the strategies of blue-green networks and eco-industrial parks. Circularity and symbiosis are addressed through the concept of recycling hubs and cascading strategies for nutrients and energy in local and regional networks. At the same time, the sustainability of social development is also manifested in enhancing the development capacity of village collectives or town governments.

2) Redundant public spaces are used for future urban development or public spaces of decentral nodes. The structure plan and project demonstrate this strategy's emphasis on improving liveability and diversity. Landscape strategies also emphasise the recreational value of landscapes in the settlement. The concentration of industrial areas and buffer zones also somehow ensures liveability.

3) An adaptive, inclusive, and decentralised planning framework is proposed to provide a realistic path for the aforementioned strategies based on adjustments to the existing planning system.

From the results perspective, the Desakota potentials described in the conceptual framework can be utilised to some extent in the GBA region through a series of strategic planning. The methodology used to achieve this design process is also proven effective through the results. In particular, the network analysis and reference study form a valuable part of the thesis methodology, providing a comprehensive and multi-scalar analytical framework for decision-making from both regional and local standpoints.

LIMITATIONS AND FUTURE ORIENTATIONS

In general, the methodology and outputs of this thesis are heading in a positive direction. However, due to limitations in time, data, and knowledge, future research needs the following improvements:

1) Although the methodology compensates for the lack of data by conducting elemental and systematic analysis at a smaller scale, obtaining more precise data, such as actual human flows and

material flows, would contribute to more accurate findings and strategies, including quantitative strategies for industrial transformation.

2) The applicability of European theories and cases to the Chinese context should be carefully considered. It should be noted that the strategies in the Ruhr region were proposed against the backdrop of urban shrinkage, while the future of the GBA region is highly uncertain. Therefore, the potential impacts of the strategies need to be predicted and evaluated more cautiously.

3) The assumed planning system is based on a consensus that sustainable development will become an essential goal of regional development. This is consistent with the current policy trend as the state gradually introduces policies on circular economy and sustainable energy transition. However, these policies have not yet been fully integrated into the planning system and only apply to specific strategic projects. Additionally, due to China's unique policy environment and complex land ownership issues, especially the uncertainties regarding autonomous and powerful village collectives within the planning system, some planning tools derived from European cases cannot be directly applicable. Therefore, a more comprehensive study of stakeholders and policy tools involved in the proposed planning system can make the proposal more realistic.

4) Due to the intention to provide a focused solution, this thesis emphasises the topic of circular and symbiotic industrial transition in the potential areas of the Desakota region. This project's strategic planning serves as a starting point for the GBA Desakota region. Other topics may not have been mentioned or explored in sufficient depth, which deserve further investigation. For example, the choice of residential patterns in Desakota, the industry symbiosis in the town nodes and the social issues in Desakota. In addition, social participation in the planning system and landscape strategies in response to climate change... All of these topics are of interest and require further exploration. I believe this thesis provides a strong basis for future research and offers sufficient flexibility to address uncertainties.

5) In addition to the topics related to urbanism or landscape architecture mentioned in point 4), uncertainties in other fields can also have an impact on the choice of development strategies for this region. For example, changes in the policy environment of the GBA, rapid development and transformation of industrial ecology, and the promotion and commercialisation of the circular economy in China, among others. However, due to limited knowledge, predicting the changes in these fields is impossible. Therefore, this thesis focuses on the contributions that urban planners can provide. In a practical setting, cross-disciplinary collaboration and communication are essential.

4. REFLECTIONS ON THE THEORY REALM

The Netstadt and Desakota models greatly inspire the methodology employed in this thesis. However, due to the contextualisation of the application environment, they have been interpreted more uniquely. The following are reflections and contributions of the methodology and the adapted Desakota pattern to these two theories.

REFLECTION ON THE NETZSTADT METHOD

Defining regions as networks of nodes, connections, and boundaries is a practical approach to assessing the degree of regional development and the communication relationships between nodes. This network method relies on fundamental data obtained from satellite imagery recognition and socio-economic data, making it applicable in various environments. However, when data scarcity exists, the morphological and physiological indicators proposed in theory may not be accurately identified. Therefore, additional analyses are needed to assess the quality of each node.

This thesis employs an overlay of element analysis and systematic analysis, which has strong operability. Firstly, satellite imagery can identify essential elements such as ponds, farmland, water bodies, residential areas, and roads, which aid in analysing the morphology of elements and layers. Secondly, field trip and material flow analysis supplement the specific characteristics of each element and layer, providing a more comprehensive understanding. Additionally, since open spaces constitute a significant portion of the Desakota region, an in-depth analysis of landscape elements and their systems is conducted. This helps address the limitations of the Netzstadt method regarding the lack of open spaces analysis and extends its applicability beyond urban areas.

REFLECTION ON THE DESAKOTA MODEL

The potential structure of dispersed areas and their planning system are closely related to regional culture, landscape systems, climate conditions, and social structure. These conditions together constitute the potential of Desakota, as emphasised in the Desakota theory. But slightly different from Desakota in theory, the potential qualities of GBA Desakota summarised are rooted in the following characteristics:

1) Frequent floods and dense water networks make traditional agriculture in the region water-related, such as aquaculture industries. Modernised fishing rather than seasonal rice farming (mentioned in the Desakota model) can also free up rural labour for industrial production.

2) The geographic conditions of hills and dense water networks make the dispersed villages in the GBA develop in a more concentrated form, with closer distances between each other. As a result, the trend of urbanisation has become more intense, and some areas have transformed from the dispersed regions described in Desakota into continuous urbanised areas along the infrastructure. Furthermore, industrial communications have been, to some extent, established

between these areas. With effective measures to limit excessive urban expansion, constructing an industrial cooperative network in this region has advantages over other Desakotas.

3) The industrial development in the GBA itself is characterised by decentralised concentration within the agricultural landscape. The decentralisation is due to the entrepreneurial spirit of local village collectives and town governments after the reform and opening up policy. They autonomously build and operate factories that directly supply products to Hong Kong. Therefore, the existing industrial forms and infrastructure networks have developed as decentral, with multiple villages jointly operating them, as envisioned in the design project. In addition to the geographical factors mentioned in point 2), concentration is also influenced by the traditional social culture of maintaining family networks in southern China. A village collective usually comprises several large families with close social relationships between them. This allows for more centralised and efficient decision-making within the collective. Therefore, they can operate their industrial hubs and reach agreements for cooperation in industry and agriculture. These characteristics provide the potential for self-sufficient industrial and agricultural activities by the village collectives and their participation in the regional industrial network.

4) The decentralised network may generate more informal institutions and activities with a dual influence. This aligns with the active informal planning discussed in the Desakota theory. The planning framework proposed in the thesis takes into account the positive role of these informal practices. However, it is crucial to have effective regulation and guidance for these activities. Compared to traditional desakota regions, the GBA region's integrated national strategy for regional integration makes it possible to manage the dispersed network across municipal boundaries. Therefore, even beyond the city limits, certain constraints can be applied through regional-scale management, which plays a crucial role in limiting the negative impacts of desakota.

5) Desakota describes the transition process and faces significant future uncertainties. Therefore, the model proposed in this thesis does not present desakota as the ultimate direction of planning but instead utilises the potential of desakota extracted from theory and practice as a starting point for sustainable and liveable development. Subsequent regional planning needs continuous improvement based on time and trends. This is the original intention behind constructing a more specific and flexible planning system for the Desakota regions in GBA.

Considering the above characteristics, the conclusion drawn is that the decentralised Desakota structure with a specific planning framework applies to the GBA. For other Chinese regions or Southeast Asia, careful consideration is needed to assess whether their spatial forms, physiological structures, and governance patterns are suitable.

8. Appendix

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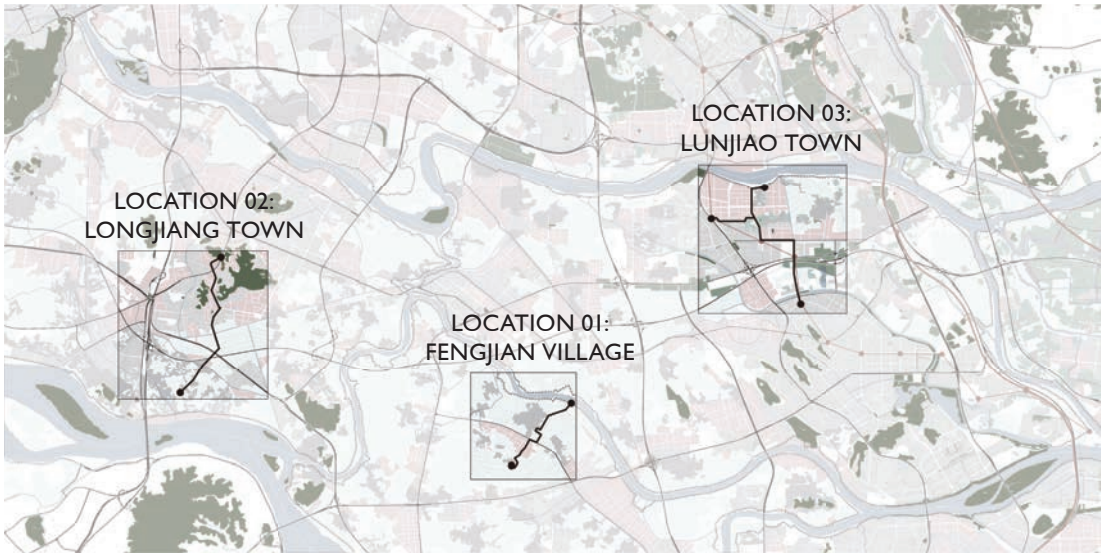
[Fig.5.55 & 5.57] Ruhr, R. (n.d.). Home RVR. https://www.rvr.ruhr/

[Fig.5.58] Shanghai 2035. (n.d.). https://www.supdri.com/2035/

[Fig.7.9] Photography of Dichong village in Guangzhou. (2022, December). Xiaohongshu. https://www.xiaohongshu.com/discovery/item/6392e6bb00000001f023c84?app_platform=ios&app_version=7.92&share_from_user_hidden=true&type=normal&xhsshare=WeixinSession&appuid=5d01da1a00000001600563a&apptime=1687458344

Field Trips

In order to better understand the local spatial quality and analyse the potentials of the design project, a field trip was carried out at three locations in the GBA desakota area. These three sites are respectively distributed on two corridors and the desakota area in the middle. The method is mainly taking photos, recording the residential, landscape and industrial spaces of each location.



Routes of the field trips

LOCATION 01: FENGJIAN VILLAGE

The research photos of this site have been presented in the design project, so here are some supplementary photos.

LANDSCAPE

Fish pond

Vegetable garden on the edge of the village

INDUSTRY

The ditch between village settlement and industrial park

The entrance of the industrial park

LOCATION 02:
LONGJIANG TOWN

SETTLEMENT

The village settlement in the town

PUBLIC SPACE

The waterfront area and playground in the village settlement of the town

The main settlement in the town

The public space in the town centre

The newly built areas in the town

LANDSCAPE

The ditch between historical buildings and residential areas in the village settlement

The main ditch on the edge of the town

The fish pond and agricultural landscape on the edge of the town

INDUSTRY

Industrial area in the village settlement

The newly built industrial park within the town

The old industrial park in the town centre

LOCATION 03:
LUNJIAO TOWN

The town centre under construction

The newly built enclosed community in the twon

Village settlements and abandoned factories on the edge of town

LANDSCAPE

Main river between different towns

The green space and ditch within the town

Natural and agricultural landscapes of the town

INDUSTRY

Concentrated industrial area of the town (mainly mechanical manufacturing and its components' production)

Concentrated industrial area of the town

Concentrated industrial area of the town