



THE STORY OF SHENZHEN

Its Economic, Social and Environmental Transformation

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Foreword

Southeast China, its coastal ports and history of trade, is particularly close and related to Southeast Asia, my home region. For centuries, the Chinese have ventured into the Nanyang, which is modern day Southeast Asia or the Southern Ocean, developed close trading partnerships and even established settlements. This pioneering spirit has created a wealth of opportunities for the people of both regions. It is not surprising that Shenzhen, the modern day leading city of Southeast China, once again proves to be an inspiring place.

This book shares economic, planning and environmental policies and strategies implemented by Shenzhen, which in a just four decades has emerged as the Silicon Valley of China. This remarkable economic and social development has been built on high-tech, manufacturing and service industries. Today, it is knowledge-based industries that drive Shenzhen's development. Its economic output is ranked third highest among 659 Chinese cities and according to the 2017 Global Financial Centres Index, Shenzhen is the twenty-second most competitive financial center in the world. In 2016, Shenzhen's contribution to China's GDP was USD303 billion, surpassed only by Shanghai and Beijing.

Yet, cities are not merely places where people reside or sites where the production of goods and services takes place. Through their own internal dynamics, cities are key drivers for growth and development. They generate wealth and prosperity, serve as hubs of innovation and transformation, create multipliers, facilitate redistribution of assets and opportunities, increase productivity and contribute to balanced territorial development.

For this four decade-old miracle to continue, the old Chinese practice of long-term thinking needs to be practiced. Sustainable development must be pursued in order to address current global challenges of rising poverty, social inequity, environmental degradation and climate change. In our rapidly urbanizing world, with more than half of the population now living in cities, the question of sustainable urban development comes to the fore. We must ask ourselves how we can improve the quality of life of urban citizens, while ensuring that urban areas remain economically productive, socially inclusive and environmentally sound for both present and future generations.

Shenzhen is truly a remarkable success story. Many growing cities, special economic zones and new cities can learn a lot from its experience. I am pleased to present to you this book, which draws upon the expertise of specialists representing various fields and institutions. It will help us understand many stories that make up the Shenzhen experience.

A handwritten signature in black ink, appearing to read 'Maimunah'.

Maimunah Mohd Sharif

United Nations Under-Secretary-General and Executive Director
United Nations Human Settlements Programme (UN-Habitat)

Preface

It is with great pleasure that I write this brief message for this book *The Story of Shenzhen: Its Economic, Social and Environmental Transformation*.

Shenzhen has achieved tremendous economic and social development within the last four decades since the establishment of Shenzhen Special Economic Zone in 1980. This book documents Shenzhen's progress over the years from economic, social and environmental perspectives. Last year, China celebrated the four-teeth anniversary of its reform and opening-up. This year we are celebrating the four-teeth anniversary of the establishment of the city of Shenzhen, and next year we will welcome the four-teeth anniversary of the inauguration of Shenzhen Special Economic Zone. I am pleased that UN-Habitat is publishing this book at this important time for Shenzhen.

UN-Habitat is committed to promote economically, socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all. Many cities, towns and special economic zones in other countries can be inspired by Shenzhen's experience in its urban development. I would hope that this book will contribute to the body of knowledge on urban development, and benefit city leaders, urban planners, academics and economists.



A handwritten signature in black ink, appearing to read 'Li Xiaogan' in a stylized cursive script.

Xiaogan LI

President of Shenzhen Association for International Cultural Exchanges

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Introduction

Shenzhen has transformed itself from a small fishing village into a global economic powerhouse in just over 40 years. It has experienced rapid economic, social and environmental transformation and is described as being *innovative, inclusive, young* and *high-tech*. In this book, UN-Habitat documents the experience of Shenzhen and shares lessons it has learned during the past 40 years.

Chapter 1 introduces Shenzhen's development and the important role it plays in the global value chain. Shenzhen's rapid development since 1979 can be explained in four stages. The first stage, from 1978 to 1992, can be characterised by labour-intensive development supported by opening-up and institutional reforms. During the second stage, from 1992 to 2003, Shenzhen reached the lower-middle position in the global value chain, with a focus on capital-intensive development. While introducing the socialist market economy, it attracted foreign direct investment and accelerated the transfer of electronic and information industries. The third stage, from 2003 to 2013, involved economic transformation amidst rapidly rising land prices. During this period, Shenzhen graduated to the middle of the global industrial value chain. It improved the attractiveness of the city and private high-tech businesses formed clusters, fostering a new momentum for innovation. In the last stage, from 2013 to 2018, Shenzhen successfully reached innovation-driven development and the highest echelon of the global industrial value chain.

Chapter 2 discusses city revenues and expenditures, municipal financing approaches and innovative strategies inspired by them. There are two main sources of finance for Shenzhen's regional municipality—central government transfers and local or own sources. In general, own sources of revenue exceed transfers it receives from the central government. A large amount of municipal expenditure is spent in five key areas—urban and rural communities, housing, science and technology, education and energy and conservation. Apart from

traditional government financing models, such as land-leasing and government-invested companies, creative measures adopted by Shenzhen include issuing of local government bonds and public-private-partnerships. The innovation in finance is closely related to the industrial growth in Shenzhen.

In **Chapter 3**, modern economic growth, special economic zones and industrialization in Shenzhen since 1980 are presented. Between 1980 and 2016, Shenzhen recorded an average annual GDP growth rate of about 20 percent. In China, Shenzhen has the highest economic openness and market economic development. This is a result of its land use reforms, housing systems, introduction of foreign-funded banks, establishment of regional joint-stock banks, a foreign trading system and the talent market. These improved the market for capital, technology, talent, property rights, trade, information and innovation. As the core city of the Guangdong-Hong Kong-Macao Greater Bay Area, Shenzhen has access to innovative resources and technologies, research and development resources and social products that boost its potential to stay competitive. Shenzhen government facilitates this process by carrying out necessary institutional and administrative reforms.

Chapter 4 presents three main phases of urban planning in Shenzhen: 1980-85 period, 1985-90 period and the post-1990 period. It discusses the relationship between urban master plans and five-year planning, which supported Shenzhen's rapid development. Three urban master plans describe the shaping of land use from a clustered linear model to a multiple axes network structure and then towards a polycentric urban development model with two centres and five sub-centres. Migrants, new labour and tourists make great contributions to the city. But they also cause explosive population growth, exacerbating challenges relating to urban space, housing, employment opportunities and public services. These challenges slow down the integration of urban villages into the urban context. Luckily, these problems have been emphasised in the most recent planning documents, like the *New Urbanization Plan*, and through the improvement in environmental protection and transportation. It still

poses a great challenge for future planning of land use management and resource allocation, but the city continues planning for sustainability.

Chapter 5 is on basic services and local infrastructure in Shenzhen. By measuring success and fostering sustainable development for basic services and local infrastructures, this chapter proposes indicators for analysing the strategies, methods and technologies used for the sustainable provision of basic services, including energy, mobility and transport, water supply and Green Urban Infrastructures. Data in Shenzhen is compared to cities in a similar geographical and climatic situation (Hong Kong and in the city-state of Singapore) and cities in totally different situations with regard to political, geographical, cultural and climatic conditions (Berlin). Recommendations are made for energy efficiency improvement and renewable energy utilization, public transit promotion, increased water dependence and expansion of green urban infrastructures.

Chapter 6 focuses on the environment. Shenzhen encountered has many challenges in the process of rapid development, including environmental bottlenecks and pressures brought about by overpopulation, excessive expansion, and high density. This chapter addresses problems of land, resources, environment and population that have restricted the development of traditional enterprises. Shenzhen has constructed an eco-city. It includes energy structure adjustment and energy efficiency improvement, increase in the use of clean energies, reduction of carbon emissions, industrial transformation and upgrading, as well as green infrastructure system construction and green building promotion for achieving environmentally friendly development. The creation of Shenzhen eco-city relies on the integration of industrial policy guidance, employment of market price leverage, financial credit and transformation of traditional enterprises through technical upgrading.

Chapter 7 is dedicated to Shenzhen's culture and its modern story. Shenzhen developed from a cultural desert to a city of libraries, to a city with

abundant cultural institutions and resources including museums, libraries, theatres, concert halls and art galleries, in response to the needs of city residents and the booming tourism industry. However, in addition to this "high culture" aspect, this chapter also explores "culture" as the medium of daily human existence, like "language", which can more directly and deeply reflect the story behind Shenzhen's development over the years. With a special focus on "villages inside the city", considering life style changes of Shenzhen's original local farmers and immigrants, the issues of traditionality and modernity are discussed here. This makes Shenzhen a microcosm, indicating the way for the transformation of China from a traditional to a modern culture. Unlike economic development, the transformation of culture requires a much longer process, up to two or three generations, with more complex components that require patience and increased self-referential modification of its cultural worldview.

Chapter 8 discusses livelihood and social policies adopted in Shenzhen. In this chapter, a comparative analysis is made between Shenzhen, China and Toronto, Canada. These two cities were both originally regional market towns. Toronto changed from a conservative and protestant city to a large, diverse and global city after 1980 with booming immigration, as Canada's largest and one of the world's most diverse cities, while Shenzhen developed from Bao'an county to a sub-provincial city after the establishment of the Shenzhen Special Economic Zone in 1980, and ranked third in China for economic output in 2017, behind only Beijing and Shanghai. The difference in history, location, area, language, immigrants and indigenous people between Shenzhen and Toronto are compared in the chapter.

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Marco Kamiya and Ananda Weliwita

Chapter 1

The Global Value Chain In Shenzhen and the Pearl Delta Region

Pengfei Ni and Marco Kamiya

Introduction

Shenzhen is known as the Silicon Valley of China, and analysts say that it may soon be even more significant, since it combines not only software, as in its American relative, but also hardware capabilities. Shenzhen is the home of major Chinese corporations, such as Huawei, a global electronic conglomerate; Tencent, an internet company that has WeChat and QQ; BYD, an electronic and automaker giant; BGI, a company working on life science and genome research; DJI, a company producing drones and aerial technologies; SenseTime, working on Artificial Intelligence.

How did a small village in 1979 become a global technological hub? This chapter explains the ascent of Shenzhen in terms of opening-up, finance, governance and policy. More important is that this fast development has been made while monitoring urban planning and expansion, combining productive capacities with urban expansion in novel ways.

Stylized Facts

According to the Global Urban Competitiveness Report 2018-2019 jointly released by the Chinese Academy of Social Sciences and the United Nations Human Settlements Programme, UN-Habitat,

Shenzhen ranked fifth in the world in terms of economic competitiveness, and by country, China topped the ranking. The Global Innovation Index 2017 released by several agencies, including the World Intellectual Property Organization (WIPO), showed that Shenzhen was the second largest innovation cluster worldwide, after Tokyo and ahead of Silicon Valley. In four decades from 1978 to 2018, Shenzhen has risen from a poor remote fishing town to a global innovation metropolis and emerged from the bottom of the world's industrial chain to a leading position. Shenzhen has made world history with its rapid development. Its evolution is represented in the following aspects:

From an agricultural town with poor infrastructure to a modern metropolis

In terms of urban built area and environment development, Shenzhen used to be a small town with an area of 3 km² in 1978, which was expanded to 390 km² in 1979 and 1,997 km² in 2010. Before the reforms and the opening-up policy, Shenzhen was a barren wasteland. After 40 years it is now covered by green lands and well urbanized. Before the establishment of Shenzhen City and in the early days, Shenzhen had barely any infrastructure. Now, it has the world's foremost infrastructure as a global urban centre. By 2017, there were eight metro lines

with a total length of 285 km, making Shenzhen one of the top 10 global cities in terms of subway length in operation. Shenzhen is connected to more than 36 overseas cities by air. The handling capacity of Shenzhen Port has grown to 25.2 million TEUs (twenty-foot equivalent unit) containers per year, becoming the second largest port in the world for five consecutive years.

From a small town with 20,000 residents to a metropolis of tens of thousands of people

In terms of urban population and social development, Guangdong Province and its Baoan County saw thousands of residents flee to Hong Kong before the reform and opening-up. In 1978, the population of Shenzhen Town in Baoan County was about 25,000. In 1979, Baoan County was converted to Shenzhen City, with a permanent population of 314,000. Over the following 40 years, millions of young people and college graduates have migrated to Shenzhen. In 2018, the registered permanent residents stood at 12.5283 million, and the number of actual population served by local government exceeded 20 million. The urbanisation rate was 100 per cent. In 2017, the number of talents of various types exceeded 5.1 million, accounting for 40.7 per cent of the total permanent population. In 2017, the average age of the permanent population was 32.5 years, and

the main labour forces aged 15 to 44 accounted for 76 per cent. At the same time, urban residents' disposable income per capita rose from 1,915 yuan in 1985 to 52,938 yuan in 2017, a 26.6-fold increase in 32 years, registering an annual growth rate of 10.9 per cent (Figure 1).

From a small fishing town to a global technological centre

In terms of urban industrial and economic development, its GDP soared from 196 million yuan in 1979 to more than 2.2 trillion yuan, increasing 2,152-fold over 38 years with an average annual growth rate of 22.4 per cent. During the same period, GDP per capita grew from 606 yuan to 183,100 yuan, an increase of 56.3 times with an average annual growth rate of 11.2 per cent. In 2018, Shenzhen's GDP hit 2.42 trillion yuan, overtaking Hong Kong for the first time (Figure 2 and 3).

From 1979 to 2017, Shenzhen's total export volume grew from \$9.3 million to \$244.221 billion, up by 9,565-fold with an annual growth rate of 27.3 per cent over the last 38 years. In 1978, Shenzhen was a small traditional agricultural and fishing town. In 1979, it started to engage in processing and small production trades: that is, processing materials or given samples and assembling components.

Figure 1 : Population and its growth of Shenzhen over the last 40 years

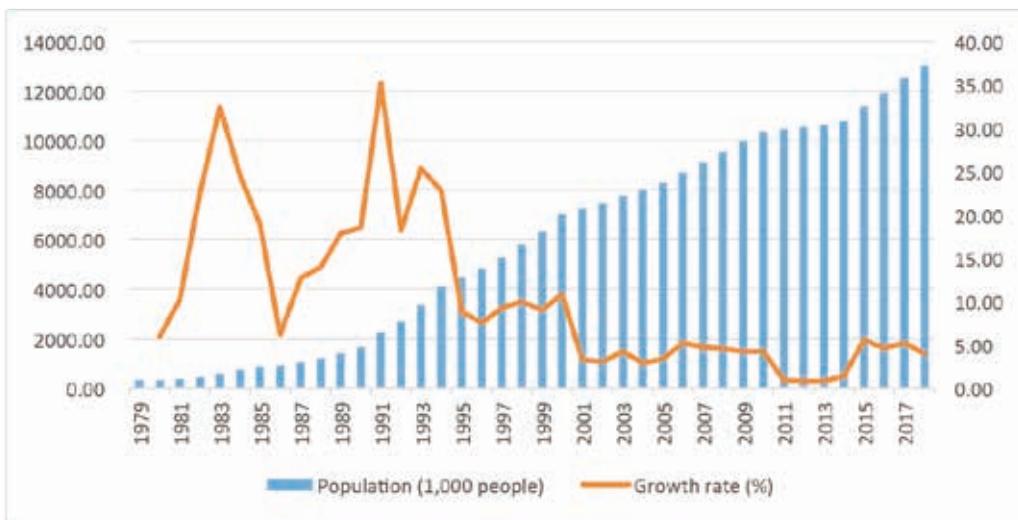


Figure 2 : Shenzhen's GDP and growth rate over the last 40 years

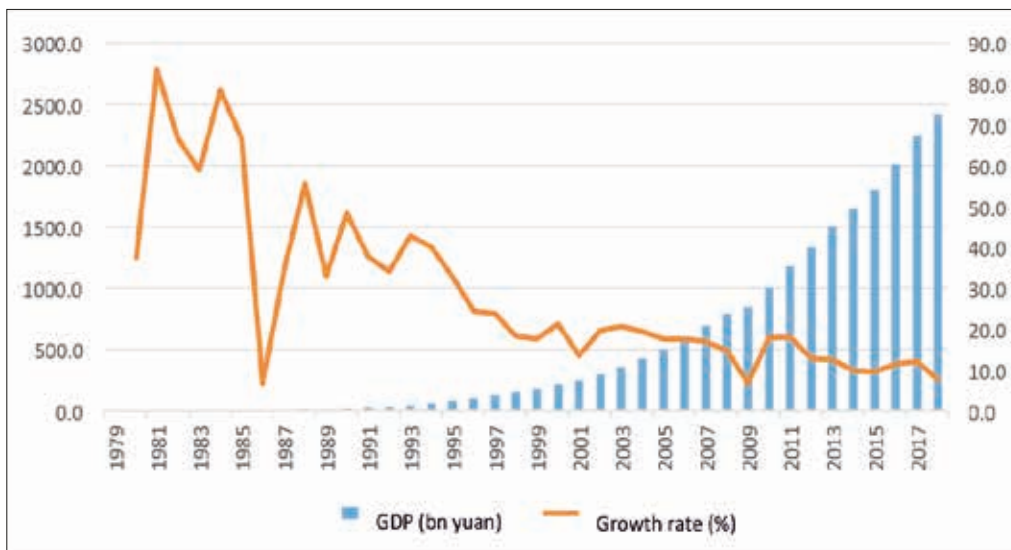
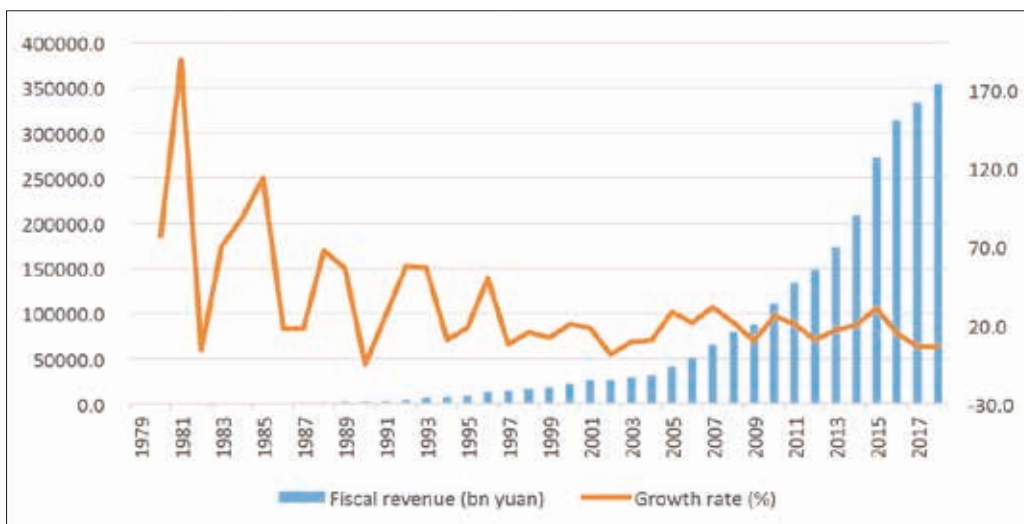
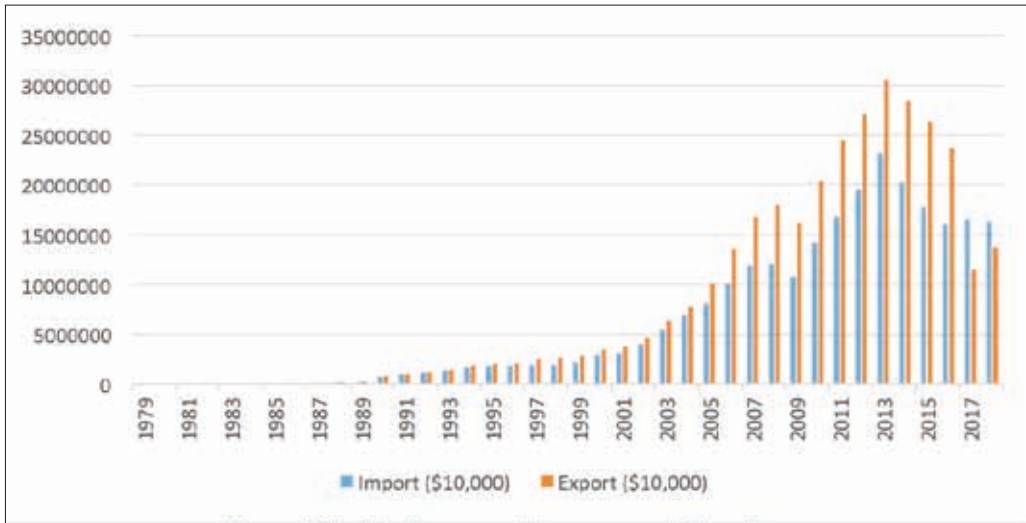


Figure 3 : Shenzhen's fiscal revenue and its growth rate over the last 40 years



In 2018, it became a regional financial centre, China's economic centre, and a global technological innovation centre. Starting from a handful of small-scale cotton mills and farming machinery maintenance and repair workshops, Shenzhen has grown rapidly to having 3.2 million burgeoning business entities, among which 1.88 million are enterprises and 12,000 are state-level high-tech enterprises. In 2017, the city produced 381,230 times more microcomputer equipment than in

1983, and 4,260 times more integrated circuits than 1983. All the products are of high technology value. Shenzhen is home to seven Global Top 500 companies such as Huawei, Ping'an, Tencent, Vanke and Evergrande. Huawei, Tencent and DJI have grown into internationally reputable tech companies. The city is capable of manufacturing world-leading high-tech products, such as mobile phones, wearable devices and high-end medical apparatus and instruments, enabling people across

Figure 4 : Shenzhen's export and import over the last 40 years

the world to experience the exciting life created by technologies.

From a small country town to a national economic and technological powerhouse

In terms of city status and influence, Shenzhen leads the development of Chinese cities and spearheads the progress of the whole world. First, Shenzhen has directly pushed the establishment of a national system of market economy and opening up on all fronts by expanding and replicating the original reforms that were then piloted in other regions across China. The city's successful experience and development philosophies have inspired China and the entire world to change their mentality regarding development. Second, a substantial part of wealth created by Shenzhen goes to the government in the form of taxation, and to migrant workers in the form of wages, supporting national economic growth, development of the hinterland and the prosperity of millions of households. In 2018, revenues from the general public budget of urban areas under Shenzhen's administration reached 910 million yuan, ranking first among cities of the Chinese mainland. This revenue accounted for 5 per cent of the national total. Third, as Shenzhen's economy grew further, its industries expanded and were transferred to neighbouring regions and

hinterland cities, directly spurring their economic take-off. Fourth, with its economic development and technological innovation, Shenzhen has fostered millions of technicians, entrepreneurs and innovation makers, some of whom went back to their hometowns or other regions, driving the development and innovation of more areas. In 2017, patents filed according to the patent cooperation treaty (PCT) by Shenzhen accounted for 43.1 per cent of the national total, making it the city filing the most PCT patents in China for 14 consecutive years.

Since the introduction of the reform and opening-up policy, the number of China's mainland cities has grown from 193 in 1978 to more than 650 in 2018, and towns from more than 2,000 to some 20,000. From the five special economic zones in coastal areas including Shenzhen in the 1980s to more new economic zones and experiment zones, impressive achievements have been made. Shenzhen does not parallel many other cities in terms of economic foundation, production factors, historical culture, and environmental capacity, but it still created an economic powerhouse and realised sustainable high-speed growth and rapid transformation in economy, society and environment.

Theoretical Framework

Based on the theoretical frameworks of economic growth theory and development economics, this research incorporates the unique variables of China's urban development and the characteristics of globalization and concludes with the driving forces, mechanism and model of China's urban development economics. The four engines that interact in the design and rise of cities in China are: (1) Institutional innovation, (2) the gathering of non-agricultural sectors, (3) the global division of labour, and (4) city governance; those are forces that compete with each other in deciding the rise of cities and shaping the urban landscape of China.

As a base, the reform to establish a market economy formalises the rights and responsibilities of economic entities and the way of resource allocation, providing basic momentum and conditions for the rise of cities. The global division of labour brought by multinational enterprises injects external vitality into the process. The gathering of non-agricultural sectors as a result of the inflow of rural labour surpluses accelerates the process. City governance and finance by the municipal governments provide unique power for the rise of the cities (Figure 5).

In general, the four engines have a joint impact: the reform to establish a market economy creates conditions and driving forces for the other three engines to unleash their power; the engine of rural labour surpluses transmits its energy in tandem with multinational enterprises and city governments; multinational enterprises have to work in tandem with the rural labour surpluses and city governments; the city government can play its role only when combined with the rural labour surpluses and multinational enterprises; the reform to establish a market economy attracts global capital, technologies and markets, and the unlimited supply of China's rural labour surpluses, land and business environment, which jointly prompt rapid industrialization and urbanization in China.

The engines play different roles at different stages to promote the transformation and upgrading of cities.

Figure 5 : Economic model of Chinese urban development



Rural surplus labour first powers the development of urban labour, then it is powered by capital from global enterprises, then by local land and environment, and lastly by talents and people.

Precisely, the interplay between the four engines follows a general law, but due to different realities in different cities, it shows particularities. Shenzhen implemented a special economic zone system and took the lead in reform. On the one hand, its market economy and globalisation level were enhanced rapidly. At the early stage of development, it jumped over the stage of rural industrialisation and small-scale urbanisation straight into the stage of export-oriented development fuelled by the engine of multinational enterprise. The urbanisation of Shenzhen was driven by export-oriented industrialisation. Next, resource scarcity and soaring costs forced development to bypass the stage where the economy is driven by land and capital and move into the stage of innovation-driven economic growth where high-end talents play the leading role.

Analysis of the Success of Shenzhen

Over the 40 years from 1979 to 2019, following the laws of urban development and giving full play to the interaction of the four development engines, Shenzhen has created a miracle in which a traditional small agricultural and fishing town has risen to a global technological centre.

Labour-intensive development: joining the global industrial chain from the bottom (1978-1992)

From 1979 to 1992, the Shenzhen Special Economic Zone was in its early days. The processing and compensation trade with Hong Kong, the inflow of population from the Chinese mainland and the large-scale land development enabled Shenzhen's urbanisation and industrialisation to expand drastically. Shenzhen made its name across the country due to its speed of growth. It also joined the global industrial chain. In this period, the dominating driving forces were labour and institutional innovation. This stage featured innovation in the economic system, an inflow of population, infrastructure construction and the development of the labour-intensive and export-oriented economy. The interplay between the four engines is shown as follows:

Reform and opening up and political trials in Shenzhen create institutional conditions for its rapid growth

Against the backdrop of China's reform and opening up, Shenzhen managed to unshackle the chain of planned economy guided by market economy principles and took bold measures in reforming the systems of pricing, payment, land and housing, infrastructure construction and labour employment by establishing a special economic zone.

In 1987, the Shenzhen Municipal Government issued China's first Interim Provision concerning Encouraging Technology Personnel Starting Private Technology Companies. The document encouraged

high-tech talents with patents or management expertise to become shareholders. Ren Zhengfei, now chief executive officer of Huawei, took the opportunity and founded the company, which has grown to be a world-leader. As early as the 1980s, Shenzhen issued the Shenzhen Science and Technology Development Plan 1999-2000, formulating policies supporting high-tech industries.

The large-scale industrial layout by Hong Kong businesses creates favourable conditions for Shenzhen's rapid growth

Amid global industrial restructuring, enterprises from Hong Kong broke down industrial chains and brought labour-intensive chains to Shenzhen in the form of processing and compensation trades, turning Shenzhen into a processing powerhouse as they pushed the transfer of capital, technology and management expertise here. In 1992, Shenzhen began to liberalize manufacturing. The processing and compensation trade enabled Shenzhen to join the global industrial value chain from the bottom. In the beginning, it mainly manufactured primary industrial products. The global value chain Shenzhen joined was for advanced electronic and information industry, and then Shenzhen chose a pivotal starting point for its path toward technological innovation and making high-end tech products.

The inflow of migrants provides labour force conditions for Shenzhen's rapid growth

In 1979, 20,000 engineers were dispatched to Shenzhen, starting the process of massive inflow of labour forces to the city. In 1989, one million migrant workers went to Shenzhen. In 1979, the number of people on the payroll in the city was only 139,500, and the figure reached 1.759 million in 1992. The share of the labour force between 15 and 59 years old increased from 58.4 per cent in 1982 to 88 per cent in 1990. However, a 1990 sample survey showed that the labour force with high school education and lower accounted for as high as 65 per cent of the total labour population. Labour force, especially the migrant workers, flowed to Shenzhen for non-agricultural jobs. They provided the most critical



A drone from Shenzhen DJI @SZAICE

condition for the city to develop labour-intensive processing and compensation trade. “Shenzhen people” from across the world and of different backgrounds were enterprising and adventurous. They injected the genes of cultural inclusiveness and entrepreneurship in Shenzhen and sowed seeds for local people to be original and visionary.

The basic hardware and software urban environment provide conditions for Shenzhen’s rapid growth

Taking advantage of its proximity to Hong Kong, Shenzhen Municipal Government went to great lengths for and gave full play to favourable policies in terms of taxation, land, finance, and foreign trade and created a low-cost business climate. On the other hand, it gave full scope to the institutional innovations of compensation for land use and housing construction. With wealth from land, the city was able to launch large-scale land development and urban infrastructure construction, creating the spatial vehicle for urban development. At the same time, the local government used foreign investment and adopted a market-oriented approach to urban development and operation. In this way, infrastructure projects like ports, wharves, power supply, roads and telecommunication facilities were established in a fast and efficient manner. The rapid

improvement of the urban environment attracted the inflow of foreign investment and labour forces, which combined to push the city to develop.

During this period, Shenzhen took the lead in reform and opening up, providing the public framework, human resources and business development with far better powers and conditions than other cities. At the same time, it managed to attract the massive labour surplus in rural areas and foreign investment for technology projects to gather in the city and realized exploding growth and the goals in the early stage of development. The development scale also took shape.

Capital-intensive development stage (1992-2002), moving up to the lower medium position of the global industrial chain

In 1992-2003, Shenzhen entered a new stage for entrepreneurship. With improved urban infrastructure and functions, Shenzhen rapidly upgraded industrialisation and urbanisation. It climbed from the bottom to the lower middle position of the global industrial chain. At this stage, the dominating factors fostering development were the capital and institutional innovations. The distinctive features of this stage are the building

of a market economy, continuous inflow of labour forces, the construction of supporting facilities and the transformation of export-oriented development. The interplay between the four development engines is shown as follows:

The establishment of the “socialist market economy” a-la-Chinese, provided indigenous development power and attraction for foreign investment

Shenzhen gave full play to its favourable conditions as a pilot for reform and opening up. By 1997, it established a socialist market economy featuring ten systems, the first of its kind nationwide. They include the establishment of the modern corporate system, deepening reform of the management system for state-owned assets, the reform of commerce circulation system, the improvement of the labour market, the establishment of a property trading market and institutional innovation in the financial sector. In the 1990s and 2001, Shenzhen issued further regulations concerning ‘Supporting High-Technology Industries and the decision concerning ‘Accelerating the Development of High-Technology Industries’. The documents formulated a set of policies for promoting the development of science and technology and building several high-tech industrial parks, creating a high-quality service system for the development of high-tech sectors.

The transfer of electronic and information industries provided conditions for Shenzhen’s rapid development and transformation

In this period, the global restructuring of electronic and information industries provided investment, technologies and a vast international market for the city to upgrade labour-intensive processing and compensation trade to capital-intensive and technology-intensive advanced manufacturing. As a result, the manufacturing of electronic and telecommunication devices expanded rapidly in Shenzhen, moving the city up to the lower middle position of the global industrial chain. Thanks to spillovers from multinational companies’ investment and technology, the locally grown high-tech industries, modern logistics and financial services

began to thrive. In 2012, the manufacturing of telecommunication devices, computer and other electronic devices accounted for 56.1 per cent of the gross industrial output above the designated size, up by 25.3 percentage points from 1993. The output of high-tech industries totalled 1.29 trillion yuan. Among them, the value of high-tech industries with independent property rights accounted for 61.0 per cent, 10.8 percentage points higher than 2000.

The constant influx of labour forces and improving structure provided human resource conditions for Shenzhen’s fast growth and transformation

Payroll employment figures expanded from 1.759 million in 1992 to 7.712 million in 2002. The population with only primary school education or lower dropped significantly, whereas the number with college education surged. People without permanent residency moved out of the city in large numbers, and the population growth rate of this group declined from 28 per cent in 1994 to around 10 per cent between 1995 and 2000. At the same time, Shenzhen eliminated restrictions of nationality, residency, identity and organisational affiliation among them to attract high-end talents, research institutions and educational facilities, enabling Shenzhen to obtain high-end factors of production without incurring extra expenses. Shenzhen obtained significant production factor support for its industrial transformation and upgrading.

The improved infrastructure created environmental conditions for Shenzhen’s rapid development and transformation

The local government continued to bring in foreign investment and increase fiscal revenue from land sales in a bid to improve a wide range of supporting infrastructure and primary city functions. As a result, the city’s governance capacity was enhanced, satisfying the demands of its high-speed development and attractiveness for investment and talents. In 2002, Shenzhen established a modern traffic network. There were 54 landline phones and 120 mobile phones for every 100 people. At the same time, public facilities had been well-built. The

built-up area citywide reached 495.3 square km, and the special economic zone was 168.1 km². The green space per capita was 14.9 mt². The treatment rate of domestic sewage expanded to 61 per cent. The average ambient noise level was maintained at 56 dB. Shenzhen received the International Garden City Award in 2000 and the China Human Settlements and Environment Award in 2001.

In conclusion, the socialist market economy system Shenzhen built first provided better powers and conditions than other regions for local government, human resources and business development. The increasing promotion of the hardware and software environment of the city attracted massive inflows of skilled labour and investment for technology projects. The incoming technology-intensive investment and global market fuelled continuous high-speed economic growth and rapid economic transformation and upgrading of Shenzhen. Global investment was the major driving force for its economic development and transformation during this period.

Soaring land cost forcing economic transformation (2003-2012) and moving up to the middle of the global industrial chain

From 2003 to 2013, Shenzhen had to adjust its policies due to radical economic transformation. On the one hand, with the reform and opening-up carried out nationwide and the modernisation drive entering a new era, Shenzhen no longer enjoyed the institutional and policy dividends. On the other hand, its advantages in four aspects of the development environment had disappeared. They were land and space, energy and water resources, the rising population, and the capacity of the environment. Shenzhen had entered a transformation stage where the economy slowed down, and innovation gained momentum to spur development. The dominating driving force in this period was the rising cost of land and scarcity of resources. Under this new scenario, local industries entered the transitional stage from lower and middle level to the middle and higher end of the global industrial chain. The interplay of the four growth engines is shown as follows:

Shenzhen added new strengths by going global to increase the level of attractiveness of the city

On one side, as the socialist market economy system was established nationwide and the reform and opening up on all fronts came into being, Shenzhen no longer had the dividends generated by institutional innovation. On the other hand, the corporate income tax for domestic and foreign enterprises was unified at a rate of 25 percent, ending the last preferential policy given to the Shenzhen Special Economic Zone. Because of this, Shenzhen began to explore new institutional innovation. At the basic institutional level, it kept in alignment with practices of leading international cities to deepen administrative reform, establish service-oriented government and encourage innovation while tolerating failures. In terms of industrial policies, it mapped out blueprints for strategic emerging industries and introduced policies to boost bio-industry, as well as Internet-related sectors, new energy, new materials, culture and innovation and a new generation of information technology among others. These new institutions and policies created conditions for the gathering of innovation factors and the growth of high-tech businesses.

The indigenous growth of private high-tech businesses formed industrial clusters and pushed challenging industrial transformation

On the one hand, due to the rising cost and contraction of the international market, the previous capital-intensive industries oriented towards the international market lost their advantages. On the other hand, utilizing the spillover of knowledge and technologies, some local enterprises multiplied and formed an industrial cluster. They survived and became significant market players by imitation and innovation. As the city shifted gear from old economic growth engines to new ones, it saw a slight slow-down of the economy, with the GDP growing 16.8 per cent annually on average. Despite this, high-tech industries in Shenzhen grew rapidly, the financial service sector consistently occupied the top three positions nationwide, modern logistics represented by supply chain, logistics and e-commerce thrived, and cultural industries boomed.

Slowing down the influx of labour forces with an improving structure supported economic transformation

On the one hand, the figure for payroll employment rose from 4.223 million in 1993 to 7.712 million in 2012. The figure for 2017 was 9.433 million. The influx of the labour force slowed down. On the other hand, the quality of the labour force was improving. The share of the population with college diplomas increased from 8.38 per cent in 2000 to 17.8 per cent in 2010. The average years of schooling grew from 9.77 years in 2000 to 10.81 in 2009. More important, Shenzhen citizens were made up of people from across China and the world who were enterprising, adventurous and open-minded, so shaped a culture of innovation, inspiring waves of people to start up businesses and undertake entrepreneurial adventures.

Disappearing advantages in terms of land and resources forced Shenzhen to foster new momentums of innovation

After previous high-speed growth, Shenzhen saw an ongoing decline in land available for development. The land cost continued to soar. The per capita freshwater volume was only one-fourth of the national average, making Shenzhen one of the seven Chinese cities with a severe water shortage. The ballooning population aggravated city issues like environmental pollution, traffic congestion, and worsening public safety. To address them, Shenzhen encouraged market competition and formulated and implemented rules on company entries, forcing the high-polluting and high energy-consumption industries to transform and relocate their businesses. On the other hand, Shenzhen continued to improve its urban infrastructure and ecological environment to attract high-end industries.

In this period, the local government addressed the disappearance of institutional and policy dividends and the bottleneck of environmental capacity by forcing businesses to take a new path of fast growth driven by innovation. On the other hand, Shenzhen assumed the mission of piloting new practices and

spearheading development. It explored innovative systems and policies to forge a new road for industrial transformation and upgrading. At the same time, the innovation culture fostered in the formation of a migrant city, the spillover of knowledge and technology brought by the export-oriented economy, and the innovation based on imitation in line with real conditions enabled Shenzhen to gradually move toward innovation-driven development in the throes of transformation.

The stage of innovation-driven development (2013-2018), moving up to the high reach of global industrial chain

From 2013 to 2019, Shenzhen successfully entered the stage of innovation-driven development. With the improving urban infrastructure and functions, the building-up of institutional software and hardware environment, and the reinforcing cycle of innovation ecology, Shenzhen began to move up to the middle and upper reach of the global industrial chain. The dominating development engines in this period have been talent and innovative institutions. The period is characterized by the gathering and combination of an innovative economic system, innovative capitalization, and innovative talent, as well as supporting infrastructure and a favourable living environment. The interplay between the four engines is shown as follows:

Institutional innovation that supports technological innovation adds powers and attractiveness to Shenzhen

At the institutional level, the city has started a higher level of innovation since 2013 by implementing trial measures and practices in four aspects of establishing a high-level socialist market economy system, service-oriented government, institutions for independent innovation and institutions for energy-saving and environmental-friendly society. At the policy level, the government introduced institutions and measures to spur business start-ups and investment, attract various professionals, and build systematic policies for technological innovation. Innovative systems and policies

motivate market entities to engage in innovation, and accelerate the gathering of global innovation resources in Shenzhen so that the city forms a new innovative industrial cluster that further attracts global resources.

Innovative investment enabled rapid growth of high-tech industries, moving Shenzhen to the upper reaches of the global industrial chain

The supporting financial sector for technological innovation continues to improve, spurring mushrooming private tech companies. The private equity industry has boomed. In 2017, Shenzhen had 4,377 registered private equity firms, accounting for one-fifth of the national total. The firms managed 12,143 funds with a valuation of some 1.7 trillion yuan. Venture capital was on the rise. From 2012 to 2017, the number of state-level high-tech enterprises increased 3.9 fold, reaching 11,230. The added value climbed from 413.524 billion yuan in 2012 to 735.969 billion yuan in 2017, registering an annual growth rate of 12.2 per cent. Its share in GDP was elevated to 32.8 per cent. The investment of private tech firms bolstered the growth of private high-tech enterprises and further supported them to move

upmarket and go global. From 2013 to 2017, R&D expenditure rose by 14.9 per cent annually. Its share in GDP grew from 3.67 per cent in 2012 to 4.35 per cent in 2017, leading the world in R&D expenditure. In this period, more than 2,000 Shenzhen-based companies invested in more than 120 countries and regions worldwide. Companies holding independent property rights like Huawei, ZTE, CIMC and BYD, had established business networks across the globe in areas of technological innovation, production outsourcing, business expansion and marketing services. Shenzhen genuinely moved to the upper reaches of the global value chain.

Innovative talent continues to grow and unleash capabilities of innovation to be the core engine of development

From 2012 to 2017, payroll employment in Shenzhen grew from 7.712 million to 9.433 million, registering a slowing down in the rate of increase. However, with more talent brought in and cultivated by the city, the total number of professionals in Shenzhen exceeded 5.1 million, accounting for 40.7 per cent of the total permanent residents. At the same time, local research institutes and education



Successful Case Studies

Case 1: Wu Yongmou - from a migrant worker to forerunner of service robots

Over the past 40 years of an economic take-off, Shenzhen witnessed one success story after another about individuals and the city. Wu Yongmou, founder and president of YYD Robo Co., Ltd., grew up with Shenzhen. From a migrant worker to an entrepreneur in the sector of artificial intelligence, he is a legendary example of how business people achieved success in this fertile land of Shenzhen.

Starting as a migrant worker

Wu Yongmou, born in 1977, grew up with Shenzhen and made his fortune in the city

In the summer of 1993, Wu Yongmou, a high school graduate, came to Shenzhen from his hometown of Jinjiang, Fujian Province, with only 200 yuan, embarking on an entrepreneurial adventure that changed his life. The first job he had was as a porter. One month later, he was working as an apprentice in a factory, starting to acquire knowledge of radio transmission analogue signal technology. He also helped the Japanese master with some trivial work. The master was in charge of workshop management and techniques in the factory and had extensive experience. Wu Yongmou took care of his master in a meticulous way, and thus found favour in his eyes. The master taught Wu everything from mobile phone production process to plant management procedure, knowledge of mobile phone components and corporate culture. Due to his poor education, he had to teach himself the primary level of higher learning and learned techniques from the master. He got up early and worked until late at night. For three years in a row, he barely had weekends or vacation. Thanks to the unremitting efforts of four years, he was promoted to a senior manager from an

apprentice, and his monthly salary rose from 200 yuan to more than 2,000 yuan.

First entrepreneurial endeavour

In 1997, Wu Yongmou, with the 28,000 yuan he earned as a migrant worker as the initial capital, went to Shenzhen seeking entrepreneurial opportunities. Relying on his accumulated professional knowledge, Wu won his first order – manufacturing precision bracket components. Starting from this product, he gradually diversified the range of production, and made the first fortune of his life. In October 1997, he founded Shenzhen Yongyi Electronics Co., Ltd. to engage in OEM production of mobile phones. Wu Yongmeng, at 20, realised his dream of becoming a boss. In its first year, Yongyi Electronics earned 1 million yuan. In 2004, Wu earned 100 million yuan for the first time in his life. In 2005, the sales revenue amounted to several million yuan, and the company expanded to employ several thousand people. Wu established Yongyida Industrial Park and bought shares of Tiancai Holding Co., Ltd.; a company that specializes in making sports cameras and intelligent hardware. Wu's investment enabled the rapid growth of Tiancai, which is firmly established as a sports camera maker with a massive shipment volume.

Entrepreneurial setback

Business prospects are unpredictable. The financial turmoil in 2008 severely hit Wu's mobile phone factory. The factory manufacturing functional components for mobile phones required technological upgrading. As a result, the order volume shrank, and the factory scale had to be reduced from 5,000 employees to 1,000. Four factories had to be shut down. Wu Yongmou was confronted with a daunting challenge in his entrepreneurial adventure.

Starting again with innovation

In 2014, Wu Yongmou was keenly aware of the promising prospect of artificial intelligence and established YYD Robo Co., Ltd. He recruited the best engineers for R&D of service robots. At the end of 2016, YYD Robo Co., Ltd., with its excellent technical strength and rapid response capabilities, stood out from its rivals and won the bid of a multi-million-dollar order of manufacturing service robots from LG. Since then, the company established its stronghold in the market. Over the following years, YYD Robo Co., Ltd. continued to invest heavily in robot R&D. It established an R&D team of more than 200 engineers, who have filed more than 200 patents, 75 of which are invention patents. The team also created a range of outstanding service

robot products, making the company a leader in the field of service robots.

From manufacturing mobile phones to sports camera, and then robot R&D, Wu Yongmou succeeded in business transformation. The background was the pivotal period when Shenzhen advanced technological innovation for industrial transformation and upgrading. Millions of enterprising businesspeople like Wu Yongmou fulfilled their personal ideals and life values with an acute sense for business opportunities and high quality of execution. Their endeavors also pushed the city to change and evolve. His story of business success is indicative of the outlook of Shenzhen people who are aggressive, risk-taking, enterprising and innovative.

Case 2: Konka - from an OEM factory to a holding company and industrial platform

Konka is the first joint venture electronic maker established after China's reform and opening up. In Shenzhen, the frontline of the reform and opening-up, Konka witnessed the remarkable accomplishment the policy brought, and achieved major goals itself. From a pure home appliance maker at the beginning, Konka has grown to be a holding company offering an industrial platform across industries via investment, acquisition and merger.

The first joint venture in electronics manufacture

On March 15, 1979, Guangdong Provincial Administration of Overseas Chinese Farm signed an agreement with Hong Kong Wah Electronics Co., Ltd. on jointly establishing Guangming Overseas Chinese Electronics Factory in Beijing. Following that, returning overseas Chinese and their families worked in processing tape recorders with given materials and samples. In the first year, the factory made

a net profit of 830,000 yuan, becoming the first Chinese company using foreign investment to succeed. On November 6, in line with the guiding principles of the central leadership of the Communist Party of China, the joint venture agreement on Guangdong Guangming Overseas Chinese Electronic Industry Co., Ltd. was signed in December the same year. China's first joint venture electronics enterprise came into being.

Processing with given materials and being an Original Equipment Manufacturer (OEM)

In May 1980, Guangming Overseas Chinese Electronics Factory was put into operation in Shahe Industrial Area of the Shenzhen Special Economic Zone, mainly making recorders, colour TV sets, sound sets, calculators, electronic meters and other electronic products. In the beginning, the factory was aware that it could earn only marginal commissions and be controlled by others in the market if it remained an OEM forever. Therefore, it named its products Konka. Thus, May 21, 1980, was made the birthday of Konka. In that year, Konka manufactured 304,000

sets of movements for tape recorders, earning foreign exchanges of 1.12 million yuan and a net profit of 830,000 yuan.

From an OEM to an independent brand holder

As Konka recorders made its name in the market, the company aimed at an emerging industry with higher technology content – colour TV set making. First, it accumulated technology and capital by processing movements of colour TV sets for Hong Kong partners. On December 31, 1987, China's ministry of machinery and electronic industry then granted Konka permission to manufacture colour TV sets for the domestic market. The company thus achieved an overall business upgrade. In 1990, Konka established a technology development centre, becoming the first company in the sector to do so. In 1992, Konka went public on both China's A and B shares. Later, it bought out the shares of Hong Kong Wah and turned itself into a state-owned enterprise. In 1993, Konka expanded northward and purchased Mudanjiang River TV Sets Manufacturing Factory in Heilongjiang Province. It launched another brand of Mukang and began to expand nationwide. In 1997, KONKA was recognized as an outstanding Chinese brand, the first of its kind in Shenzhen and Guangdong Province. Seizing opportunities in the 1990s, a time of awakening Chinese consumerism, Konka built its foothold in the Chinese market with the strength of its low prices. In 1999, it took up the largest market share of colour TV sets in China and become the first locally grown company in Shenzhen with a valuation exceeding 10 billion yuan.

Strategic upgrading and pursuing asset-light development

Starting in 2007, the colour TV industry saw the emerging of liquid crystal display (LCD)

screens. Major TV makers increased inputs on R&D, and tech firms also made forays into the colour TV set manufacturing sector, causing the industry to reshuffle. At that time, Konka failed to respond promptly, and its home appliance making went into a recession. At the same time, its management was unstable, suffering from frequent changes of officers. The immediate result was the record revenue loss in 2015. The annual financial statement of the company showed that the net loss of shareholders of Konka's listed companies was as high as 1.257 billion yuan. The revenue was down 2,488.32 percent year on year. The corporate cohesion, employee morale, product planning strategy and operational efficiency were all severely affected.

Konka re-established a senior management team and adjusted the product mix. After more than one year of effort, it managed to overcome its loss making. At the same time, in the face of the latest development of the colour TV industry, and amid national economic transformation and restructuring as well as promotion of innovation-driven development, the company began to seek its transformation to build itself into an asset-light holding company as a platform for multiple industries. It set a clear development goal, combining technology with industry and urbanization, took consumer electronics as the base of the business and gradually upgraded to strategic emerging industries and expanded to a science and technology industrial park, internet and supply chain management. Four business clusters of science and technology industrial park, products and businesses, platform service, and investment and financing have taken shape and grown in a coordinated manner. With the acquisition of and investment in high-tech firms, Konka has made steady progress towards building new growth momentum and attaining diversified business expansion.

Case 3: Shekou Industrial Zone - the frontier of Shenzhen's reform and innovation

Shekou Industrial Zone in Shenzhen was the first to implement the reform and opening up policy across China. The famous slogan, "Time is money and efficiency is life," was born here. The zone has been the frontier of Shenzhen's reform and innovation ever since. Formerly occupying an area of 1.24 square km, it has gradually expanded to 10.85 square km, gathering companies engaging in processing and compensation trades and giving birth to present global top 500 companies like China Merchant Bank, Ping An Group and Huawei, among others. In 2014, the zone was included in the Guangdong Free Trade Zone and is expected to spearhead a new round of reform and opening-up.

Shekou model, the "test tube" of reform and opening-up

In an inhospitable wasteland, the Shekou Industrial Zone was born in 1979. It is the first processing industrial zone for exports in the Chinese mainland and was dubbed the "test tube" of reform and opening-up. In a real sense, China's economic reform started from here. Before 1990, Shekou Industrial Zone had autonomy in terms of personnel, finance, assets, and public security and the authority to pilot institutional innovation and reform. It was the first nationwide company to implement a recruitment system for government officials, bonus system, project bidding practice, commercial housing and rental system, social security system, and shareholding system and other reform measures. After the trial in Shekou, the practices and systems were expanded to Shenzhen and other regions in the country. These reforms were dubbed the Shekou model, generating far-reaching impacts.

Pursuing high-end industrial development to rebuild Shekou

In 1990, Nanshan District of Shenzhen was established. Shekou Industrial Zone seized the historic opportunity and proposed to return powers that were supposed to belong to governments so that it could focus on the management of businesses. The zone found its new role. Based on its previous development, Shekou could not continue to thrive with a labour-intensive industrial structure. In 1995, the zone started a massive round of industrial adjustment. After clean-up campaigns, the zone pulled out of its investment in more than 100 companies engaging in labour-intensive industries with low added value and explored moving up to the middle and upper reaches of the industrial chain. By 2002, after rounds of industrial integration, Shekou Industrial Zone re-defined its business structure, forming a new industrial landscape with real estate and logistics as the core industries and high-tech and industrial park services as the main lines of business.

Upgrading the industrial structure and pursuing innovation-driven development

From 2003 to 2013, a raft of measures was introduced to push the industrial upgrading of the Shekou Industrial Zone. Previous low- and middle-end companies were moved out to make space for new planning and renovation, which focused on R&D centres of the global top 500 and other research institutes. In 2009, Shekou Industrial Zone invested 60 billion yuan to rebuild the zone with a primary goal of establishing a high-end industrial structure dominated by Internet information, technology services and cultural innovation. In 2010, Shekou Internet Valley came into being, gradually gathering Internet firms, Internet of Things, and e-commerce companies to form a platform for industrial transformation.

Building the free trade zone to explore the road for deepening reform

On December 26, 2014, Shekou was included in a free trade zone as part of a national development strategy. With an area of only 13.4 square km, Shekou once again stood on the frontier of China's reform and opening-up. It had to upgrade itself from secondary industry to the tertiary sector via innovation. With its unique strengths, China Merchants Group aimed to build Shekou into a bridgehead, hub port and starting station along the 21st Century Maritime Silk Road, and an essential gateway for the Shenzhen Bay Area. Shekou is now building three strategic platforms of an international hub port, urban transformation and upgrading and financial innovation and development. As it was included in the free trade pilot zone, Shekou will implement the rule of law and financial innovation from other free trade zones across

China. These two features are also the source of the strongest future competitiveness of Shekou. By stepping up efforts in institutional innovation, the establishment of an international hub port, urban transformation and upgrading, and financial development, Shekou strives to become the unique free trade zone in China and make a new contribution to national reform and opening-up by exploring new models. In the future, Shekou will no longer be a single industrial zone. It has been redefined as a free trade zone with distinctive characteristics, as well as a brand new commercial and business district that is suitable both for businesses and residents. Its industries will cover shipping logistics, finance and securities, real estate, hospitality, industrial manufacturing and high-tech industries, among others, with businesses spreading across China, Hong Kong and overseas markets. It will once again be at the forefront of China's reform.

facilities expanded rapidly. In 2017, Shenzhen had 4,296 research institutes, 7.1 fold the level of 2012, registering an annual growth rate of 47.9 per cent. Key laboratories incubating innovation reached 1,688, 2.2 times that of 2012, registering an annual growth rate of 17.3 per cent. Schools of higher learning numbered 12 in 2018. In a favourable environment for innovation, the large volume of innovative talent unleashed massive energy of innovation. In 2017, Shenzhen filed more than 20,000 PCT patents, 2.5 times that of 2012, ranking fourth after countries including the United States and Japan.

Shenzhen established infrastructure and an ecological environment distinctive to innovative cities to attract factors for innovation in support of innovation-driven development

While continuing to force high-polluting, high energy-consuming but less productive enterprises to transform and transfer, Shenzhen gave priority to the building of a hardware environment for

innovation. First, it built a smart city, and established an efficient intensive supporting system of information infrastructure, and the system for information sharing and big data application. Second, it built an ecologically friendly city. In 2014, Shenzhen issued the decisions concerning Pushing Forward the Building of Ecological Civilization of Beautiful Shenzhen. According to the document, Shenzhen will have been established as a state demonstration city for ecological civilisation and typical beautiful city in China by 2020. It will launch three initiatives for promoting the atmospheric environment, water environment and green urban landscape. In 2017, energy and water consumption for GDP per 10,000 yuan continued to decline to one third and one-tenth of the national average. The PM_{2.5} concentration dropped to 26 microgram per cubic meter. It worked to build Shenzhen into a garden city with a public green area per capita exceeding 17 square meters. The environment effectively attracts and keeps innovative talent and supports the operation of sophisticated, innovative activities.

In this period, by successfully carrying out the transformation to innovation-driven development, Shenzhen attracts the gathering of high-end innovation factors, like global investment, talent and technology, by further creating and fostering institutions and policies for the innovative economy and new advantages of ecological environment. It also enables the combination of innovative technologies and entities in industrial activities to achieve innovation-driven economic development of a larger scale and higher level.

In sum, the fundamental driving forces for Shenzhen's leapfrogging development from a fishing village to a technological centre are as follows: Ongoing deepening opening-up creates conditions for the massive inflow and effective use of external production factors. Continuous institutional advantages attract external resources for development and innovation, and create conditions for the combination of production factors and unleashing of driving engines. The improving hardware environment creates conditions for urban development and innovation, and forces the city to keep on developing and innovating. By actively participating in and taking full advantage of fierce market competition, Shenzhen forced itself and market entities to evolve and regularly upgrade.

Experience and Inspirations

With neither resources nor production factors, Shenzhen made leapfrogging development from a remote country town to a global technological centre and from an agricultural town to a manufacturing powerhouse over a period of 40 years. From the development stage featuring rapid quantitative growth driven by production factors to the throes of transformation when the economy slowed down and the growth engine shifted gears, and then the stage when innovation-driven, high-quality development was pursued, Shenzhen showcased the whole process of how a city joins the global value chain and moves from the bottom to the highest rank, making itself a role-model in promoting competitiveness for global peer cities. Shenzhen has produced

experiences which are of reference to China and other cities pursuing future development, and world cities, especially those in developing countries.

First, guided by continuous institutional innovation, Shenzhen fosters new strengths to increase attraction and radiation and create powers and conditions for further development and innovation

In an era of globalisation, various resources for development are mobile, but institutional environment, which is unique to different cities, cannot be moved. By continuously improving the institutional environment, lowering institutional transactions costs, and increasing the benefits of development, a city can motivate market entities to develop and innovate, and attract more external production factors. Shenzhen took the lead in exploring the market-oriented primary economic system, then continued to lead in exploring how to improve the socialist market economy system, then remained aligned with the practices of international cities, and then achieved institutional innovations that support the innovation-driven economy. At each stage, it stayed one step ahead of the inland cities, so the city always outperformed inland peers in terms of institutions, even compared with more and more international cities. Innovation enabled it to attract constant foreign investment and production factors for development and innovation and to endogenously create new resources and production factors for development and innovation.

Second, Shenzhen kept on deepening reform and attracted and made full use of production factors, markets and industries from the Chinese mainland, Hong Kong and the world

In 1979, the Shenzhen Special Economic Zone was established. In the 1980s, the city opened its market to overseas investors and allowed foreign businesses and overseas Chinese as well as compatriots from Hong Kong and Macao to invest and start factories. Preferential policies and lower business costs attracted a massive influx of overseas industries, laying the industrial foundation for the city to grow export-oriented industries and go global. In the

1990s, Shenzhen furthered the reform, allowing independent decision-making and fair competition for both domestic and foreign market entities. It took decisive actions to attract foreign investment and rapidly finished industrialisation. In the early 21st century, Shenzhen highlighted the building of an international city, and kept itself aligned with leading international cities in terms of institutions and standards. This was of great significance for gathering high-end resources and production factors. After 2010, Shenzhen encouraged local businesses to go global and expand operations across the world. The goal of moving up to the upper reaches of the industrial value chain was achieved. There is an ancient saying in China, “People cannot get rich without external help, and a horse will not get fat and strong if it is not fed at night.” By opening its market to the outside world, Shenzhen took advantage of the international division of labour, global capital, technologies and markets. This is the key that enabled the city to leapfrog development.

Third, Shenzhen gathered production factors, created a favorable environment and chose the suitable industries at the beginning, creating the conditions and path for its sustainable development and innovation

For one thing, immigrants fostered a culture of innovation in Shenzhen, which features an equal and inclusive environment thanks to those enterprising and risk-taking immigrants. They created a culture of innovation. For another, global industrial transfer brought innovative industries to Shenzhen. In the 1980s, the focus of industrial transfer was on the electronic information industry, whose industrial chain spans across the world. It was also a high-tech industry. From this perspective, it was inevitable that the industry relocated to Shenzhen, and provided a blessing and initial conditions for Shenzhen’s innovation and development. This also determined the direction of Shenzhen toward continuous innovation.

Fourth, the government played a subtle role in handling external pressure and guided the market to play its decisive role, enabling the city to climb to the

upper reaches of the global industrial chain

Generally, the initial economic development generated favourable conditions but also brought difficulties and pressure for further expansion. The key to whether a city maintains sustainable growth and transformation or goes to stagnation or recession lies in the awareness, capability and action of the government. Shenzhen was successful in the following aspects: first, the local government remained enterprising and innovative and continued to develop new strengths to replace the disappearing ones utilizing previous experience and conditions. Primarily, it bore the national responsibility for exploring new practices for reform and had to move forward and produce innovation. Additionally, the culture of innovation, and the experience that it achieved, multiplying benefits from innovation, motivated it to keep on innovating. Secondly, the government actively used market forces to encourage the survival of the fittest, so that market entities had to transform, relocate and upgrade their businesses in the face of pressure, difficulties and problems caused by resource scarcity and soaring costs.

Fifth, Shenzhen accumulated experience and practice that the regions taking the lead in development could apply to the rest of the nation to move toward shared prosperity

For one thing, by establishing a special economic zone, China piloted various plans for development and revised and improved the successful plans. In this way, the rest of the country was able to catch up by following the exemplary forerunners and their successful models, while avoiding the risks of rushing into the nationwide expansion of an immature plan. For another, the practice of achieving development, transformation and innovation in one place by concentrating resources there and then expanding the successful model with the market playing the decisive role and government playing the guiding role, is in line with the law of development and also an important approach to national development. This has been proven by Shenzhen’s development and the expansion of its successful experience.

Chapter 2

Financing the City, Financing the Firms and Financing Entrepreneurship

Aloysius C. Mosha

Introduction

Shenzhen is located in southern Guangdong Province, China, and borders Hong Kong. The city has witnessed rapid growth in a very short time. The city has grown from an area of 3km², when the Special Administrative Region was first established in 1979, to 968km², an expansion of more than 300 fold. After being established as China's first economic zone in 1980, Shenzhen quickly developed from a sleepy small border town into a large modern city, quite impressive in the history of industrialization, modernizing, and urbanization.

From 1979 to 2019, Shenzhen has skyrocketed from a tiny border town with a population of more than 30,000 to a metropolis with a population of more than 10 million. In 2019 the population is estimated to be 12.12 million and still growing mainly through rural urban migration. It has become a prosperous, chic, innovative, harmonious and beautiful city and has established many firsts in the history of world industrialization, urbanization and innovation in many ways.

Financial industry is the backbone of Shenzhen's economy, totalling 15 percent of the city's GDP. Shenzhen also has more than 25 years' experience as an SEZ to draw from. It has a flexible and efficient

management system and its institutional reform always leads other regions in China, directly boosting its economic growth.¹

Shenzhen also has advantages in basic industrial structure. In recent years, it has energetically promoted industrial restructuring and hi-tech industry has become the pillar of its manufacturing sector. In the past three years, the share of hi-tech products' output value in the city's gross industrial output value increased at a rate of 2.5 percentage points annually, reaching 48 percentage in 2017, higher than in any other mega-city nationwide. Shenzhen has large market shares in rising industries such as computer products, communications equipment, optical fibre communication equipment, internet devices, digital audio and video products, biological pharmaceuticals and high-tech medical appliances. Logistics has developed rapidly, becoming an important part of the city's manufacturing sector and its entire economy in general.²

This chapter covers an array of issues, dealing with the way the city finances development, industrial development and infrastructure. Section one introduces the concept of municipal finance, followed by a background on the state of local government finance in China and the challenges

faced. This is followed by a background on the city of Shenzhen in terms of the responsibilities of the city in financial planning and management. Also presented here is an outline of the revenue and expenditure patterns of the city. The next section looks at financing capital expenditure from different sources, viz. own revenue resources, government transfers, the private sector, borrowing and also capital markets. Critically, there will be a review of the innovative methods the municipality has pursued to obtain money for development. Finally, the chapter provides a brief summary of the issues of municipal finance and lessons to be learnt from the city's experience.

Municipal Finance In China: An Overview

There are many definitions of Municipal finance, but by and large "*Municipal finance*" refers to the decisions that municipal governments make about revenue and expenditure. These decisions cover the sources of revenue in the form of taxes used by municipal governments and intergovernmental transfers. They also include ways of financing infrastructure from operating revenues and borrowing, as well as charges on developers and public-private partnerships. In most cases, municipalities always have challenges in raising their own resources and, in the end, they resort to bank borrowing, going into partnerships in infrastructure development, attracting foreign investments, and so on. All said, for a municipality to succeed it has to look for innovative ways to finance its development and this is where Shenzhen stands out as a trail blazer.

Zang and Li³, in an Asian Development Bank paper, clearly articulate the main issues in local government finance in China as follows: Through the 1990s, reforms of the fiscal system made no concessions to municipalities or the financing needs of urbanization. Except for a few favoured cities in the rich coastal provinces, the current system of revenue-sharing does not provide sufficient resources for cities to meet their heavy responsibilities in service provision, including education, health care, social welfare and

pensions, alongside urban facilities. Moreover, municipalities are prohibited from borrowing, even for capital expenditures, making it difficult to finance infrastructure. In spite of these constraints, the remarkable growth and development of cities have proceeded because political leaders have been willing to tolerate a plethora of informal, backdoor solutions that enabled cities both to obtain the resources needed and to adapt to limitations on eligibility for benefits.

As it evolved, China's municipal finance has come to rely overwhelmingly on extra-budgetary resources and borrowing. Apart from charging user fees and imposing quasi-taxes on various services, municipal governments have used state assets to generate revenues to supplement the budget. And land is their principal asset. With accelerated urbanization boosting land values, land has become the biggest source of extra budgetary revenue. In 2010, receipts from land sales accounted for an estimated 35 percent of comprehensive fiscal revenues for prefectural level (second-tier) cities, compared with just 30 percent from tax revenues. In addition to sales receipts, municipalities collect a plethora of taxes from land and associated activities— property taxes, deed taxes on property transactions, and turnover taxes on construction and real estate companies, and so on. To finance public investment, municipal governments have relied mainly on two sources: land revenues and borrowing. Prohibited from direct borrowing, they have resorted to the use of financing platforms. Set up as enterprises under municipal departments, these local investment corporations (LICs) coordinate and finance the construction of facilities such as water supply, sewerage, roads, and utility hook-ups. First piloted in Shanghai in the early 1990s, these LICs now operate in all cities and have been instrumental in helping local governments achieve world-beating levels of investment in infrastructure. Typically, the LICs raise and bundle together bank loans and other financing, using a variety of municipal assets, including budgetary and off-budget revenues as equity and collateral. Increasingly, with urbanization bringing rising land values, land has become the principal asset backing LICs.

Zang and Li continue to elucidate that municipal finance in China today grew out of ad hoc, adaptive experimentation over the past three decades, a period during which the Chinese economy was undergoing three transitions: from a socialist planned economy to a market oriented economy, from an agrarian society to an urban industrial society, and from being one of the world's poorest economies to a middle-income country. These transitions overturned pre-existing social and economic organizations, and new ones had to be created. With the central government preoccupied with the fiscal crisis brought on by the decline of the state economy, municipalities were left on their own to cope with their changing environment. In this maelstrom, municipal governments faced enormous pressures to provide a new social safety net to replace the one under the state economy, and to provide infrastructure to support the fast unfolding economic growth and the migrants flooding into cities.

They improvised. One tactic was to limit eligibility for urban services to reduce the growth in demand for them, and the system of residency registration (*hukou*) instituted in the 1950s provided a convenient, fool-proof mechanism for excluding the new migrants. Another tactic was to go off-budget in search of resources, and municipal governments displayed remarkable ingenuity in doing so. This decentralized approach has been instrumental in enabling China's urbanization and growth, but it has also produced some adverse outcomes. First, the current high dependence on land is risky and unsustainable. Land prices are notoriously volatile and land revenues are unsuitable as a pillar of local finance. With leases running for 40-70 years, land is an exhaustible resource. In the coastal regions, cities are already running out of land to sell. Second, the interplay between land and LICs has led to the overuse of both. The expanding resource envelope has softened the budget constraint for municipal governments and encouraged wasteful and inefficient investments.

Second, the reliance on extra budgetary resources has led to a fragmentation of municipal budgets

that renders macroeconomic control difficult. Revenues are collected by different agencies and local governments. Information is scattered in different channels and not always reported in full. Finally, decentralized decision-making and benign neglect from the top have allowed the creation of a two-tier society where access to vital and costly public services, such as education, health care, social welfare, and pensions is open only to those with urban *hukou*, leaving over 200 million de facto, second-class citizens in Chinese cities.⁴

Shenzhen Economic Growth

According to the *2016 Report on China's Urban Competitiveness*, published by the *Chinese Academy of Social Sciences*, Shenzhen is ranked as number one on the mainland in terms of "overall economic competitiveness". It is also regarded as one of China's most important high-tech R&D and manufacturing bases, while additionally being home to the world's third largest container port and China's fourth largest airport. Shenzhen's per capita GDP is the highest in Guangdong.⁵ (Table 1)

Shenzhen Municipal Finance

The Shenzhen municipality has many responsibilities in respect of financial planning and management. State law requires the municipality to adopt a balanced budget. No expenditures may be permitted unless authorized by the budget ordinance or by the Council via a subsequent resolution. However, at times this has not been always the case. The municipality is responsible for the overall fiscal management of the Council. It must develop and maintain budget enforcement standards. It also approves borrowing and other financing options, including financing capital improvements. Ultimately the Council is responsible for establishment and utilization of financial reporting systems and standards. The Council establishes policies for investment and management of cash assets. Finally, it selects and approves an independent public accountant to perform annual independent audits.

TABLE 1: SHENZHEN: MAJOR ECONOMIC INDICATORS

Economic Indicators	2016		2017	
	Value	Growth (% y-o-y)	Value	Growth (% y-o-y)
Gross Domestic Product (RMB billion)	1,949.26	9.01	2,243.84	8.81
Per Capita GDP (RMB)	167,411	3.71	183,127	4.01
Added Value Output				
- Primary Industry (RMB billion)	0.71	-0.61	1.85	52.81
- Secondary Industry (RMB billion)	778.05	8.01	926.68	8.81
- Tertiary Industry (RMB billion)	1,170.49	9.81	1,315.30	8.81
Value-added Industrial Output ² (RMB billion)	719.95	7.01	808.76	9.31
Fixed-asset Investment (RMB billion)	407.82	23.6	514.73	26.2
Retail Sales of Consumer Goods (RMB billion)	551.28	9.8	601.62	9.1
Inflation (Consumer Price Index, percent)	—	2.4	—	1.4
Exports (RMB billion)	1,568.04	-4.5	1,653.36	5.5
Imports (RMB billion)	1,062.66	-4.2	1,147.79	7.9
Utilised Foreign Direct Investment (US\$ billion)	6.732	3.6	7.401	9.9

Source: *Shenzhen City Information, 2018.*

It is encouraging to see that Shenzhen has been receiving clean audit bills of health in most years, a reflection of good financial management.

The Budget Process

The preparation of the budget goes through the following cycle:

Preparation The Council develops the budget calendar. After this, discussions follow on the goals, needs and the outlook for the coming year. Then it sets some parameters for staff to make requests. The Council generally concentrates at the beginning on any major planning and programming for service delivery. It is worth mentioning that its revenue and expenditure must equal one another – net of contribution to, or use of, fund balance.

Revenue and Expenditure In preparing the budget, the Council starts off with expenditures that are composed of personnel (salaries, benefits— this is the biggest item of all); operating (office supplies, utilities, contracts) and capital (computers, vehicles, etc.). Revenue of the municipality comes from taxes, business licences, user fees, fines and forfeitures and investment. Conspicuously missing is revenue from land and property, a common practice in China, as land was owned by the state until recently.

Adoption of the Budget The annual budget must be adopted by ordinance. A public hearing must be held before adoption of the budget. This makes the budget inclusive.

Financial Controls and Reporting The Council is responsible for ensuring that monthly reports are prepared and that information is accurate. Further, the Council monitors departmental expenditures by using monthly reports, general ledger and, when necessary, general ledger transaction reports. Independent annual audit is required. The Council must accept and review the audit annually and this must be available to the public for review. However, some weaknesses remain. For example, important decisions are still made outside of the budget process. Strengthening accountability mechanisms and enforcing aggregate fiscal discipline constitute the challenges for reform in the next phase.

Overview

On the positive side, Shenzhen's budget responsibilities have been carried out diligently and responsibly. There have been frequent reforms to fine tune the process time and again. The following is worth noting. First, there has been a rise of the legislator in local budgeting/budget reform. The

Shenzhen municipality expenditure in improving the legislature's role in the budgeting process has been quite successful. In 1995 the People's Republic of China's Standing Committee established a Planning and Budgeting Supervision Committee responsible for examining and supervising the government budget. In 2000 the PBSC was promoted as an independent committee called the Special Committee for Planning, Budgeting and Supervision (SCPBS).

In Shenzhen, early in 1977, the legislature issued the departmental budgeting reform as the "break through point" to improve the legislator's role in the budgeting process. Therefore, during the past ten years, the legislature has been a driving force to implement and improve the departmental budgeting reform.⁶

Second, Shenzhen government's performance evaluation is effective and comprehensive as it has been getting clean audits year after year. It could serve as the role model for government performance auditing. Shenzhen put in place Shenzhen Special Economic District Auditing Regulations as early as 2001. In 2004, it expanded the scope of performance evaluation and issued regulations on auditing government investment projects. In recent years, annual reports of government performance evaluation have been presented to the public.⁷

On the negative side, the following observations have been made. In Shenzhen, as well as in other local governments in China, there are issues with the budgeting process and the budget itself. As noted by Wong C., 2007, pg.14, both in central and local government, there are weaknesses here and there. A number of criticisms have been observed. First, the capital budget is made separately from recurrent budgets; Second, Extra-budgetary expenditures remain high and unreported. Nearly all infrastructure investments are financed off budget, in non-transparent ways and poorly tracked; Policy makers continue to use tax expenditures, the costs of which are not reported in the budget; Many earmarked transfers from central government arrive late in the year and in unpredictable amounts. The

matching requirement means that the Municipal Council has to hold significant reserves of funds in the event that they are successful in getting projects allocated.⁸ Lastly, revenue forecasting remains weak and pegged to growth targets, rather than economic fundamentals, and reporting on contingent liabilities is also weak to non-existent.⁹

Revenue and Expenditure

To begin with, Shenzhen's regional municipality has diverse sources of finance, some from central government (revenue sharing) and some from own sources. On the whole, revenue sharing does not provide all the funds required. Revenue from own sources exceeds that from central government. A review of financial reports shows that revenue has been rising in recent years by between 3-10 percent annually. A chronology of revenue and expenditure from 2012 to 2016 is shown below (Table 2).

Using 2017 figures for the municipality rather than the region, we trace the spread of revenue versus expenditure during the year as shown below. According to municipal records, in 2017 the city's general public budget revenue reached 208.68 billion yuan, having increased by 10.0 percent since 2016, plus miscellaneous transfer income of 128.32 billion yuan, resulting in total income of 337 billion yuan. The city's general public budget expenditure was 236.15 billion yuan, an increase of 3.7 percent, plus transfer expenditure of 90.55 billion yuan, resulting in total expenditure of 326.7 billion yuan. Finally, the revenue of 337 billion yuan exceeds the expenditure of 326.7 billion yuan, which is a healthy state of affairs.¹⁰ This has resulted from the adoption of innovative ways of raising funds, as well as prudent financial management by the municipality.

Revenue

The city gets much of its revenue from a wide variety of taxes; from non-tax sources and transfers from central government. With the city's dynamism and fast urbanization, revenue from various sources

TABLE 2: SHENZHEN REVENUE AND EXPENDITURE 2012-2016 (10,000 Yuan)

ITEM	2012	2013	2014	2015	2016
LOCAL GOVERNMENT REVENUE	17,929,886	22,312,100	27,698,077	36,908,610	41,028,880
Local Government General Budgetary Revenue	14,820,800	17,312,618	20,827,326	27,268,543	31,364,923
1.Taxes	13,299,766	14,989,200	17,548,398	22,722,315	24,888,827
Value Added Tax	1,875,512	2,740,958	3,156,076	3,362,040	6,509,463
Business Tax	4,210,150	4,232,223	4,798,432	6,846,839	3,639,382
Corporate Tax	2,697,311	2,884,159	3,450,200	4,649,574	5,695,240
Individual Income Tax	1,391,188	1,384,659	1,684,918	2,239,807	3,047,503
2.Non-tax revenue	1,521,034	2,323,418	3,278,928	4,546,228	6,476,096
Special Programme Receipts	382,587	444,215	487,301	1,562,019	3,823,354
Charge of Administrative & Units	398,482	546,072	910,550	438,659	279,760
Penalty Receipts	209,042	177,672	267,880	303,057	249,007
Government Fund Revenue	3,109,086	4,000,482	6,870,751	9,640,067	9,663,957
L.G. BUDGETARY EXPENDITURE	18,792,934	20,521,394	26,283,153	38,644,225	46,247,931
L.G. General Budgetary Expenditure	15,690,071	16,908,280	21,661,841	35,216,708	42,110,429
Education	2,461,343	2,877,280	3,294,137	2,885,520	4,147,269
Science & Technology	792,651	1,329,814	945,707	2,143,182	4,035,240
Culture, Sports & Media	328,388	329,433	580,070	527,260	547,941
Social Security & Employment	667,785	784,985	738,828	845,801	1,054,524
Medical & Health Care	1,052,925	1,069,185	1,576,028	1,505,974	2,012,739
Energy Savings	1,080,036	1,419,861	1,352,999	1,083,493	1,402,415
Urban and Rural Community Affairs	1,998,352	2,217,321	2,458,768	4,656,457	5,584,938
Agriculture, Forestry and Water connections	446,591	614,196	566,042	441,526	612,541
Transportation	1,000,381	1,116,493	2,938,739	10,445,932	4,508,921
Government Funds	3,102,863	3,613,114	4,621,312	3,427,517	4,137,502

Source: Shenzhen Website and Municipal Reports

has been on the rise year after year. The range of tax revenues includes domestic value added tax, business tax, land value added tax, city maintenance and construction tax, resources tax, tax on use of urban land, stamp tax, individual income tax, corporate income tax, tariff, tax on agriculture and animal husbandry and a tax on the occupancy of cultivated land, etc.

Tax revenue According to 2017 figures, the city's tax revenue reached 1.47 billion yuan, an increase of 3.9 percent from the previous year. Among them,

value-added tax (including "cash reform") was 54.81 billion yuan, down 11.5 percent, mainly due to the impact of comprehensive reform and tax reduction; corporate income tax was 45.67 billion yuan, an increase of 17.0 percent; personal income tax was 20.16 billion yuan, an increase of 15.5 percent, and land value-added tax was 14.65 billion yuan, an increase of 19.4 percent.

Non-tax revenue The city's non-tax revenue reached 61.08 billion yuan, an increase of 5.8 percent, of which special income was 37.21 billion yuan,

administrative business fee income was 2.06 billion yuan, penalty income was 2.49 billion yuan, income from the use of state-owned assets (resources) was 12.44 billion yuan, and other income was 6.85 billion yuan.

Inter-governmental Finance and other Transfer income The city's financial transfer income from central government was 1,283.3 billion yuan, except for the settlement income of the upper and lower levels of 40.84 billion yuan. Other income was mainly transferred from government funds and financial stock funds amounting to 42.47 billion yuan. All in all, the annual balance was 12.3 billion yuan, which is rather healthy for the city. These funds provide the financial basis for the equalization of public services, which is also indicative of the local government's over-reliance on transfer payments. Government transfer payments to the council improve basic public service capabilities and promote equitable access to them. However, at times they are not transparent or steady, and not well regulated. Furthermore, the over reliance on government transfers leaves the council with little autonomy.

Council Expenditure

Urban local authorities spend vast sums on the delivery of services that include health, education, social services, infrastructure, culture and sports; safety, and environmental protection. By all accounts, Shenzhen has done quite well in-service provision compared to other cities in China, resulting in a sustainable living environment. Of the 2017 figures, between 30-50 billion yuan were in five key areas viz: the highest expenditure was on urban and rural community expenditure (49.7 billion yuan), an increase of 200.2 percent from the 2016 budget. Expenditures were for urban and rural community management, public facilities, environmental sanitation, engineering construction and other fields and industry authorities.¹¹ This was followed by housing provision, at 38.11 billion yuan, an increase of 34.8 percent. This was expenditure for affordable housing, housing reform and other activities; transport followed closely with 30.24 billion yuan, down by 31.0 percent. Expenditure was in the areas of highway, waterway, railway transportation, air transportation, bus subsidy and other activities.



Expenditure in the range of 10 and 18 billion yuan is spread as follows: Science and technology 17.2 billion yuan; education 14.77 billion yuan; and energy conservation and environmental protection 10.5 billion yuan. This clearly shows how serious the city is with regard to technology, education, science and environmental concerns. General public expenditure was 10.69 billion yuan an increase of 21.7 percent; and resource exploitation was 12.22 billion yuan, down 72.1 percent.

The rest of the sectors received less than 10 billion yuan each. These were as follows: Public safety expenditure 9.71 billion yuan, an increase of 22.9 percent; 9.26 billion yuan on social security and employment, an increase of 143 percent; and 9.45 billion yuan on medical and family planning, an increase of 36.5 percent.

Lastly, 6.12 billion yuan was spent as aid to other regions, an increase of 61.3 percent; other expenditure stood at 5.42 billion yuan, an increase of 198.3 percent; and expenditure on business service sectors was 4.23 billion yuan, down 72.7 percent. Agriculture, forestry and water expenditure was 3.11 billion yuan, down 5.2 percent; and expenditure on financial expenditure like supervision, 1.10 billion yuan, a decrease of 48.3 percent. The rest of municipal expenditure was less than 1 billion yuan.

The above expenditure accounts for the spectacular state of the city, with its modern facilities, adequate transport infrastructure, medical and educational facilities and its modern, smart growth. However, in spite of this rosy picture, the municipality, like most municipalities, has also been facing financial challenges to meet the ever-rising demand for services, as more and more people flock to the city. The major challenge has been capital development funding that normally requires vast sums of money, but Shenzhen has ventured to adopt innovative ways to meet the challenges head on with spectacular and proud results. This is the subject of the following section.

Financing of Capital Development In Shenzhen

Having looked at the revenue and expenditure patterns of the city, this chapter now moves on to outline and discuss both the traditional and innovative financing models adopted by the Shenzhen municipality for industry and infrastructure development. With the gradual emergence of the disadvantages and risks of traditional financing modes, local governments across China have been paying more attention to innovative financing models. Financial difficulties have forced local governments to rely on such financing models as land-leasing, and government-invested companies. But the features of these financing channels are low stability, high risk, and low sustainability. As a result, in addition to resorting to innovative revenue channels, the PRC's local governments are taking creative measures to be able to provide public services, for instance, through issuing local government bonds, establishing public-private partnerships (PPP), and transfer payments from the central government. We now look at innovative strategies that have been adopted by Shenzhen municipality to enhance development, that have made the city the envy of many local authorities across China and Asia at large. To begin with, we will look at the pace of industrial growth in Shenzhen and the role of innovation in financing said growth and the support that industry receives from the municipality.

Industrial Growth and its Financing

According to the City Information (9 May 2018), dating back as far as 2008, the GDP share of Shenzhen's tertiary industries has exceeded 50 percent. In 2017, such industries accounted for 58.6 percent of the total. Overall, the city has four pillar industries – high-tech, financial services, modern logistics and the cultural sector. In the case of its high-tech industries, their overall value-added output has risen from RMB 305.9 billion in 2010 to RMB 735.9 billion in 2017, an average annual growth rate of 13.4 percent.

“Indigenous innovation” has long been seen as the cornerstone of Shenzhen’s development. In 2016, its overall R&D expenditure amounted to 4.1 percent of its GDP, a figure significantly higher than the national average of 2.1 percent. In terms of total PCT international patent filings and invention patent ownership per 10,000 people, it ranks first among all of China’s medium to large-sized cities. It is also seen as a global pioneer in several high-tech sectors, including 4G technology, DNA sequencing, meta materials and 3D displays.

In 2016, 3,791 of Shenzhen’s businesses were designated as national high-tech enterprises, taking the city’s overall total to 8,037. Among these newly designated enterprises, 54 percent were engaged in the development of electronic information systems, 18 percent were focussed on advanced manufacturing and automation, while the remaining 28 percent were spread across six other technological sectors – biotechnology and new pharmaceuticals, new energy and energy conservation, resources and the environment, aviation and aerospace, new materials and high-tech services.

Shenzhen’s “maker” population has also enjoyed continuous growth over recent years, with thousands of such businesses now active in the city, including **Chaihuo Maker Space, Makeblock** and **Seed Studio**. In addition, a number of globally-renowned high-tech enterprises have established R&D centres or regional headquarters in Shenzhen, including **ZTE, Huawei Technologies, Tencent** and **Apple Inc.**

In addition to manufacturing, Shenzhen is quickly becoming a financial centre, with two of China’s largest banks headquartered there. The Shenzhen Stock Exchange (SZSE), like the Shanghai Stock Exchange, is a national exchange with more than 1,700 listed companies on SZSE, including those listed on Growth Enterprise Market (GEM) Board. The SZSE Composite Index consists of 500 listed stocks with a market capitalization of more than US\$300 billion. The Shenzhen-Hong Kong stock connection, which will facilitate cross-border trading, is expected

to be launched sometime in 2019 and could open up more opportunities for investors.

The government is currently promoting Shenzhen as a financial centre to equal Hong Kong by designating Qianhai, a district of Shenzhen, as a financial centre with special rights and privileges. The purpose is to position the zone for innovation and development of modern services, in addition to fostering closer cooperation between Hong Kong and mainland China. Most significantly, Qianhai is being given special freedoms with regards to the internationalization of China’s currency, the renminbi (RMB), by loosening capital account restrictions so Hong Kong banks will be allowed to extend commercial RMB loans to Qianhai-based onshore mainland entities.¹²

Financing industrialization

Funding innovation in Shenzhen has been hailed as a success story that is known worldwide. The rapid pace of industrial growth noted above is due in part to the adoption of innovative city financing strategies adopted by the city, and inducements and preferential policies introduced by the municipality to woo industries to locate in the city. Mark Mobius has observed that Shenzhen is an experimental zone for financial innovations in China. Shenzhen has a long history in the implementation of reforms and opening up policies ahead of other cities in China, since it was designated as a Special Economic Zone in the 1980s. At the early stage of development, Shenzhen provided many preferential policies to attract FDI. Processing trade industries (processing with materials, assembling supplied components, and then exporting the final products to overseas markets) were very popular in Shenzhen in the 1990s due to its proximity to Hong Kong. Many Hong Kong industrialists moved their production processes to Shenzhen, seeking lower production costs. Hong Kong enterprises brought advanced management concepts, new modes of operation and so forth to Shenzhen. These indirect effects were beneficial for Shenzhen’s economic growth and attractiveness to other foreign MNCs. Hong Kong’s enterprises had become innovators, generated investment and

nurtured Shenzhen's business environment, making it easier for foreign enterprises to do business in China's regions. The prosperity of foreign investment initiated domestic investment and attracted a lot of money from other parts of the mainland to invest in Shenzhen from spheres such as real estate, logistics, financial industries, etc. Hong Kong remains the largest source of FDI in Shenzhen. By the end of 2010, there were about 42,000 Hong Kong companies in Shenzhen and US\$ 60 billion in FDI from Hong Kong, accounting for 80 per cent of the total foreign companies and two-thirds of the total FDI in Shenzhen.

Apart from Hong Kong's contribution, the Shenzhen municipal government actively conducts a preferential policy to attract foreign companies setting up their headquarters. In 2007, the Shenzhen municipal government promulgated 'Some Opinions on Accelerating the Development of Headquarter Economy in Shenzhen' which states that any company that establishes its headquarters in or moves to Shenzhen will get support from the government in financing, use of land, human resources as well as the simplification of related procedures. In fact, with a lot of foreign investments and new technologies, Shenzhen itself cultivated several global corporations, like

Huawei technologies, ZTE Corporation, BYD, Tencent, China Merchants Bank and Ping An Insurance. The function and role of reforms and opening-up of frontiers, moved Shenzhen forward to become an experimental zone for financial innovation in China, especially of the pilot plan approved by the central government for the development of Shenzhen-Hong Kong Modern Service Industry Cooperation Zone in Qianhai.

Internally, the Shenzhen municipal government also provided different kinds of preferential policies to promote financial innovation. For the insurance industry, the Shenzhen government issued 'Measures for Accreditation of Headquarter Enterprises in Shenzhen (Trial)' and the 'Detailed Implementation Rules of Several Opinions on Accelerating the Development of a Headquarter Economy in Shenzhen (Trial)' in October 2008, which provided 5 billion RMB to award enterprises that would set up or move their headquarters to Shenzhen in the next five years. This preferential policy is the direct reason for the movement of China Life to Shenzhen.^{13 14}

Apart from the preferential policy, one of the reasons for insurance companies to move their headquarters to Shenzhen is the good investment



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environment and unique institutional innovation, which is beneficial for the development of insurance businesses. Shenzhen's government supports the innovation development of its insurance industry and have made Shenzhen into a major experimental place of insurance innovation development in China.¹⁵

Another favourable factor is Shenzhen's close proximity to Hong Kong, which enhances the flow of talented people between Hong Kong and Shenzhen and allows Shenzhen's financial industry to learn from Hong Kong's advanced financial practices.^{16 17}

Further, in a bid to woo overseas investment and attract the presence of more foreign companies, Shenzhen has initiated a series of moves designed to make the city more business friendly. These include streamlining administrative requirements and delegating decision-making to more accessible levels with regard to business licence approvals, operating standards, government procurement and finance channels. The ultimate aim is to reassure overseas investors that they will enjoy the same privileges as domestic businesses both before and after gaining market access.

Overall, three primary areas have been targeted for change: Firstly, moves are to be made to welcome overseas investment into previously prohibited sectors. Second, foreign capital is also to be sought for the manufacturing sector in line with the *Shenzhen Action Plan for Made in China 2025* and third, the co-operation between Shenzhen and Hong Kong, in accordance with the *CEPA* framework, is also to be deepened.¹⁸

Foreign Direct Investment and the Transformation of Shenzhen

Foreign Direct Investment (FDI) has a long history in China and Shenzhen in particular. Steve Olson (2016) considered that Shenzhen city was transformed from a sleepy fishing village by the decision of the Chinese government to open Shenzhen to foreign direct investment. If there is any city in the world that

can be said to have been built—in both literal and figurative terms—by FDI, it is Shenzhen. The sheer size and volume of FDI into Shenzhen is breath-taking. The pivotal year was 1979. The developmental gap between China and the West had grown so immense that China's leaders recognized the need to embark upon a reform and opening-up program in order to jump-start the country's economic development. Attracting foreign direct investment was job number one. The first major initiative was to set up Special Economic Zones (SEZs) in Shenzhen and three other cities. Given its proximity to highly internationalized Hong Kong, Shenzhen was a natural choice (ibid).

The idea was simple enough. The SEZs would be given unprecedented flexibility to loosen labour laws and price controls, permit Sino-foreign joint ventures, openly tender infrastructure contracts, and provide tax benefits and other forms of preferential treatment to FDI-providers. The hope was to attract foreign companies—at the onset, principally from Hong Kong—in order to build out the needed infrastructure, and develop a light manufacturing sector and a viable export capacity. Hong Kong companies were especially important because of their strong cultural connection to the mainland, as well as their experience, contacts and saviness in international commerce.

The cause of reform was given a further boost in 1992, with Deng Xiaoping's famed "Southern Tour", which solidified the centrality of FDI and hastened the pace of reform, helping to push Shenzhen even further up the development ladder. The emphasis began to shift during these years from export processing to high technology, and FDI was often conditioned upon technology transfers to local partners and commitments to undertake more and more research and development locally. The Shenzhen High-Tech Industrial Park was established in 1996, and attracted a number of leading international firms, such as Intel, IBM, Toshiba, and Samsung.¹⁹

As Shenzhen was growing by leaps and bounds, much of its physical infrastructure and housing was being delivered through FDI. The Central

Government and local government invested only 1.4 percent and 13.1 percent, respectively, of the funds used for the physical development of Shenzhen from 1980 to 1990. Much of the rest was provided by FDI partners, principally from Hong Kong.²⁰

By the end of 2014, Shenzhen had attracted more than 58,000 foreign invested projects, with a utilized value of \$65 billion. The impact of this FDI on Shenzhen's economy would be hard to overstate. Historical and ongoing FDI and foreign invested enterprises accounted for roughly 41 percent of Shenzhen's GDP, 42 percent of its employment, and 48 percent of exports in 2013. The trade performance of Shenzhen's FIEs accounted for a whopping one-fifth of the city's GDP. As if these figures were not amazing enough on their own, it should be noted that they do not include the service sector or the various spillover benefits that FDI typically brings such technological transfers, greater managerial expertise, and increased productivity (ibid).

The figures for several key industry sectors are even more extraordinary, with FIEs accounting for all or nearly all revenue in areas such as the production and supply of gas (100 percent), the processing of petroleum (97 percent), the manufacture of automobiles (81 percent), and the manufacture of general purpose machinery (78 percent). According to Shenzhen City Information, the utilized Foreign Direct Investment (US\$) value in 2016 was 6,732 and in 2017 it was 7,401, a growth of 9.9 percent.

The Shenzhen experience with FDI is not only striking, but also highly instructive. Chinese officials essentially used Shenzhen as a laboratory in which to run real-world experiments on the attraction, management and impact of FDI. The results—and implications—of these experiments are entirely evident for all to see. When properly managed, FDI can be nothing short of transformative for developing economies. Shenzhen's astonishing transformation from a sleepy fishing village to global metropolis tells this story both eloquently and convincingly.²¹

Entrepreneurship Financing in Shenzhen

Shenzhen is a top innovation hub for start-ups. The city is the Fintech hub and is compared to Silicon Valley. Their development is mainly a result of financial help from the municipality, in part, as well as through self-financing. Shenzhen is the most entrepreneurial city in greater China and its start-ups are well geared to deliver innovative ideas with high growth potential. A survey done by CUHK Hong Kong University shows that 16 percent of the population is engaged in start-ups, a threefold rise since 2009. She says that Shenzhen has topped Hong Kong and Taiwan's capital Taipei in terms of entrepreneurship in China, according to a joint university survey. Sixteen out of every 100 adults in Shenzhen were engaged in early-stage entrepreneurial activities in mid-2016, more than a threefold increase from 2009, when the figure was less than five. China's average was 10 percent in 2016, slightly outperforming Taipei's 8 percent. New businesses that were between 3 and 42 months old in Shenzhen jumped by 284 percent compared to 2009. The prevalence rates of established businesses recorded an increase of 389 percent as well. It is worth noting that while entrepreneurship rates are on the rise in Shenzhen, they are declining in other places in China (ibid).

Sources of financial support

A collaborative effort by CUHK CFE, HKBU School of Business, the University of Hong Kong's Faculty of Business and Economics, Shenzhen Academy of Social Science and Savantas Policy Research Institute, the research entitled "Global Entrepreneurship Monitor (GEM) Hong Kong and Shenzhen Report 2016-17" notes that in recent years, Hong Kong and Shenzhen have experienced an explosive growth in the start-up support ecosystem.²²

Start-ups traditionally require several things to be successful: Funding, customers, products, competition and the right team. Shenzhen offers all of these elements today. Aside from huge government funding and subsidies for the internet

and technical start-up scene, there are also a lot of venture capitalists offering funding for start-ups. Much also comes from self-financing. The SMBWorld Asia study notes that the principal source of financial support is their own savings (pg. 2). The role of the family in financing new ventures is still significant in Shenzhen. Banks are also quite supportive. Aligned with higher entrepreneurship rates, the research team also found a growing culture of informal sectors developing in the city. Shenzhen recorded a high investment prevalence rate of 20.5 percent of the adult population. In fact, Shenzhen's informal investors are among the most generous of all economies in the study, with a contribution of USD76.112. The study also recorded a dramatic change in investment patterns. While in 2009 individuals were preferably investing in family members, by 2016, friends and neighbours had become the first choice.

The rush to entrepreneurship might be linked to relatively lax lending for new business in Shenzhen. Banks in Shenzhen are generally more supportive of start-ups as they are seeking profit opportunities that are lacking in traditional businesses. The Shenzhen government has offered subsidies for banks to provide loans for start-ups. Maker spaces in Shenzhen are in effect large incubators (providing co-working space, mentoring, marketing and financial support) for young entrepreneurs with ideas. They concentrate on ICT hardware and software development (3-D printing, robots, drones, connected equipment, mobile apps and internet of things). Their development and funding are supported by holding companies that are active in real estate, finance, construction or logistics. Such companies can nurture creative entrepreneurs, provide business training, seed funding as well as investment capital at a later development stage. In effect, the strength of Shenzhen's maker spaces lies in the integration of strong financial investment capacity to fund new businesses. This will make Shenzhen attractive to creative professionals worldwide looking for capital funding and affordable manufacturing. Shenzhen holds the second largest stock exchange of the country.

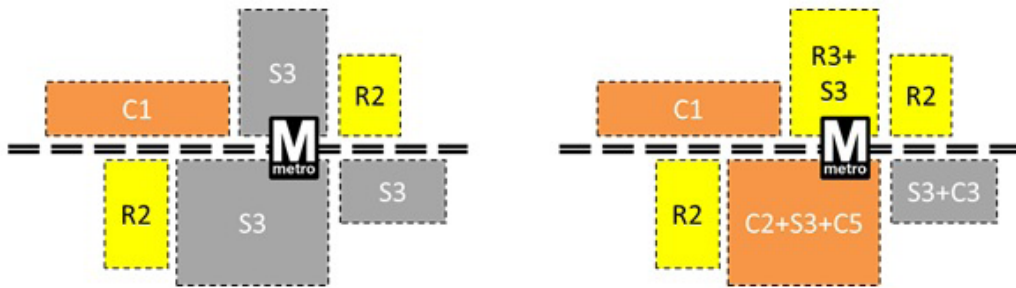
Financing the Firm

The city of Shenzhen has been quite supportive in encouraging and financing entrepreneurs who are interested in industrial development. For example, it is reported that the municipality set up US\$2.2 billion in funds to assist local listed firms in 2015.²³ Authorities in Shenzhen have set up special funds to the tune of CNY15 billion to assist listed companies in dealing with pledge risks and boosting liquidity. Further, Shenzhen Small and Medium-Sized Enterprise Guarantee Group and Shenzhen HTI Group jointly established a CNY10 billion fund, while Kungpeng Capital set up a CNY 5 billion pot, a market insider told Yicai Global (ibid).

The municipal government has also begun formulating a plan for assisting more than 20 listed Chinese companies that have faced pressure in terms of equity pledges and financing over the last 2 months. Local authorities have also set up a special working group led by major officials from 10 departments to coordinate and resolve stock pledge risks facing controlling shareholders of listed companies.

Financing Innovation Eco System

Local enterprises are the key innovators in Shenzhen's city innovation ecosystem and the city has abundant resources. Over 90 percent of R&D, including personnel and funding, is generated by enterprises, but universities and research institutes are also powerful innovators. Since 2008, when Shenzhen became China's first National Innovative City, it has allocated more resources to develop tertiary education and research institutes. Currently, Shenzhen has 56 national innovation platforms. Collaborating with universities, Shenzhen has established the Research Institute of Tsinghua University in Shenzhen, the PKU-HKUST Shenzhen-Hong Kong Institution, the Shenzhen Virtual University Park and other research organizations. These have become a continuous source of knowledge and technology.²⁴

Figure 6 : Integrated Transport and Land Value Capture

An example of development plans for a metro station, with standard zoning codes on the left and Shenzhen's new zoning codes on the right. Previously, it was impossible to develop land for purposes other than transport (coloured in grey). Now, the zoning codes allow for mixed-use (coloured by primary land use type). Source: Wanli Fang and Lulu Xue (2015) and Graphic by WRI Ross Centre for Sustainable Cities.

Through its Basic Innovation Program, Shenzhen is supporting the development of national R&D infrastructure in the city, including key national labs, national engineering labs, national engineering research centres and the China Best Practice case studies National Genebank. Shenzhen is now ideally equipped to carry out ambitious national strategic R&D projects. Building on its newly-developed R&D infrastructure, Shenzhen is promoting independent innovation in areas like IT, genetic engineering and stem cell research. Innovation intermediaries are another player in Shenzhen's innovation ecosystem. These include incubators, professional services firms, technology consultancies, trade associations and recruitment agencies. Services provided by innovation intermediaries—including information exchange, decision-making advice, resource allocation, technical service and technology evaluation—enable innovators and entrepreneurs to mitigate risks and commercialize technology faster. The city has now become a highly important innovation hub in South China.

Innovation resources

According to Cai Jian²⁵, Shenzhen has implemented a number of measures to attract talent. By the end of 2015, the "Peacock Plan" had attracted 59 innovative R&D teams to Shenzhen and Guangdong. A total of 1,219 people had been designated as high-calibre foreign professionals under the Plan. In 2015 alone, the Plan attracted 18 R&D teams specializing

in areas such as biology, pharmaceuticals, life sciences, software, telecommunications, microelectronics and new energy. Among them, 2D Material Optoelectronic Devices is an emerging field of research in China. The city has also taken steps to attract and retain talent by strengthening local universities and improving incentives and services. Total R&D spending across Shenzhen represented 4.05 percent of its GDP in 2015. Municipal and district governments allocated a R&D budget of 20.93 billion Yuan to support pioneering, generic and core technologies. One hundred fifty six strategic technology projects were initiated. According to the Shenzhen Municipal Government plan, total local R&D spending will be 4.25 percent of its GDP by 2020. As well as encouraging companies to invest more in R&D, the government will also provide additional funds. Moreover, the government will set up an investment company focused on hi-tech, innovative and entrepreneurial activities as a boost to the local venture capital market.

Innovations In Infrastructure Financing

The focus of this section is on "innovative" infrastructure funding mechanisms. Infrastructure is usually funded from special assessments, development charges, reserves, general borrowing, grants, and property taxes (as opposed to operating expenditures, which are funded only from

grants, user fees and property taxes). Innovative funding mechanisms include any variation in the conventional mechanisms (such as borrowing backed by revenue from a specific source rather than by general municipal revenues, or development charges that vary according to the location of the project rather than being applied municipality-wide) or any relatively new mechanism that is not already widely used in Chinese communities (such as a parking site tax or a vehicle registration tax). Innovation in funding mechanisms usually involves some change to local bylaws and administrative arrangements, but they may also require more far-reaching changes such as modifications to provincial legislation or funding arrangements.

Traditionally, the financial vehicles China employs to finance infrastructure include public funding (including the annual budget, treasury bonds and other financial capital), debt financing (funds raised through banks and other financial institutions and bonds), inner accumulation (undistributed profits). However, most of these do not meet the ever-rising demand for funds. In this section, we look at some of the innovative ways Shenzhen has used to finance many of the infrastructure projects in the city in response to rapid urbanization. These include land value capture, public private partnership, and bonds. Due to limited funds, the city has consequently turned to alternative sources of financing local government. Local government investment vehicles (LGIVs) have been a preferred source. Many of these vehicles lack adequate governance and transparency arrangements, and the central government has recently acted to curb their use. Financing from land transactions has also been important. But limits on the supply of higher-quality land, uncertainty about the future of land prices, and distortions in the urbanization process resulting from this Public Finance Reform Agenda are causes for concern.

Transport development and land value capture in Shenzhen

Xue et al.²⁶ posits that in Chinese cities, funding for large-scale urban transit infrastructure traditionally

comes from two sources: sales of land development rights and bank loans. However, these approaches not only financially burden city government, but also lead to costly urban sprawl. Recently the city of Shenzhen has been successfully experimenting with alternative approaches to overcome these significant challenges. Shenzhen's experience demonstrates that financing transport infrastructure by harnessing the value of land can also be an opportunity for sustainable transit-oriented development (TOD) in Chinese cities.

Shenzhen was the first city in China to use the Rail plus Property (R+P) LVC model as an innovative way of funding its infrastructure development. This model leverages partnerships between the public sector, transit companies and developers to coordinate planning and financing of new transit stations and adjacent real estate developments. In Shenzhen, the government used traditional finance (municipal budget and bank loans) for the initial phase of its metro project and then switched to more innovative financing methods after project costs increased tenfold in the metro expansion phases. Flexible risk-and-profit sharing arrangements ensured that both costs and benefits were shared among the government and various metro companies.²⁷

The evidence of benefits suggests a win-win situation: Average home values within walking distance of metro stations increased by 23 percent at 400 metres and 17 percent at 600 metres. This speaks of the added value that residents gain from increased accessibility and increased revenues of property developers who have paid into the R+P system to finance public transport infrastructure. Here it clearly shows that land value is created, shared and reinvested, spurring a virtuous cycle of urban infrastructure investment (Figure 6).

Paving the way for the future

Shenzhen's success has profound implications for other Chinese cities. If Shenzhen can successfully implement R+P under the same regulatory and legislative environment, other Chinese cities can follow suit. However, R+P does not offer quick wins.

In Shenzhen, it took over a decade to implement viable solutions. Hong Kong also took about a decade to make a profit. Change won't be possible without a booming real estate market, a mature capital market, a capable and willing private sector, and—more important—a strong political will that is open to new approaches. Given the need for sustainable transit-oriented development in China, leaders can't afford to overlook Shenzhen's successes and the opportunities that R+P presents.

Use of Local Government Financial Platforms

As noted earlier in this chapter, local governments in China are by law not allowed to borrow from the financial market and thus they have been relying on local government financial platforms (LGFPs) to finance their urban infrastructure development; Shenzhen has used them quite a lot to finance development across the city with some success here and there. Good as they are, they are subject to the volatility of the real estate market.

Local government financing vehicles (LGFVs) are economic entities established by Chinese local governments and their departments and agencies through fiscal appropriation or injection of assets to perform the function of financing government-invested projects. LGFVs are the combined result of local governments' exuberant investment demand, limited fiscal capacity and a narrow financing channel. Their origin, development and operation model reveal an unignorable aspect of state capitalism in China—state capitalism at the local level.²⁸

Major problems and risks associated with LGFVs

To be clear, the sustained operation of the LGFVs' "land for loan" model depends on two preconditions, i.e., unlimited supply of land and the constant rise of the land price. But neither of them can be continuously met in the real world, not even in Shenzhen, as it was surrounded by traditional

land holdings. Once land is in short supply, or more probably, the land price drops, the debt-raising capacity of LGFVs will decrease sharply. And considering that a large portion of the LGFV debts are paid through the "borrow new to pay the old" cycle, the sharp decrease in their capacity to borrow new money is highly likely to result in a break of the capital chain, thus triggering default (ibid).

Use of Bonds by Shenzhen Municipality for Infrastructure Development

As indicated much earlier, financing the huge amount of infrastructure needed to meet the demands of growing urban population in Shenzhen has been beyond the reach of the municipality and governments alone. Private sector financing has been sought to close the financing gap, particularly given widespread public constraints.²⁹ In May 2014, a programme was rolled out that allowed 10 local governments (Zhejiang, Jiangsu, Jiangxi, Ningxia, Shandong, and Guangdong provinces as well as the cities of Qingdao, Beijing, Shanghai and Shenzhen) to issue municipal bonds. Before then, local governments were not legally allowed to borrow money or seek outside financing for their debt. However, the lack of direct, legal options for financing local government spending did not prevent borrowing, but simply moved it underground to China's shadow banking sector. The shift to allow local governments to directly issue bonds is a move to eliminate the riskier shadow banking practices, while providing a better-regulated alternative.

To stimulate the economy, the central government allowed local governments to issue bonds with a yearly quota of CNY200 billion in 2009, 2010, and 2011. In 2011, Shanghai, Zhejiang province, Shenzhen, and Guangdong province, were the first pilot areas to issue local government bonds. The government bonds issued by trial provinces or cities were fixed-rate bonds with a term structure of three years or five years. Issuing of local bonds profoundly upgraded local governments' investment capability for infrastructure construction. Shenzhen

Box 1: International Low Carbon City project, Shenzhen

Shenzhen International Low Carbon City (ILCC) is a demonstration project of the China-EU Partnership on Sustainable Urbanization (CEUPSU) and an intriguing example for understanding innovative forms of funding with the specific aim of doing this in environmentally, socially and economically sustainable ways. Urban Investment and Finance Platforms and Public-Private-Partnerships (PPPs), in a broader context, were the two financial vehicles ILCC uses. A broad approach to PPPs is chosen in which stakeholder involvement is key and social conflicts are avoided by balancing the interests of various stakeholders. In particular, planning the village area in Shenzhen as a whole and arranging finance through 'metro + property' provides a replicable and operable example for other cities in funding urban renewal and community transformation and dealing with the issue of how residents can share the benefits of urban development with developers. The combination of these financial arrangements facilitates the achievement by ILCC of the triple bottom line in sustainable urbanization. ILCC is environmentally sustainable by promoting low carbon transition, socially sustainable through resident and villager involvement, and financially sustainable through diversification of funding sources. The financing experience gained from ILCC provides practical lessons for other cities and has significant implications for adapting institutional and organizational arrangements to create enabling conditions for innovative financing activities.

itself has made great use of bonds and public private partnerships in building its vast array of modern infrastructure in the city. In 2014, 10 pilot provinces and cities managed to pay back the local government bonds themselves.

Hand in hand with bonds, Shenzhen has also embraced Public Private Partnerships for infrastructure development. These models have been very popular. This followed the issue by the central government of 19 PPP-related policies in 2015, which were aimed at regulating PPP development and facilitating various investment and financing activities. PPP financing models can make up for the shortcomings of traditional financing methods and ease fiscal and financial stress. But the uncertainty in cooperative relations with government remains a factor restricting the development of PPP patterns. PPP models did provide the municipality with a stable and sustainable source of income for the Council to undertake municipal construction and provide public services, transportation, and ecological environmental protection within the fragile city.

The PPP model binds infrastructure construction to its operation to provide more infrastructure at

lower cost and of higher quality. Multifunctional public-private partnerships have been used in Shenzhen in the areas of the city's infrastructure construction to arouse the enthusiasm of people from all walks of life. This has enhanced the city's capacity to invest in infrastructure construction. It shows that the PPP model is a cooperative model that shares benefits as well as risks and requires full cooperation between local government and business. The model offers the council more financing channels for infrastructure construction, improves its public service capabilities, and to some extent enhances its spending capabilities on ecological environmental protection.

Eco Cities and Their Financing

China has undergone a rapid process of urbanization, but this has been accompanied by serious environmental problems. Therefore, it has started to develop various eco-cities, low-carbon cities, and other types of sustainable cities. The massive launch of these sustainable initiatives, as well as the higher cost of these projects, requires the Chinese government to invest large sums of money. Identifying the financial toolkits to be

employed to fund this construction has become a critical issue. Against this backdrop, the authors have selected Sino-Singapore Tianjin Eco-city (SSTEC) and Shenzhen International Low-Carbon City (ILCC) and compared how they finance their construction. Thus far, both are considered to be successful cases. The results show that the two cases differ from each other in two key aspects. First, ILCC has developed a model with fewer financial and other supports from the Chinese central government and foreign governments than SSTEC, and, hence, may be more valuable as a source of inspiration for other similar projects for which political support at the national level is not always available. Second, by issuing bonds in the international capital market, SSTEC singles itself out among various sustainable initiatives in China, while planning the village area as a whole and the metro plus property model are distinct practices in ILCC. In the end, the authors present a generic financing model that considers not only economic returns but also social and environmental impacts to facilitate future initiatives to finance in more structural ways.

Green Finance

Green finance refers to financial services provided for economic activities that are supportive of environment improvement, climate change mitigation and more efficient resource utilization. It includes investment and financing activities for projects in areas such as environmental protection, energy saving, clean energy, green transportation, and green buildings.^{30 31 32 33}

Green finance in China has been piloted in 7 cities, Shenzhen among them, with varying success. Among the 7 pilot areas at present, the Hubei market has the largest trading volume, the Shenzhen market has the highest trading activity, and the Chongqing and Tianjin markets have relatively small trading volumes, with trading almost stagnant. The carbon allowance price of each pilot market also varies: the carbon price in Beijing and Shenzhen is RMB 40-50/ton, while that of the other 5 pilot markets is around RMB 10/ton.³⁴

Current Development Situation of Shenzhen Carbon Market

As one of the 3 cities possessing both carbon exchange and financial centre functions in 7 national carbon trading pilot markets, and as the vanguard in China's economic system reform, Shenzhen leads the whole country in carbon emissions market construction and is highly experienced in trading practice and management. Shenzhen generates nearly 9 million tons of trading volume with about 30 million tons of carbon allowance, with a liquidity rate of 30 percent, which is far higher than that of Beijing and Shanghai carbon trading markets in the same period.³⁵

The high trading activity of the Shenzhen market mainly benefits from three aspects: firstly, Shenzhen, the first carbon trading pilot area, has a long carbon market running time and high enterprise awareness; secondly, Shenzhen has the smallest total allowance—30 million tons among the 7 pilot markets, but has the largest coverage—845 enterprises and other subjects; thirdly, Shenzhen market has been open to institutions and individual investors from the beginning, without access restriction.³⁶

However, Shenzhen carbon trading market has some problems, despite the achievements and experience obtained. In particular, only a single product is now traded in the Shenzhen carbon market, its carbon price is lower than the level of world mainstream carbon markets and far lower than the effective emission control price measured and calculated by the National Development and Reform Commission, and its role in promoting enterprises' emission reduction is to be improved.

Shenzhen should use the means of green finance to support green projects on energy conservation and emission reduction, to strengthen the market activity of carbon trading market by expanding the carbon emissions market breadth, increasing the diversity of carbon derivatives, and the carbon trading market thickness, trying to become a regional carbon emission centre and international

green financial centre. Policy recommendations for developing green finance to drive Shenzhen carbon market include: Formulate the green finance development plan and promotion scheme. Establish carbon assessment procedures. Lower the threshold for financial institutions to participate in the carbon trading market and explore carbon derivatives in an orderly manner.³⁷

Land Concessions and Land Leasing

Lastly, local governments have also ventured to raise money through land concessions. The Municipalities try to acquire as much land as possible, and as cheaply as possible, then either sell it at market rates, use it as collateral for infrastructure loans, or provide it at below-market rates to strategic (mostly foreign) investors for industrial development.³⁸

Despite municipalities' ability to create new supplies of urban land, land leasing is a transitional infrastructure-financing strategy. The supply of land available for leasing will eventually run out. Shenzhen, the pioneer in land leasing, aggressively expanded its urban boundaries for 15 years. The municipality's sale price for leasing land for urban use has vastly exceeded the purchase price it pays farmers, often by a factor as large as 100 times. By now, the potential for further expansion or new land leasing has almost been exhausted. In fact, Shenzhen's asset management company has turned to buying and selling land-use rights in other urban areas of the interior of China as a way of continuing to use its entrepreneurial skills to generate revenues from land transactions. By contrast, land leasing as an infrastructure-financing tool is gathering speed in other parts of China.³⁹

Conclusion and Lessons Learned

In this chapter, we have seen how a small, sleepy village has been catapulted to a modern, sustainable city in China through the adoption of reforms of administrative laws and practices, and secondly, through careful management of resources at hand.

In terms of economic development, Shenzhen has been outperforming China's first-tier cities in economic growth over the past couple of years, developing a reputation for innovation and economic transformation. The city has come a long way from a small village to a special economic zone in the 1980s, and now its transformation into a hub for innovation-driven industries—including biotechnology, the internet, new energy, new materials, information technology and cultural and creative industries, which together grew 20 per cent last year and accounted for 40 per cent of Shenzhen's gross domestic product.

Furthermore, Shenzhen has become a hot spot of innovation in China. Shenzhen has become the centre of attention in China as authorities hold it up as a role model of economic transformation and wealth accumulation that defies the economic headwinds that have slowed growth in most other parts of the mainland.

Besides being the nation's innovation hub, Shenzhen could very possibly overtake Shanghai as China's global financial centre in the next decade, if it cooperates with Hong Kong. While the Shanghai market is dominated by large state-owned enterprises, Shenzhen is more representative of smaller, younger, privately owned companies, and is the headquarters for a number of property developers. The city is a hotbed for private economic growth, spawning more than 1 million private companies, including some of China's biggest and hottest companies, such as internet giant Tencent Holdings, telecommunications.

The success noted above has come about because the Shenzhen government has been innovative in the way it has financed its development over the years, beyond normal city financing from own sources or transfers from central government. It has gone out of its way in making several reforms to facilitate development in the city and has also provided many incentives to woo local and international investors. Today Shenzhen can pick and choose whichever FDI it wants. The city has also been quite supportive in encouraging and financing entrepreneurs interested in industrial development.

With fast urbanization has come the need for infrastructure and other services. To-date, Shenzhen has gone beyond the traditional funding streams and ventured into innovative strategies, such as issuance of municipal bonds, foreign direct investments, project finance, use of local government platforms, public private partnerships, special purpose vehicles and tax incentive financing. Shenzhen municipality was the first city in China to use land value capture through the rail plus property land model as an innovative way

of funding its infrastructure development. Shenzhen's success in this approach has profound implications for other cities both in China and in the developing world. All of these actions that have resulted in one of the best planned and developed cities should be a model not only in China but the rest of the world, especially the emerging low-income countries in Africa, Asia and Latin America.



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Chapter 3

Modern Economic Growth, Special Economic Zone and Industrialization

Jie Tang

Introduction

Shenzhen is a young city woven from an infinite number of legendary stories, and it is the leader of China's reform and liberalisation. Forty years ago, Shenzhen boldly broke through the constraints of the traditional planned economic system and formed a relatively sound socialist market economic system and mechanism, establishing a relatively complete urban governance system and framework for the rule of law. Shenzhen has implemented bold innovation, continuous transformation and upgrading, and has formed an innovation-driven pattern of high economic development level, embarking on a new path of rapid growth and ecological civilization. Before 1980, Shenzhen's GDP was 0.2 percent of that of Hong Kong and in 2017 it was CNY2.24 trillion, which was the same as Hong Kong. Its per capita GDP is USD27,000, the ratio of secondary and tertiary industries was 6:4, and high-tech industry and financial sector accounted for 33 percent and 13.6 percent, respectively. No other city in the world has made a transition from agricultural economy to knowledge and information economy in such a short time. It has grown into a representative of China's 5 most important economic, trade, financial and innovative development centres.

Literature Review

The economic development of Shenzhen has caused many scholars to explore, and engage in countless discussions on the development model of Shenzhen. Yu Jun argued that Shenzhen has developed 5 features in economic transformation and industrial upgrading: (1) transformation to service industry from manufacturing industry (2) integrated development of service industry and manufacturing industry (3) manufacturing industry gives priority to innovation and branding instead of low cost (4) traditional service industry upgrades to modern service industry and (5) reliance on both domestic and international markets from an export-oriented economy.⁴⁰ Fan Gang also presented five priorities: incorporating more rural residents into urban life, improving the urban administration system for promoting the growth pattern transition from an outward economy model to an open economy model, promoting further Shenzhen-Hong Kong economic integration and social harmony, stability and efficiency by further institutional reform.⁴¹ Yi Yongsheng holds the view that facing the market is the foundation of independent innovation, enterprise is the key to independent innovation; industrial transformation and upgrading is the motivation of independent innovation; taking the lead in the formation of an innovation system is the

environment of independent innovation; energetic policy guidance is the guarantee of the independent innovation of Shenzhen.⁴² Sun Changxue considered that Shenzhen's special economic zone should focus on enhancing the construction of a modern industrial system, improving the income distribution system and incentive mechanism, promoting a new round of comprehensive opening and regional coordinated development policy, constructing a wise and happy city and a first-class soft environment to continually lead the next step of reform exploration.⁴³ In this chapter, we mainly discuss five representative stories.

Shenzhen Improves the Quality of Growth and Speeds Up Industrial Upgrading but Speed of Growth Declines

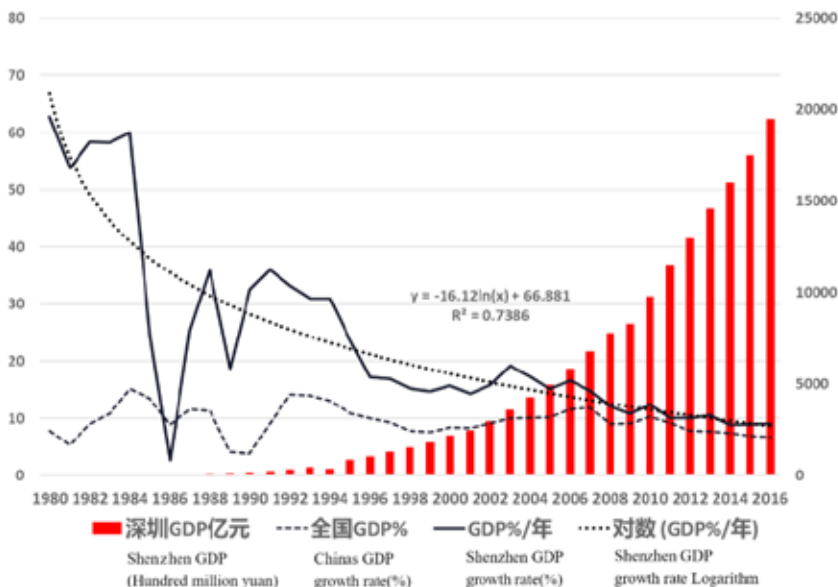
The average annual growth rate of GDP in Shenzhen from 1980 to 2016 was about 20 percent, but it can be seen intuitively from Figure 1 that Shenzhen's long-term growth rate continues to decline. The gap between Shenzhen and the national average annual growth rate is shrinking. The average gap between

1980 and 1985 reached 40 percentage points. It was 20 percentage points from 1990 to 1995. Then it has been 2 percentage points since 2010.

In the past 40 years, Shenzhen's economic growth has a medium-long period of about 10 years that is not regular but has been traced. It has nested a financial cycle of about three years. Shenzhen's economic openness is extremely high, and the economic adjustment period is also different from the national ones, generally one year or two ahead of the country. Several important transformations that the Shenzhen economy has experienced have basically taken place at the bottom of the medium and long-term cycle. They have created a new boom in structural adjustment and industrial upgrading, and have embarked on a path of low-to-high, gradual and rapid industrial upgrading.⁴⁴

The first major transformation of the Shenzhen economy occurred roughly in 1985. After the rapid growth of the arbitrage era of the planned economy and the market economy price difference in the previous years of the establishment of the special economic zone, Shenzhen began the process of rapid industrialization and urbanization. "Domestic

Figure 7 : The average annual growth rate of GDP in Shenzhen (1980-2016)



Source: Shenzhen Statistics Bureau and Shenzhen Statistical Yearbook

investment is the mainstay, production is mainly based on processing and assembly, and products are mainly exported". It has become the most concise policy claim for Shenzhen to join the global division of labour system. The low-cost land and labour force and Hong Kong form the former store-and-factory centre-peripheral relationship. The Shenzhen processing trade enterprise represented by OEM has become the core force supporting Shenzhen's return to high-speed growth. This is an era in which Shenzhen has completely broken through the traditional planned economic system and promoted market-oriented reform. It has attempted to create a systematic market economic system, created the Shenzhen securities market, led the reform of interest rate credit, reformed the land auction system, and adopted diversified investment methods for ports, and urban infrastructure construction such as airports and highways.⁴⁵

The second phase of the transformation in Shenzhen began in 1995 and lasted for about 10 years. Along with the SAR preferential policy of the year, Pratt & Whitney were open to the coastal policy. In 1995, the Chinese special economic zone including Shenzhen was essentially a special economic zone without special policy support. In addition to major institutional changes, the Hong Kong-Shenzhen-Shantou high-speed railway was built. The completion of the large-scale operation of Shenzhen Airport has also become a driving factor for enterprises to re-discover new and reasonable locations. Shenzhen enterprises have left Shenzhen to seek better development opportunities, such as the large-scale entry of processing trade enterprises into Dongguan, triggering a new round of recession in Shenzhen's economy. The Shenzhen economy has shifted from processing trade to imitation innovation. Whether it is the cottage phenomenon in the Chinese context or the Copycat in the English context, it depicts the core industrialization process without core R&D competitiveness and the imitation of large-scale production capacity. Undoubtedly, the phenomenon of the cottage is an important example of attending a middle school, and it is also an important way for knowledge catch-up by developing countries. No longer in cottage-style

production, today Shenzhen may still remain in the stage of decentralized process processing trade. Shenzhen enterprises have entered the production process of specialized and differentiated products from cottage production. Many famous brands in Shenzhen were born in the golden age.⁴⁶

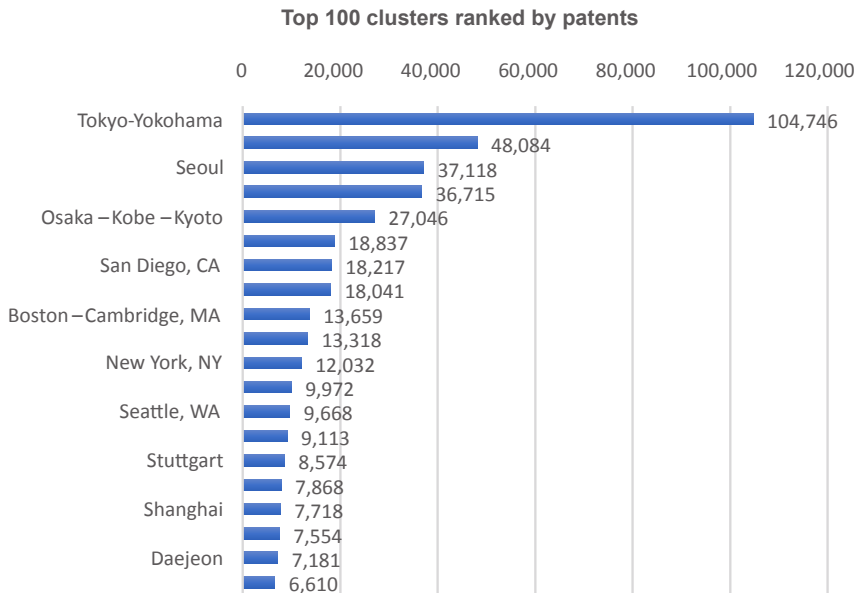
The third transformation in Shenzhen almost alternated with the second transformation. Around 2003, Shenzhen's economy was in a new round of recession. The main reason was that Shenzhen exploited the prevailing advantages of the global dividend for the demographic dividend, and quickly popularized and promoted it in the coastal areas. The phenomenon of the cottage moved from Shenzhen to the entire country. Shenzhen urgently needs to introduce new production methods to achieve new and higher levels of innovation growth. This is a new round of upgrades with a solid foundation and comprehensive integration. It is a process of upgrading from specialized processing and assembly to specialized manufacturing and collaborative innovation. Today, Shenzhen is not known for its large number of large enterprises. This is a feature of Beijing and Shanghai. Shenzhen is characterized by a large number of small enterprises. There are complex network-type supply chain relationships between large and medium-sized enterprises. The large-scale Shenzhen enterprises represented by Huawei are constantly improving their global innovation status. SMEs entering the supply chain of first-class large enterprises are not only sharing the innovation achievements of large enterprises, but more important, obtaining and maintaining the qualification of suppliers is a competitive survival process; many companies compete, but only one can stand out. Every participating company must propose the best possible solution to defeat the opponent to obtain the supplier qualification. Therefore, this is not a one-way innovation sharing or the process of traditional large enterprises relying on monopoly status to eliminate small and medium-sized enterprises, but a collaborative innovation process. It is division of labour and innovation, innovation deepening the division of labour, and promoting new continuous innovation.

Around 2010, Shenzhen began a new innovation-driven transformation. The supply of effective public goods, such as public research and development platforms, public information platforms, and public innovation service platforms has grown rapidly. Combined with the increasingly strong innovation capabilities of enterprises, Shenzhen has begun to move towards the forefront of global innovation, from the world-famous copycat to the famous innovation greenhouse.⁴⁷ Entering the era of innovation, Shenzhen has formed an independent innovation model based on market demand and integrating production, education and research. Using new technologies such as Internet platform, cloud computing and big data model, and relying on technology-based leading enterprises, 45 industry-university-research alliances have been formed to cultivate this model. There are 70 new R&D institutions that integrate basic research, applied research and industrialization. Perhaps the biggest feature of the new round of innovation transformation is that Shenzhen has begun the process of invention + innovation. Knowledge and ideological creation, basic science and industrial innovation are more and more closely integrated.

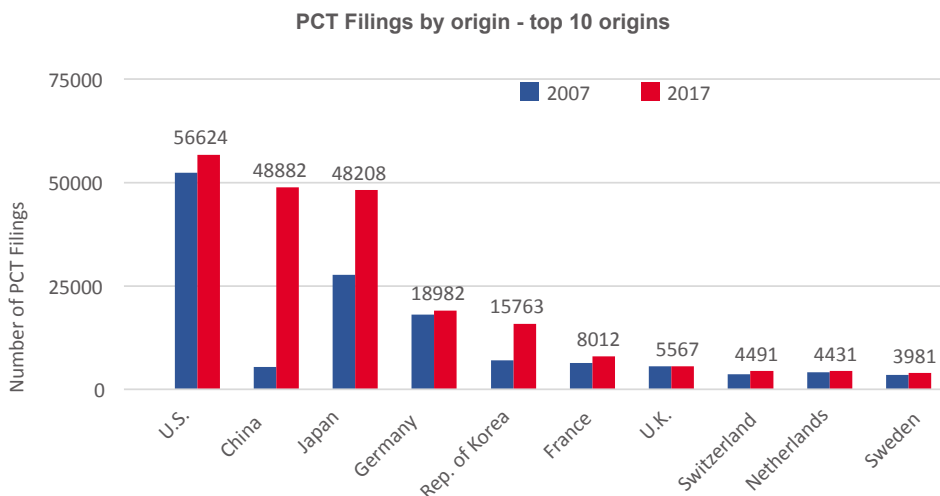
New technologies, new industries, and new ideas have replaced material capital investment as the main source of economic growth. In the first 20 years of Shenzhen's economic development, on the whole society's average investment rate in fixed assets was over 50 percent, and then gradually declined. The average investment rate since 2010 has dropped to 23 percent. The next generation of wireless communication technology, gene sequencing analysis and equipment manufacturing, new materials, new energy vehicles, display technology and other fields have become the world's leading innovation capabilities. According to the five-year cumulative number of international patent applications, Shenzhen-Hong Kong has become the world-class regional innovation cluster after Tokyo-Yokohama in Japan.⁴⁸

Transforming in innovation, improving economic quality, and continuously strengthening the ability of collaborative innovation. Figure 8 shows the application for international patents of major countries in the 2017 World Innovation Report published on the website of the United Nations Intellectual Property Organization. The data of

Figure 8 : World's top 20 city centers for patents during 5 years



Source: Cornell University, INSEAD and WIPO (2018): The Global Innovation Index 2018

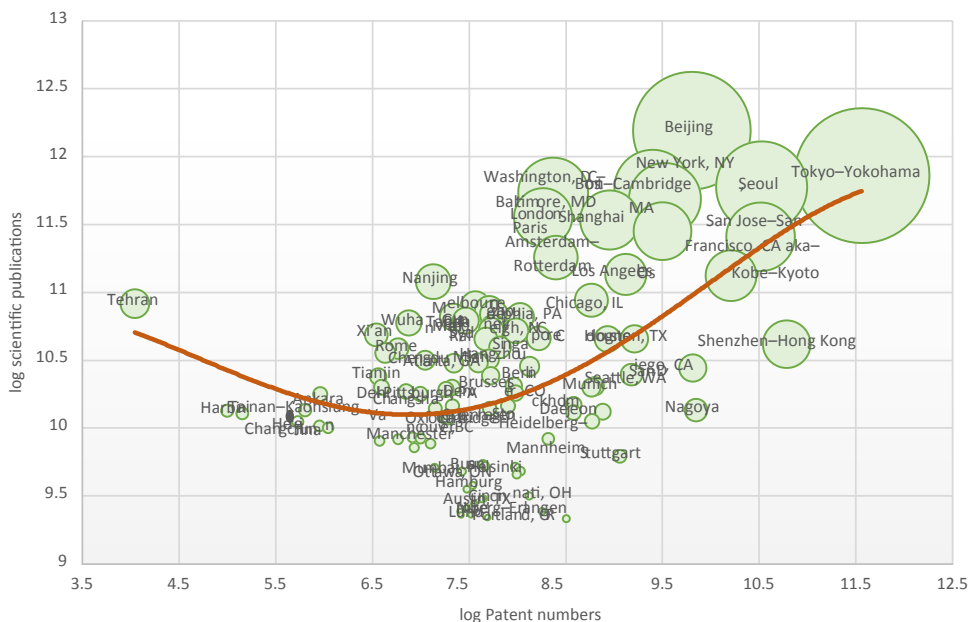
Figure 9 : Application for international patents in major countries in 2007 and 2017

Shenzhen is from the annual report of the Shenzhen Intellectual Property Office.¹⁰ In 2007, mainland China applied to the International Intellectual Property Organization (WIPO) for the seventh largest number of PCT international patents, ranking second in the world in 2017, and may surpass the United States within three years, when it is expected by WIPO to become the world's number one (Figure 9). In time, China's international patent stock during the patent protection period is likely to surpass the United States as the world's number one in 2030-2035. In 2004-2017, the number of patent applications in Shenzhen began from 331, increasing to more than 20,000, exceeding Germany and South Korea, slightly lower than the total of France in 2017. In the 2016 international patent application rankings, there were 4 companies with more than 4 patent applications, and 4 companies from China, totalling 10,651, ranking first (Figure 10). Among them, the top 3 companies exceeded the top 5 in the USA and the top 7 in Japan respectively. (National Intellectual Property Statistics Bureau). It is particularly worth mentioning that Shenzhen's innovation system, with division of labour as the core, has demonstrated a huge ability of collaborative innovation. The ten large-scale innovative enterprises represented by Huawei account for about 50 percent of international patent applications, professional and large. International patent applications for small and medium-sized innovative companies that are symbiotic in the

enterprise account for another 50 percent.

Shenzhen's independent innovation is not only reflected in the high-speed growth of high-tech industries, but also in the deep impression left by traditional industry. For example, the development of the Shenzhen garment industry started with nail buttons and sewing sleeves. After 30 years, it has become a fashion base, occupying half of China's women's garment production. The application of the latest technologies such as clothing computer integrated manufacturing system (CIMS), PAC programmable control, digital jet printing technology, computer colour measurement and colour matching, and a large number of fashion design teams has greatly enhanced the brand development and product design of apparel enterprises, their production level and capacity, and completed a major transformation from traditional OEM to ODM, and finally to the fashion industry with its own brand and technology and a close division of labour. Shenzhen is also the first city in the country to be awarded the title of "Design Capital" by UNESCO. It has nearly 5,000 industrial design institutions. Shenzhen Design has won the "Red Dot Award" and "IF Award" for the world's top design awards, with hundreds of items (Figure 11).

Figure 10 : World's top 100 clusters patent and scientific publishing performance



Source: Cornell University, INSEAD and WIPO (2018): *The Global Innovation Index 2018*

Shenzhen is the City with the highest Economic Openness and good Market Economy Development

A sound market mechanism is the most important institutional guarantee for stimulating innovation and enhancing economic vitality. The market mechanism has three core functions. First, the market economy can provide a reasonable incentive mechanism. The market and the planned economy are completely different. The planned economy has no incentive mechanism. Under market conditions, the maximum benefit of the enterprise is the incentive mechanism. Second, the market is a signal discovery mechanism. When everyone says that the planned economy is an unrealizable economic mechanism, in fact, no individual or organization can collect all the information about resource allocation. When it is impossible to collect complete information or collect some information at a very high cost, the comprehensive economic plan itself is a paradox. The biggest feature of the market economy is that everyone may find that some points may be imperfect and may be inaccurate from different angles, but may be useful information. This

information generates incentives for entrepreneurial innovation and motivates companies and individuals to discover new information. Third, the market mechanism is a measurable mechanism. Is resource allocation effective? Is the information obtained accurate? Finally, it will definitely be reflected in the market value of the product.

Before the reform and liberalisation, Shenzhen took the lead in establishing a framework system for the market economy in China, which played a key supporting role for Shenzhen's innovation and development. For example, Shenzhen took the lead in reforming the land use system in China, separating the national ownership of land from the rights of use of specific operators, and implementing bidding and auction systems for the transfer of rights of use of operational land; comprehensively implementing housing system reforms to achieve commercialization of housing. It led in reforming the state-owned asset management system, building and improving the three-level state-owned asset supervision and operation system; in the financial aspect, introducing a number of foreign-funded banks, establishing regional

joint-stock banks, such as China Merchants Bank and Shenzhen Development Bank, and breaking through the resistance to create a stock trading market; establishing a foreign trade system that is oriented towards the international market, operating according to international practices, and market mechanisms, and forming a set of foreign trade systems and organizational forms that adapt to the development of the market economy; earlier establishing a “talent market”, facing the country, achieving the free appointment and free flow of talent. Through a series of market-oriented reforms, Shenzhen has gradually established and improved the system of capital markets, technology markets, talent markets, property rights trading markets, information markets, etc. The specific space that Shenzhen has is domestic and foreign commodities, labour, and capital. Production factors such as enterprises and technologies provide a freely mobile, mutually integrated and grafted place and stage, providing a key guarantee for the market mechanism to play a fundamental role in innovation activities. Of course, the market mechanism needs to be legalized to ensure that in a fragile legal environment, production factors will be difficult to accumulate, and economic and innovation activities will be more inefficient.

At present, Shenzhen listed companies account for 7.9 percent of the country's total, profits account for 11 percent of the country's total; Shenzhen

Figure 11 : Shenzhen's mobile phone cluster is constantly updated from assembly to manufacturing and innovation



listed company controlling shareholders: state-owned holdings 19.5 percent; private holdings 76.1 percent; foreign investment 2.9 percent; and others 1.5 percent. The distribution of labour employment in Shenzhen, the number of entrepreneurs and the number of employees per capita of enterprises can be obtained from the table 3, which is clear evidence of the high degree of marketization in Shenzhen. The degree of economic development is the highest, and the competition for enterprises is the most intense. In 1980, the total number of labourers in Shenzhen was about 150,000, of which some 50,000 were employed by enterprises, 82.7 percent were employees of state-owned enterprises, 2/3 were non-employees, and the average number of

Table 3 : Shenzhen labour force employment and distribution; Entrepreneur numbers and enterprise per capita employees

Year	All labour force	Corporate employees	State-owned enterprise employees	Enterprise share (percent)	Share of state-owned enterprises (percent)	Number of enterprises	Labour force per business
1980	14.9	4.9	4.05	32.9	82.7	830	180
1985	32.6	22.7	16.8	69.6	74.0	6853	48
1990	109.2	55.4	50.5	50.7	91.2	19827	55
1995	298.5	88.8	40.2	29.7	45.3	70785	42
2000	475.0	93.4	31.0	19.7	33.2	107457	44
2005	576.3	165.4	35.9	28.7	21.7	209443	28
2010	758.1	251.1	46.6	33.1	18.6	360912	21
2016	926.4	442.6	41.8	47.8	9.4	1504255	6

Source: Shenzhen 2017 Statistical Yearbook



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employees was 180. In 2000, the total labour force reached 4.75 million, the number of employees was 934,000, and the employees of state-owned enterprises accounted for 33.2 percent. The number of entrepreneurs has reached nearly 110,000 from 830, and the average number of employees is 44. In 2016, the total labour force reached 9.264 million, the number of employees reached 4.426 million, and the proportion of employees in Chinese enterprises fell to 9.4 percent. Employment in towns and villages is no longer counted, and individual industrial and commercial households account for about half of total employment. It is not difficult to see that the fundamental change in the employment of labour in Shenzhen in 2000-2016 is that the number of employees in work has increased by 3.5 million. The Shenzhen enterprises have gone through the process of scale and standardization. Traditional towns with three to one supplement are the main characteristics. Employment in the village has gradually narrowed, and the proportion of employees in state-owned enterprises has fallen to 9.4 percent; the proportion of total employment has fallen below 5 percent. The number of entrepreneurs in Shenzhen was 830 in 1980, close to 20,000 in 1990, and about 110,000 in 2000, currently more than 1.5 million. The average number of employees in the company has dropped to 6, roughly the same

as in New York. This shows that Shenzhen is a representative city of entrepreneurship.

A typical market survey found that 80 percent of innovation comes from customers and partners, which illustrates the fundamental role of market division of labour in innovation. This is because a highly developed market means that the market has sufficient specialized division of labour and cooperation and a developed industrial chain. In 2018, the number of high-tech enterprises in Shenzhen exceeded 10,000, ranking second to Beijing among all cities. The number of domestic and overseas listed companies was 374, ranking first in the national cities. Shenzhen has attained outstanding achievements in the innovation industry, and has gathered a large number of different industries, different sub-disciplines, and different scales of enterprise groups to carry out collaborative innovation. As the core city of Guangdong-Hong Kong-Macao Greater Bay Area, Shenzhen can integrate a large number of social products and R&D resources, innovative resources and common innovative technologies. After cooperation, suppliers and even competitors rapidly spread among different industries, and a wave is formed. Then a wave of industrial innovation and upgrading is not so much the innovation of

large enterprises, but essentially the collaborative activities of the enterprise groups that cannot be counted. Innovation has become the conscious behaviour of Shenzhen enterprises under conditions of market competition. The development level of the market economy determines the potential for innovation and development. Innovation boosts the ability of Shenzhen enterprises to achieve stronger competition and survival.

The Shenzhen government has also actively explored the administrative system of small government and large society. It has carried out 8 institutional reforms and 4 rounds of administrative examination and approval system reforms. The examination and approval items have been reduced from 1091 to 391, continuously improving the overall efficiency of government services. At the same time, the Shenzhen government's fiscal funds have been withdrawn from the competitive and profitable sectors, and concentrated on infrastructure construction and public utility projects, providing a good external environment for the development of high-tech industries. Since the mid-1990s, the Shenzhen government has given the initiative and discourse power of independent innovation to the main body of the enterprise, and has accelerated the service function of the development of high-tech industries to social intermediary organizations, becoming the builder of an independent innovation environment. This has also become the key to Shenzhen's successful innovation drive.

Innovate in Competitive Survival, rely on Industry Chain Synergy, Gather Innovative Entrepreneurial Energy

The developed market economy system and division of labour are the basis for the continuous upgrading of industry. According to Smith's theory, division of labour is considered to be the source of economic growth. The role of this division of labour not only refers to the role of internal technical division of labour in the improvement of labour productivity, but also includes the division of labour in industry,

the division of labour in different industrial sectors, the international division of labour, and the increase in the roundabout production process thus driving the expansion of the economic scale. The theoretical logic of the Shenzhen experience is that through opening up and participation in the international division of labour, Shenzhen has gained knowledge spillover and spreads of foreign investment and technology licensing methods. Through the "introduction-learning-improvement-innovation" model, Shenzhen local enterprises have gradually developed Process technology, industrial manufacturing technology and specialized technology of the professional workforce; these specialized labour forces in the subsequent follow-up and catch-up stage imitate innovation and achieve original innovation, and form a new specialized workforce, with professionals. With the increase in the number and types of labour, the endogenous specialized division of labour is deepening and refining. These sub-sectors and industries will attract more enterprises, accelerating market competition and innovation activities, which may lead to the formation of new industries, and perfect, driving economic growth. The extension of this theory to the endogenous growth theory is that, unlike the homogeneity of the latter's human capital, the difference in specialized labour as seen in this paper will provide the backward regions with comparative advantages in certain emerging industries. They can achieve the catch-up development of increasing scale returns across static comparative advantages.

Shenzhen has many fascinating qualities, the most prominent of which is the entrepreneurial spirit that vibrates in every corner of the city. Entrepreneurship and innovation create new products from scratch and create new enterprises. The growth of excellent enterprises is a process of never giving up. Only by continuous innovation can we survive in market competition. An innovative city, the core of an innovative country, is the process of entrepreneurs creating entrepreneurs. The result of 100 innovative entrepreneurs driving 100 innovative entrepreneurs to continue to advance is the process of increasing marginal revenue. The middle-income trap is the diminishing marginal return of innovation, and there

are many cases in which high-income countries in the world fall into the marginal diminishing returns trap.

What we need to pay close attention to is that competition and survival are not the single enterprise's process of lonely pursuit. On the contrary, the competition of many professional and innovative enterprises in the industrial cluster constitutes the synergy effect of the industrial chain. Many enterprises in many fields, multi-level, multi-link innovation, collaborative innovation resulting in resource restructuring and effective re-allocation, are at the root of the rise of a new industry. Shenzhen's latest rise in the UAV industrial cluster is a classic case of competitive survival and collaborative innovation. The brief expression of accuracy is that the UAV is a new industry based on AI technology and material technology, precision processing technology, power battery technology, control technology and digital mobile communication technology. No one company can independently produce drones, and it can't produce drones without the core key technologies in the industry chain.

First of all, there are many fibre material companies in Shenzhen. In the era of processing trade, from processing fishing rods, badminton rackets, tennis rackets to golf clubs, with the gradual upgrading of the industry, a number of subdivided enterprises emerged for the manufacture of fuselage, casing and main structural parts for drones. Secondly, the UAV precision parts manufacturing enterprise, as a post-processing sub-sector of aviation aluminium, originated from low-end aviation model parts, mobile phone casings, consumer electronics casings, robot parts and so on. Shenzhen's mobile phone manufacturing has risen in the era of imitative innovation. According to incomplete statistics, after entering the 21st century, output has reached 600-800 million, and exports accounted for 70-80 percent. With the advent of the smart phone era, the traditional low-end mobile phone industry has rapidly declined, becoming a typical overcapacity industry. Synergies with drone manufacturing and improved precision manufacturing capabilities

are opportunities for related companies to gain a new round of innovation growth. Similarly, it is the specialty plastics industry that provides enclosures, propellers and low-cost consumables for UAV production. The lithium polymer battery industry is the basis of mobile phone production and is also a traditional advantage industry in Shenzhen. The drone reaches its maximum speed from the hovering state. The shorter the UAV performance, the higher the requirement for instantaneous power increase of the battery. Therefore, the energy density of the power battery is much higher than that of the mobile phone battery, and the volume energy density or the mass energy density is the key to the transformation and survival of the traditional mobile phone battery manufacturer. The competition of different technical solutions in different fields and different links has created the rise of the UAV industry in Shenzhen. An expanding industrial cluster has also provided more market demand for hundreds of related companies. It is worth mentioning that the micro-motor is the key component of the UAV. The magnetic material is the core material for the production of micro-motors. It has the characteristics of small dosage, high value and high innovation difficulty coefficient. A single business will pay a higher price and bear greater risks. The Shenzhen Municipal Government did not foresee the rise of the drone industry, but knew that the micro-servo motor is the core technology for the development of the robot industry. It has given critical support to the research and development of magnetic materials in the field of public service and research and development, and upgraded the Shenzhen motor industry. Played a role of four or two.

Reform and Opening Up Make Innovation the Characteristic of Shenzhen

From simple assembly and division of labour to specialized division of labour, Shenzhen's continuous transformation and upgrading from large-scale manufacturing to R&D creates a huge market competition pressure. There are pressures to be eliminated without innovation, and innovation

failures must be eliminated. Businesses are often at a loss, and this requires the government to play a role in providing innovative public goods. The list of public goods in which the government plays a protective role is long, but the core points are extremely clear:

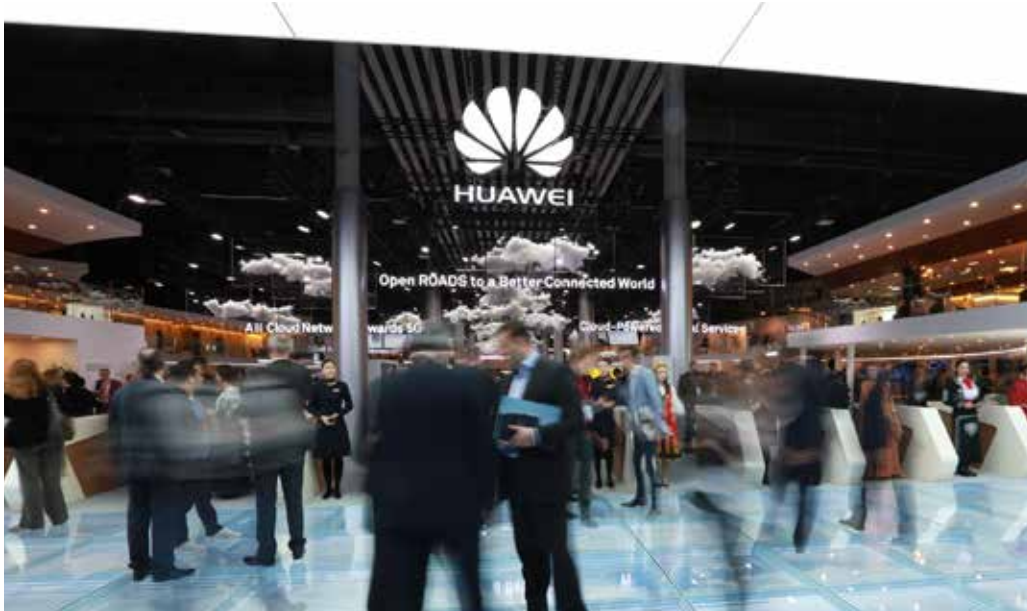
The first is to encourage enterprise innovation and promote the hyperspace cooperation between the Science Innovation Centre and the Industrial Technology Innovation Centre (Innovation). The four 90 percent features are the most notable aspects of Shenzhen's innovation, 90 percent of research and development institutions, 90 percent of research and development personnel, 90 percent of research and development expenditures, and 90 percent of research and development results are from enterprises. However, since the mid-1990s, Shenzhen has insisted on encouraging, supporting and subsidizing enterprises to establish research and development institutions, and has promoted the establishment of long-term research and development cooperation with universities and research institutions. This is an important institutional factor for the explosive growth of Shenzhen's international patent applications since 2004. Now, every time Shenzhen applies for 100 international patents, 12 of them are completed in cooperation with Beijing.⁴⁹ Because Beijing and Shenzhen have grown into a globally important industrial innovation centre: because of Shenzhen, Beijing's scientific discovery has become the frontier theoretical basis of industrial technology innovation, and the status of scientific innovation centre has been further strengthened.

The second is to promote market-led enterprise innovation. How do the scientific and technological innovations from the whole country and even the world, represented by Beijing, integrate with the innovation activities of Shenzhen enterprises, or why have the scientific research results in Beijing entered Shenzhen in large numbers, instead of other cities? The core is not the difference in government behaviour, but the difference in outcomes of market-led innovation resulting from differences in government behaviour. The industrialization of scientific research results began with a "thrilling leap"

in rational market pricing. Knowledge is power, and the high return on personal intellectual property will spur more knowledge discovery. Companies need to reduce innovation costs and risks and want to pay lower intellectual property fees. Walras' "auctional" market equilibrium cannot solve the problem of pricing knowledge products. It turns out that the government cannot price high-risk and high-decision innovation activities, which is the mission of a specialized venture capital industry cluster. From a global perspective, areas where innovation activities flourish are areas where venture capital is most concentrated. The most active cities for innovation investment in mainland China are highly concentrated in Beijing, Shenzhen and Shanghai.

The third is to create an innovative basis for the rule of law. The essence of a market economy is the contract system, which is the most important public product on which innovation depends. The legal contract is signed, the contract can be effectively executed, and the market economy can operate. Without the enforceability of contracts and their fair implementation, it is impossible to produce a wide range of innovative activities. If one company creates intellectual property and another company plagiarizes it without penalty, no company will be willing to innovate. Contracts can be fulfilled on the basis of the rule of law, rather than government administrative controls. The government's commitment to eliminating administrative monopolies is the greatest support for innovation. If there is a problem, finding the market is the rule of law. If there is a problem, finding the mayor will lead to improper intervention by the government. The Shenzhen government has built a perfect venture capital and equity investment system for 20 years, and has formed a deterrent intellectual property protection system to give full play to the decisive role of the market economy in resource allocation.

In July 1995, Shenzhen City defined a transformation strategy with high-tech industry as the forerunner and began to implement a series of policy measures to support the development of high-tech industries.⁵⁰ In September 1997, it was explicitly proposed to establish a technology venture investment system,



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which was made official in November 1998, in order to initiate the venture capital legislation process, and translate the venture capital of English “Venture Capital” into a venture capital investment, and determine that intellectual property rights can become equity assets in legal form; in October 2000, the “Interim Provisions on Innovation Investment” were enacted into law. The legislative procedure, the Shenzhen Innovation Investment Regulations passed by the Standing Committee of the Shenzhen Municipal People’s Congress in 2003, which contains several important theories and forward-looking institutional breakthroughs, laid the legal foundation for the development of Shenzhen’s innovative investment industry, and was the 10th National Committee of the National Development and Reform Commission in 2005. The Interim Measures for the Administration of Venture Capital Enterprises provide useful legislative references. In September 2012, Shenzhen accumulated 10 years of practice and promulgated the revised “Shenzhen Special Economic Zone Venture Capital Regulations”.⁵¹

The fourth is to establish an industrial policy system that is compatible with market support. In 2006, Shenzhen proposed a far-reaching slogan to support “non-consensus innovation”.⁵² This is a slogan full of philosophical implications and a policy

proposition that has raised questions. The challenge is, what is the basis for the government to support non-consensus innovation? Consensus must not be innovation. Most major scientific discoveries and industrial technological innovations in human history have gone through a process from being suspected to becoming consensus. Innovation must not be the myth of the so-called aura of light, and must conform to the general law of scientific discovery. The government can’t determine who can succeed in innovation, and can’t specify who is the innovator, but it can guide innovators and companies to understand the scientific basis of industrial technological innovation, follow the scientific norms of innovation, grasp the innovation progress in related fields, and understand their predecessors. Innovative explorations that have been carried out, whether successful or not, clarify the technical routes that are feasible in the future. Under the conditions of market competition, reasonable government behaviour is to clearly define the direction of scientific research and industrial innovation to be supported, as well as to evaluate the innovative ability of the innovation team in many aspects and effective organization. The biggest difference between determining direction and assessing innovative ability and designating winners is that innovation is based on market competition and

effective incentives for market players. By playing a fundamental role in the allocation of resources, the market will ultimately determine who is the winner. Only in this way is it possible to better fulfil the role of the government. Since 2006, Shenzhen has continued to patiently and meticulously explore the establishment of an environment that encourages innovation, formulates reasonable and effective policies and rules to support innovation, and has created an evaluation system in which scientists and innovative entrepreneurs rely on both sides.

Create wetland effects and support the development of strategic emerging industries. Wetlands are the most dynamic ecosystem in nature and have an extremely rich species diversity. The economic activity of the wetland is a fair, just and open market competition environment. As long as the government does not stretch out, market competition can determine who is the innovation winner. There will be no eternal innovation winners in market competition. Shenzhen has formulated and implemented a series of fruitful industrial policies and played an important role in promoting industrial transformation and upgrading. Through case analysis, it is observed how the industrial policy based on industrial planning is compatible with the market mechanism, and industry is transformed and upgraded according to market principles. In 2010, Shenzhen put forward the concept of “Shenzhen Quality” transformation development, formulated a more restrictive list of restrictive industry development, implemented a more active and intensive development policy, and rapidly moved enterprises in industrial restructuring. In the first quarter of 2012, Shenzhen’s economic growth rate plummeted to 5.8 percent, which was lower than the national and provincial average. Shenzhen still insisted on the same direction, kept pace, and did not lose momentum.⁵³ In 2013, Shenzhen launched the life health industry planning and related industrial policy points. It is clearly stated that it is necessary to build major medical infrastructure such as a stem cell bank and establish a clinical efficacy and safety evaluation system for individualized cell therapy.⁵⁴ In 2018, Shenzhen has completed the construction of a stem cell bank and the first national immune cell

quality testing laboratory. Cell technology innovation cannot be carried out from laboratory technology, across intermediate processes, quality control, and cellular products used in humans must undergo regulatory approval and have strict third-party quality checks. The US Food and Drug Administration and China’s Food and Drug Administration have clearly stipulated that the application of cell products must have strict quality testing: one is the detection of cell type and source; the other is safety testing, whether the cell source has infectious diseases, and whether the preparation process has pollution; the third is the effectiveness test, the cell as a kind of drug, whether the clinical use can achieve the goal of treatment. The development of China’s cellular industry has clearly lagged behind the US, Europe and Japan. The lack of cell preparation standards and quality standards in the development of the cell industry is an important reason. It can be seen from this that an effective industrial policy can speed up the key shortcomings in the process of industrial development. As long as they do not violate the market principle of competitive access to resources, industrial policies are conducive to the role of resource allocation in market mechanisms.

Increase Reform and Opening Up, Form An Innovation Incentive and Competition Survival Innovation System

In the mid-1990s, Shenzhen proposed the development of high-tech industries, but there are few universities or research institutions in Shenzhen. Shenzhen has done two things. First, “policy and depression” attracts talents to gather in Shenzhen. Due to the success of the first batch of high-tech enterprises in the early 1990s, Shenzhen has formed a “policy depression” that is more suitable for the development of high-tech industries due to market-oriented reforms. At that time, a large number of research institutions and technology developers who could not independently develop in the Mainland went south. Shenzhen established an electronic information enterprise, and in the 1990s, it formed a large-scale innovation resource

transfer of hundreds of thousands of scientific and technological personnel. Second, Shenzhen has actively built an innovation system integrating production, education and research. If the arrival of these entrepreneurs initiated the motor of Shenzhen's scientific and technological innovation, then the objective of Shenzhen's relatively complete independent innovation system, which is enterprise-oriented, market-oriented, and closely integrated with government, industry, research and development, is to maintain Shenzhen's continued innovation. This is the inexhaustible motive force for innovation. The establishment of an innovation system has several important roles in the development of high-tech industries in Shenzhen: first, overcome market failures and organizational failures, reduce the uncertainty and risks of innovative enterprises, and enhance the investment in and motivation of enterprises; second, establish technological transformation. Market derivative, and incubate high-tech enterprises, to promote the transformation of scientific and technological achievements; third, increase the number and types of specialized labour, and lay the foundation for deepening and refining of the division of labour.

In 2013, 591 new national high-tech enterprises were identified in Shenzhen, amounting to more than 3,000; 176 innovative carriers including key laboratories, engineering centres, and public technology platforms were accumulated, a total of 955 in all; social R&D investment exceeded 50 billion yuan. The proportion of GDP has increased to 4 percent, exceeding the average level of developed countries. Shenzhen has achieved "four 90 percent" phenomena in the field of scientific and technological innovation, that is, more than 90 percent of R&D institutions are established in enterprises, more than 90 percent of R&D personnel are concentrated in enterprises, and more than 90 percent of R&D funds are from enterprises and over 90 percent of service invention patents come from enterprises. The high-tech zone's entrepreneurial and innovation environment has been further optimized, and it has formed a relatively complete innovative and entrepreneurial service chain, including an international technology business

platform, venture capital service plaza, virtual university park, Shenzhen-Hong Kong production and research base, and National IC design Shenzhen Industrialization Base and other service agencies.

The resources of scientific and technical personnel and professionals are the basis of technological innovation. The number of people engaged in science and technology activities in large and medium-sized enterprises increased from 57,200 in 2005 to 257,000 in 2012, an increase of 3.5 times. By the end of 2013, there were 1,216,300 professional and technical personnel in Shenzhen, including 392,100 professional and technical personnel with intermediate technical titles and above. By 2013, 3,033 high-level professionals were recognized. In 2013, Shenzhen newly introduced "sea returnees" talents approached 50,000, and 76 overseas high-level talents were selected into the national "Thousand Talents Plan". Among them, Shenzhen Virtual University Park, as the only innovative institution in the country and the world that integrates the resources of 53 domestic and foreign universities, has trained more than 140,000 students. Shenzhen University City has trained more than 6,000 graduate students every year, and has become an important local institution with systematic, all-round training and introduction of high-quality talents.

Shenzhen's relatively complete technology service intermediary is an important bridge to promote innovation. For example, through the establishment of the GEM and SME board in Shenzhen, the company's financing channels will be expanded; the Shenzhen High-tech Zone Service Centre will establish the Shenzhen High-tech Zone Venture Capital Service Plaza, through the introduction of venture capital funds, brokerage investment banking and non-listed business units, property rights transactions. The assessment, accounting, law firm and guarantee, credit, and patent service intermediaries have settled in, providing "multi-level, three-dimensional, and full-process" financing services for small and medium-sized micro-technical enterprises at different stages of growth.

The industrial policy formulated by the government is an important part of the Shenzhen innovation system. The uncertainty of technology, the uncertainty of markets, the uncertainty of equity distribution and the uncertainty of policy environment, as well as the imperfect market mechanism, require a certain degree of government intervention. Therefore, in the post-development countries or regions, the government can influence and guide the role and efficiency of innovation activities through various forms such as policy planning, government procurement, and finance. Shenzhen promulgated the “Regulations on the Protection of Technical Secrets of Shenzhen Special Economic Zone Enterprises”, “Measures for the Management of Intangible Assets of Shenzhen Special Economic Zones”, “Interim Measures for Shenzhen Technology Enterprises for Reward Enterprises” and “Interim Measures for the Extraction and Use of Enterprise Technology Development Funds in Shenzhen”, the “Regulations on Further Supporting the Development of High-Tech Industries” and other regulations have compiled scientific and technological development plans, high-tech industry development plans, strategic emerging industry revitalization development plans, and future industrial development policies. The Shenzhen Municipal Government has also invested 3 billion yuan to set up a venture capital guiding fund to solve the problem of financing difficulties in the seeding and start-up period. Shenzhen has also set up a special fund for strategic emerging industries. The government supports strategic emerging industries such as biology, the Internet, and new energy. By guiding financial funds and leveraging, it will guide more social capital into the research and innovation field of the whole society.

In order to maintain the growth of Shenzhen’s “innovation-driven model” in the future, Shenzhen proposes to promote market-oriented reforms with the rule of law and internationalization, establish an internationally competitive, standardized and orderly market economy and rule of law economy, and give full play to the market in resource allocation. The decisive role of improving resource allocation efficiency and enhancing the incentive mechanism

for innovation activities. Shenzhen proposed to build “Shenzhen Quality” as a guide, continue to promote innovation-driven development strategy, enhance brand value by strengthening independent research and development, and implement quality priority, and promote the continuous upgrading and development of Shenzhen industry. Shenzhen should strengthen the institutionalization of marketization, rule of law and internationalization in the field of science and technology, and build an open and independent innovation system with international competitiveness through an innovative cooperation model of industry, university and research. To this end, Shenzhen proposes to build a first-class talent education and training system, support the establishment of relevant education majors and basic research facilities, and enhance the professional talent training, basic research, and original innovation level.



Chapter 4

City Growth and Urban Planning: Encountering the Challenges of Population Growth

Raffaele Scuderi

Introduction

The fast growth of Shenzhen from small village to metropolis in only three decades is a unique case of urban development. The impressive dynamics of both population and economy is the result of a peculiar and successful process that has been promoted, sustained and regulated by governmental planning⁵⁵. Through the institution of the Special Economic Zone (SEZ), near Hong Kong, the Open Door Policy set up Shenzhen as a “window” on the new trends in economics, a “training ground” for talents in the Mainland, and an “experimenting ground” for reforms in China⁵⁶. In order to achieve this, it was the first city in China to adopt capitalist world-type development, market and planning practices, which once more stress its uniqueness among other cities.⁵⁷

As Ng and Tang claim, “as the testing ground for the importation of foreign capital, science and technology into China, [Shenzhen] has been at the forefront of that country’s efforts at integration with the world economy, especially since the mid-1980s”.⁵⁸ Shen and Kee (2017)⁵⁹ report that, similarly to what happened in Guangzhou, the success of Shenzhen is mainly related to both the capacity of agglomeration and the creation of flows in terms of foreign trade and movement of people. But the

peculiarities of its success reside in the innovation processes, also in administrative structure and practices, and in the active involvement of government in addressing development. The latter has been crucial in driving the evolution of the city from a centrally planned, “resource-constrained” economy, typical of socialism, towards a modern capitalist, “demand-constrained”, economic system.⁶⁰ A system of unprecedented economic and social reforms for China, as well as appropriate promotion policies of the city, attracted and involved private stakeholders and then facilitated the city’s explosive development. Overall, as Ng (2003) claims,⁶¹ “[j]udged by the growth in population size, spatial development and various economic parameters, the experiment [of Shenzhen’s SEZ] was extremely successful”.

Urban planning has played a central role in sustaining and driving the city’s economic growth and the transformation of urban landscape, going hand in hand with both socio-economic and political context.⁶² Master plans and their development strategies have rationalised expansion and land use⁶³, with the latter having a prominent role in the city development.⁶⁴ Over time, these strategies have been consistent with the changing needs and role of the city, from early SEZ consolidation, to its expansion of the former city’s Counties, to the strengthening

of its role in the region and in the world. These needs, along with growing competition worldwide and with other Chinese areas, have stimulated what Ng defines as “an impressive job in integrating socio-economic and spatial planning”.⁶⁵ The latter efforts to plan spatial expansion consistently with the city’s social and economic needs are indeed typical of centrally planned economies like China. However, the main novelty in Shenzhen was the use of socioeconomic and spatial planning in a new way, namely, facilitating and promoting economic growth and market development. Planners have learned this unprecedented approach only by practice, gradually moving over time from the exclusive realm of centrally planned system to a more locally based formulation of plans.⁶⁶

In the following Sections, I will outline the main phases of urban planning and how it has supported the city’s growth since the inception of the SEZ. I will then focus on some core issues related to population growth that have characterised the city expansion, that is migration, urbanization and urban concentration, with a digression on a particular floating population, like tourists. Afterwards, I will discuss the main principles of sustainable planning and the related need to improve the living standards of the city’s population.

Planning and the Evolution of the City

Since the institution of the SEZ in 1980, the design of Shenzhen development as depicted by urban plans has constantly evolved. The gradual transition from a centrally planned economy also concerned the process of urban planning itself, where a real modern system emerged only in the late 1980s and the 1990s with the establishment of the Shenzhen Urban Planning and Land Administration Bureau (1989), the Regulations on City Planning of the Shenzhen Municipality (1998) and the Urban Planning Board of Shenzhen (1999)⁶⁷ (Shen and Kee, 2017).

As discussed in previous papers⁶⁸ [Ng (2003), Ng and Tang (2004a, 2004b)], over time, three phases of this

process can be identified. One of the most evident elements these stages have in common is the strict relationship between urban master plans and five-year planning, which has implied a tight connection between urban planning and socio-economic aspects of city growth.

The first phase goes from the SEZ inception in 1980 to 1985. The early challenge was to build a modern and attractive city for foreign investors based on industry, mainly high-tech and capital intensive, from the formerly agricultural economy. At the same time, the city should have developed multiple specializations in commerce, agriculture, housing, and tourism. However, this early stage mainly attracted foreign investors for real estate development and low-value added and labour-intensive industries. At the same time, domestic investment in the city grew significantly, with central ministries having a prominent role as investors. In Ng and Tang’s view,⁶⁹ potential foreign investors were discouraged, mainly by the lack of adequate physical and legal infrastructures.

In the second phase (mid 80s–mid 90s), planning was addressed to boost the economy through the export and attraction of foreign direct investment (FDIs), with an increasingly important role of high-tech industry and services. A series of administrative reforms were implemented. Actual growth of FDIs was the most important result of these efforts. At the same time, progressive land allocation, for uses that were functional to city development, started to pose questions as to its scarcity.

As time passed, the city of Shenzhen ceased to be an “exception” in China, as other cities also started to grow economically. Therefore, it had “no choice but to strive to be an exemplar” (Ng and Tang, 2004b) in order to consolidate its position towards both other Chinese cities and the rest of the world. The ambition to make it a world-class city has characterised the planning documents since the 1990s. Planners have reinforced the role of high-tech industry and services, with particular attention on the strategic use of land, and transportation and infrastructure development. After years of planning, mainly focused on economic growth, the Tenth Five-Year

Plan (2001-2005) introduced sustainability, quality of life and environmental protection. The city's efforts in sustainable practices and environmental protection have been acknowledged, both in China and worldwide.

A work by Zacharias and Tang⁷⁰ adopts a complementary perspective and describes how urban planning has shaped land use.

According to the first master plan in 1986, early development of the city and its SEZ was along a "clustered linear" model, where the SEZ would have grown as a string of clusters along traffic corridors. It included, in order from west to east, the administrative Districts of Nanshan, Futian, Luohu and Yantian. This distinction can also be seen today, as the city is divided into "integrated "self-sufficient" urban clusters"⁷¹. This rationale was opposite to the traditional core-periphery development of Chinese cities.⁷² The plan also considered the development of infrastructures, and the allocation of different areas to specific functions for city expansion.

In the subsequent years, the city grew, along with comprehensive transportation infrastructure that facilitated its development. Administrative adjustment also promoted the growth of both the original SEZ area and its neighbouring areas within the city land.⁷³ In 1993, the two Counties of Bao'an and Longgan became Districts. Completed in 1996, the new comprehensive plan extended the development model of the original SEZ to the new Districts, by promoting the building of a multiple axes network structure that would have connected the different parts of the city. Despite the former division between SEZ and non-SEZ zones ceasing to exist, the economic and urban landscapes of these two areas are still different.⁷⁴ The main objective was to control development, as the process was more disordered than expected in the first master plan. However, development control did not succeed in the way that planners expected.

A further urban master plan named 'Shenzhen 2030 Development Strategy' was launched in 2004. It tried to implement the lessons learned from the previous

experience in order to overcome the main "four difficulties", which constitute obstacles to further development. Two of them are the limited availability of resources, like land⁷⁵ and water for urban use. Overcrowding and environmental degradation are the other two. This strategy meant increasing the specialization of different parts of the city, as well as improving its role in the region with respect to Hong Kong, Dongguan, Guangzhou and Huizhou. The plan wanted to foster the building of a polycentric urban development model with two centres and five sub-centres.⁷⁶ This would have facilitated the agglomeration of both activities and services.

A following stage of urban planning called 'Shenzhen 2040 Development Strategy' was launched in 2010, following the success of the third one. It again faces issues related to land use and economic development, but now it seeks to improve city sustainability by giving importance to family, health, education, culture, society.⁷⁷

Population and Migration

Development control has been one core issue for Shenzhen urban planners. Migration and new labour force may be fundamental to the development of a city's economy. However, indiscriminate and uncontrolled growth can be costly to cities, as a city may not be as receptive as expected. This may happen because the city structure would not be adequate to face unexpected flows of incoming population. As a result, urban space, housing and employment opportunities, and services for population can be lacking. Proliferation of slums around the most populated cities worldwide is the self-organised response of the fast-growing population in the absence of appropriate policies. Well-known implications of living in marginal conditions, like social exclusion and crime, certainly justify the need to govern social and economic phenomena related to population expansion, in order to reduce and/or avoid threats to the citizens' quality of life.

Explosive population growth of Shenzhen has

characterised its development process. Official data⁷⁸ report that in the period 1980-2016, Shenzhen's permanent population grew by 3,477 per cent, reaching nearly 12 million people in 2016, of which 77,8 per cent are employed. However, from Ng and Tang's⁷⁹ reconstruction of the different waves of planning, actual population growth has always exceeded the targets of five-year plans, despite control policies having been generally effective in limiting the growth of cities in China.⁸⁰

The implications of such mismatch between planned and expected population are different, as pressure on spatial development increases significantly. The unexpected need to increase the amount of investment in infrastructure and services for the population is one of them. Limited land surface and the already mentioned need to comply with the central government's five-year population targets are further critical aspects. As an example, Ng and Tang report that between 1986 and the early 1990s, the growth of the central part of SEZ in Luohu District led planners to assign new residential areas in Futian District. This movement of people caused an increase in traffic, as well as environmental problems and a shortage of resources like water.⁸¹

In addition to merely quantitative aspects, there are other social impacts related to population composition over time. Shenzhen is a city where the population's share of migrants is massive. According to SSB⁸², in 2016, 67.7 per cent of the permanent population was non-registered. This share has grown with population, from 3.6 per cent in 1980, to 59.1 per cent in 1990, and 82.2 per cent in 2000. Since the beginning of the 00s, it has decreased to 67.7 per cent in 2016.⁸³ This happened despite the *hukou* Chinese system, which grants only registered citizens access to education, social and health services in the city where they reside. Clearly, from these numbers, one can conclude that registration policies have not discouraged migration from internal rural areas.

Although Shenzhen is one of the wealthiest cities in China in terms of per capita GDP, the share of low-income population is large, and most of it consists of migrants.⁸⁴ Living conditions of migrants is another aspect of Shenzhen's explosive urbanization. Before the Open-Door policy came into effect, the duality between urban and rural areas was functional, to create industry and services development in the former, and production of food in the latter. Rural areas were also those where the poor population



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concentrated.⁸⁵ After the 1978 reform, rural migration to cities has become the main factor for city growth,⁸⁶ putting increasing pressure on the urban context. Usually, in big urban centres, the development of either slums or squatter settlements is the response to the housing needs of the low-income population, when rapid urbanization takes place. In China, this has not happened due to institutional constraints. The response to migrants' pressure in Shenzhen was the expansion of neighbouring traditional villages called "urban villages", which, over time, have been progressively incorporated into the city. They often represent the only available and affordable possibilities for housing. In addition to rapid urbanization and lower income of rural migrants, barriers for rural population to rent public housing have fostered their development.⁸⁷ With the increase of migrant flows, many former villagers have changed the function of their buildings from family houses to rentals. In parallel, there has been an increase in unauthorised buildings. Despite the government's efforts to regulate the phenomenon, uncontrolled development of such illegal houses has taken place.⁸⁸ In many cases, this led to the development of communities where families controlled residential, non-public land, and where parallel business and commerce grew.

Urban villages have maintained their characteristics of satellite entities in relation to the central urban area, with lower average education and where formerly rural population live who are unable to gain access to the city's welfare services because of the *hukou*.⁸⁹ The influence of urban planning on the regulation of these agglomerations is still an issue, as well as the effectiveness of controls on urban expansion. Higher crime rates, lower living conditions, and slower integration of urban villages into the urban context are further critical aspects. These are the reasons property developers, government officials, and planners have had a negative view of the informal way urban villages have developed. But from another angle, urban villages have been the only housing opportunities available to migrants, besides being a business for inhabitants who rent their houses.⁹⁰ Despite the progressively increasing importance of high-tech sectors in

the city's economy, labour intensive industry still constitutes a significant share of the total. For this reason, urban villages also have a key role in hosting the low-skilled working population that concretely contributes to the city's economic growth.⁹¹

Urbanization, Urban Concentration, and City Expansion

The explosive population growth of Shenzhen reflects one of the best-known figures on urban population in the last decades.⁹² The World Urbanization Prospects forecasts that today's 55 per cent share of urbanised population will increase to 68 percent in 2050.⁹³ Glaeser⁹⁴ argued that this process signals the progressive transition from poverty to prosperity. At the same time, the impact on living conditions in cities may be enormous and negative, if appropriate policies do not address phenomena like inequality, crime, pollution, diseases, and congestion.

Urbanisation is associated with economic growth. A quick look at some statistics shows how positive urbanization has been for countries: as Henderson⁹⁵ reports, "In any year, the simple correlation coefficient across countries between the per cent urbanized in a country and, say, GDP per capita (in logs) is about 0.85".⁹⁶ Urbanization also implies a higher level of development and life satisfaction⁹⁷ two broader concepts than the solely economic one represented by GDP. However, urbanization alone does not suffice to sustain productivity⁹⁸ caused by an increase in per capita GDP of cities; it is the process of population moving from rural areas to cities. As such, it is characterised by a progressive shift of the labour force from the primary sector to the secondary and tertiary sectors. Economic policies can influence it only indirectly, by acting on sectorial composition and income.⁹⁹

Unlike urbanization, urban concentration is influential for economic growth, and it is a factor that both policymakers and urban planners can influence.¹⁰⁰ Proximity of activities generates scale economies that improve productivity, and then the wealth of

citizens. The phenomenon of concentration in cities and its implications allows the classical Malthusian view on the relationship between population and growth to be overcome. What this classic theory predicts is that, on the one side, an increase in wealth would have expanded population by both increasing births and reducing deaths.¹⁰¹ But on the other side, population growth would have had a negative effect on per capita income because of diminishing marginal productivity, as the increasing population would deplete resources. A stationary population in the long term would have been the final outcome.

Explosive dynamics of population growth worldwide since 19th century, along with a raise in per capita income contradicted this view. The theory of Malthus is typical of economies with limited human capital and technology, such as those based on agriculture. Instead, increased density caused by higher population and greater urbanization is what characterises modern urban economies, in the fashion of Marshall's clusters. This leads to specialization, human capital improvement and greater investment in knowledge-based activities, the increasing returns of which, in turn, foster economic growth through productivity increase. At the same time, there might be an opposite effect of diminishing returns from the use of natural resources, as the increase of population limits the city's resource availability for each citizen. This causes significant social costs, such as crime, congestion, and contagious disease.¹⁰² The overall result of this trade-off depends on which of the two effects prevail.¹⁰³ Concretely, this generates variable returns to city size.¹⁰⁴

In Section 3, I pointed out how migration has been

crucial for city development. Uncontrolled flows have boosted the growth of urban villages, where in many cases living conditions are worse than in the rest of the area. The common view of economists is that when migrants are free to move, cities may become inefficiently large. Migrants may both produce negative externalities, and not necessarily pay for the related cost. At the same time, they compete with locals for city resources like land and services.¹⁰⁵ The overall result is that private returns may be higher than social returns.¹⁰⁶ Therefore appropriate migration and integration policies are key elements to overcome the related social costs. And, of course, the role of government is crucial in this, with significant implication for urban planning. As population grows, the dilemma is between fostering agglomeration and city density, with related advantages and costs, and favouring the expansion across space with amenities providing lower utility than the one coming from concentrated activities.¹⁰⁷ Given available land constraints, the choice of Shenzhen seems to be obvious and towards the former model.

Land use

In some cities, socio-economic patterns have had a dramatic impact on the use of space. Old and new activities, as well as residential needs, have changed the landscape significantly. As already mentioned, Shenzhen is one of the Chinese cities the development of which has been driven by socio-economic factors. In this regard, Schneider and Woodcock (2008)¹⁰⁸ studied the rates of expansion and patterns of urbanisation of 25 cities from different countries by combining remotely sensed data, spatial pattern metrics and statistical census data. They identified four main categories, namely

Table 4 : Population and built-up area

Year 0-	Population (1000)		Built-up area (sq.km)		GDP per capita (yuan)	
	1-	(variation %)	2-	(variation %)	3-	(variation %)
1988	1,201.4	---	112.45	-	6,477	---
1996	4,828.9	+301.94	266.04	+136.58	22,498	+247.4
2005	8,277.5	+71.42	656.30	+146.69	60,801	+170.3
2015	11,378.7	+37.47	834.26	+27.12	157,985	+159.8

Source: Compiled from SSB (2017) and Dou and Chen (2017)

expansive growth, frantic growth, high growth, and low growth cities. The analysed Chinese cities are Guangzhou, Dongguan and Chengdu, and they all fall within the second category of frantic growth. They have experienced high growth rates within a relatively small spatial extent, thus determining high population density. Their patterns of land conversion to urban use have been fragmented. Along with expansive-growth cities, which are typical of the USA, their growth can be ascribed to socio-economic and political determinants, which, in the case of Chinese cities, is due to “economic and demographic transformation following significant reforms on the coast and, later, in the interior”.¹⁰⁹ The authors also note that in Dongguan and Guangzhou, the rate of land conversion has been impressive and, as in the case of Shenzhen, its main causes are policy decisions that have led to an increase in GDP, foreign investment and trade, as well as a rise in rural-urban migration. This is not surprising, given the central role of both, and the symbiosis between, urban and socio-economic planning for China. Also, Deng et al. (2008)¹¹⁰ found that socioeconomic factors are significant for the monocentric growth of Chinese cities, using a sample of over 2000 counties. In particular, growth was positively associated with population, income, and transportation costs, whereas agricultural rents had a negative effect.

Dou and Chen (2017)¹¹¹ investigated the expansion of Shenzhen across the land during the period 1988–2015 using satellite data. Specifically, they discussed how land use and land cover have evolved. They point out how urban expansion has considerably affected the change in landscape of Shenzhen. Over these years, built-up area has increased by 721.1 square kilometres, from 5.63 per cent in 1988 to 41.77 per cent in 2015. Building's main impact was on cultivated land, forest, and water body, of which the average yearly decrease has been 0.88 percent for cultivated land, and 0.35 for forest. In the “early age” (1988–1996), urban development concentrated mainly around the SEZ area. In the ten years of the “rapid development” stage (1996–2005), the urbanization rate increased mainly outside the SEZ area, with built-up areas evolving from 13.32 per cent of the land in 1996 to 32.86 per cent in 2005.

In the third, “intensive” stage (2005–2015), there has been a slowdown in city growth, mainly due to limited urban land resources. These figures are consistent with the dynamics reported in the Atlas of Urban Expansion.¹¹²

Table 4 reports the data on built-up area in Shenzhen taken from the elaborations of Dou and Chen, as well as some official population and GDP statistics from SSB (2018).¹¹³ Built-up area is the part of the land distinct from forest, cultivated land, water body, grassland and bare land. Therefore, settlements in this area include all the types of buildings (residential, industrial, commercial, etc.) and other structures, as well as both authorised and unauthorised ones. After the period of early development, Shenzhen's built-up area expansion rate has been greater and exceeded population growth between 1996 and 2005. In those years planning had the effect of promoting expansive growth all over the land. The figures show a slowdown in built-up area growth over 2005–2015 due to land limitation, whereas population rose at a faster rate. From these numbers and the available data, I cannot infer much about details and quality of city concentration. However, there is evidence of an increase in urban concentration in the most recent period.

The evolution of Shenzhen's GDP (Table 1) suggests that its dynamics may not be necessarily synchronic with the ones of both population and urban growth. This is not surprising. Though authors like Glaeser calculate that a worldwide 10 per cent increase in urbanization is associated with a 61 per cent increase in per capita GDP, he admits that “[s]ome authors have questioned the causality of this link and shown that initial urbanization levels are neither positively nor negatively associated with subsequent income growth”.¹¹⁴

City size

New needs of population and increasing opportunity for business have promoted the growth of the urban factory. Of course, land availability is one natural limit to city growth. Besides this, is there a limit to physical

expansion of the city, after which diseconomies in the city would exceed advantages? In other words, is there an optimal city size? This is a crucial point for some economies, as sometimes there is concern as to whether cities are either too big or too small. In some former planned economies, the “excessive size” of cities led to restrictions in urbanization. However, scholars have argued that an ideal city size can be hardly identified and depends on a number of factors, and the context in which a city is inserted is among the most significant ones.¹¹⁵

Unlike city size, an “optimal level” of urban concentration can maximise productivity growth. Proximity in cities eases the exchange of goods and services between firms, it promotes innovation, it reduces travel time for citizens between places of interest. In other words, it increases productivity. But any deviation from the “optimal” level causes losses in productivity.¹¹⁶ This “best degree” of concentration varies with a country’s development level and size. Specifically, it increases with income up to a certain level, and then it declines. The way the relationship between urban concentration and income evolves is consistent with the Williamson hypothesis¹¹⁷ for which increasing urban concentration is typical of the early development stage, where proximity plays a key role in promoting synergies between the various components of physical and human capital. At a later stage, congestion and the need to expand economic activity to neighbouring areas may favour deconcentration. Optimal concentration decreases as country scale increases. Investment in inter-regional transport matters as it reduces concentration, and this effect increases with income. Also, trade and political decentralization are both influential, though the effect is not strong. By implication, growth losses from urban concentration are higher for those cities where income level is higher.¹¹⁸

Urbanization concentration is again reported as a key influencing element of the economic development of a city, as shown earlier in this Section. A first reflection arising from this is that the size of a city is not necessarily related to its growth. What matters instead is the “quality” of urban concentration,

and the “efficient size” of a city.¹¹⁹ This is crucial in order both to generate agglomeration economies, and avoid diseconomies and social costs for the population. This depicts interesting perspectives for the future growth of Shenzhen. At the early stage of SEZ, the city grew in the relatively limited area bordering Hong Kong. Then it expanded, gradually including urban villages. Land availability since then has become a major issue. Together with its growth in wealth, and the pressure from migration inflows, the price of houses has risen dramatically. Urban planning now has major challenges, as sustaining growth means to reorganize urban spaces in order to limit the negative effects of the increasing population density. The new urban plans, envisioning the city as polycentric, may succeed in this and result in putting less pressure on the former SEZ area, although still favouring the successful agglomeration economies that have fostered Shenzhen’s growth.

Tourists, a peculiar floating population

In many cities tourism is only one of the economic sectors. However, unlike other sectors it allows significant flows of people to enter the city. This group is heterogeneous in terms of motivations, ranging from leisure to business, from visiting relatives to health reasons. However, it shares the same space and resources of residents, though each of the two groups may have different purposes in doing so.

Tourism has been one of the sectors explicitly targeted by Shenzhen’s master plans.¹²⁰ Today Shenzhen is a top tourist destination. Euromonitor International¹²¹ ranks the city tenth among the most important world destinations in terms of number of international arrivals.¹²² It is the second Chinese city in the ranking, after Hong Kong that is ranked first, and the largest Chinese destination in terms of international demand.¹²³ In 2017 more than 12 million tourists visited the city with a yearly growth rate of 3 per cent.¹²⁴ According to SSB (2018),¹²⁵ in 2016, the sector of hotels and catering services accounted for 1.8 per cent of Shenzhen GDP, and reported a growth rate of 2.8 per cent. However, the total economic effects of tourism are wider and more complex to assess, as they also include



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indirect and induced effects from other sectors, like transportation, construction, culture and entertainment, etc. For instance, WTTC¹²⁶ estimated that, in 2017, the direct and total contribution of tourism in China was 3.3 per cent and 11.0 per cent of GDP, respectively. Impact on employment was 3.6 per cent (direct) and 10.3 per cent (total). All these statistics are expected to rise in 2018.

A large share of Shenzhen tourists is indeed composed of business travellers. Though the city is not a top world destination for leisure tourism, the number of international travellers is one further symptom of the degree of openness of the city. Over the years, the city has also invested in developing its attractions for leisure. SMC¹²⁷ reports that today Shenzhen is “[o]ne of the most important and profitable tourist cities in China [and] regarded as the capital of Chinese theme parks and tourism innovation.”

Tourists are a peculiar floating population. As Ashworth and Page¹²⁸ observe, tourism is embedded in many dimensions of a city, which implies that the same principles of urban planning may apply to tourism. However, the management of tourist flows presents some criticalities. The number, time of arrival and stay, objectives and spatial behaviour

of tourists may be heterogeneous and go beyond the control of planners and governments. And usually governmental actions mainly concern the management of “tourists” rather than “tourism”, as often the main goal is to mitigate the undesirable impact of guests.¹²⁹ The main reason is that urban planners and local policymakers’ primary aim is the improvement of the living standards of the local residents.

Tourism is one of the fastest growing industries worldwide. Shenzhen has become one of the top cities in China at the forefront. Its economic policies have also involved the promotion of the city as a “brand”, which is indeed functional to the attraction of people travelling from abroad.¹³⁰ Exploitation of local resources for tourism,¹³¹ including both tangible and intangible ones, is one further step towards the consolidation of the city in the world market. The trade-off between affirming its uniqueness as a world destination, and replicating other standard tourist models and types of attractions in the fashion of a “disneyfication”,¹³² is one main challenge to further develop its role as an attractive destination, also for leisure tourists.

Planning and the Search for Sustainability

Despite Shenzhen's expansion leading to the well-known explosive economic growth, different questions about the social costs of city growth still arise. As recalled in Section 4 above, population and economic growth are in a direct relationship until resources are available for each citizen and diseconomies do not occur. Agglomeration costs are the negative side of agglomeration economies and "the price paid for being close to other humans."¹³³ This recalls the current debate on the quality of city growth. There is growing attention to the way to govern the economic, social and environmental aspects brought by the explosive phenomena of increasing population in major cities. Rise in crime and pollution, inequalities and social exclusion, congestion and quality of urban services, are only some examples of those harmful phenomena to cities as "places of pleasure, [besides being] places of productivity".¹³⁴ Best practices are indeed of help to this end, though planners have shown that some models are unique and may hardly be replicated.

Urban planners have a crucial role in addressing growth processes, in order to combine new and pressing needs of a city with sustainability.¹³⁵ The Campbell model,¹³⁶ one of the best-known theorisations for sustainable planning, summarizes very well the basic principles of planning for sustainable design of cities. The theory identifies three key priorities for planning, namely social justice, economic growth and environmental protection. The so-called "Campbell's triangle", represents them as corners of an equilateral triangle, the centre of gravity of which is sustainable development, with equity being the top corner. Then the centre would be the equilibrium point between the three dimensions. Any shift from that point would bring it closer to one of the sides of the triangle. Each side represents a potential conflict between two dimensions. When social justice clashes with economic growth and efficiency, it generates property conflict resulting from the diverging interests between the public good and private benefit. Economic interest may interfere with environmental protection, thus generating a conflict

for exploiting natural resources instead of preserving them. When social justice and environmental protection contrast, development conflict is at stake. This model is particularly evocative, as it sees sustainable development as a fragile condition, which is also difficult to achieve, since deviating from the equilibrium may cause conflicts.

Other contributors have stressed the key role of cities in promoting sustainable development. Among others, the works by Camagni and co-authors¹³⁷ emphasised the crucial interactions between different dimensions of a city in order to reach sustainability, where the latter is "a dynamic, balanced and adaptive evolutionary process, i.e. a process in which a balanced use and management of the natural environmental basis of economic development is ensured".¹³⁸ A sustainable city not only gives priority to the environment, as doing this would somehow neglect the synergies related to agglomeration. Rather, the three environments, namely physical (both built and natural), economic and social, coexist and interact. In a static sense, they generate externalities, both positive and negative. Their balanced dynamic co-evolution may develop distributive efficiency and territorial identity (when social environment integrates the economic one), long-term allocative and territorial efficiency (economic with physical), and environmental equity and territorial quality (social and physical). A "good" city is a city that favours the development of all the aspects, along with long term, sustainability related objectives instead of short term, profit oriented ones. Spatial planning should be addressed to provide adequate tools in order to reach sustainability, and the latter should set the goals for the former.¹³⁹

Theory indicates that evaluating whether a city has reached a sustainable and harmonic¹⁴⁰ development pattern has to account for several aspects, each pertaining to the three basic domains of social, economic and environmental development. There are several ways to evaluate whether a city has entered a sustainable pattern. To this end, the availability of a good set of indicators is often an important starting point. SSB¹⁴¹ provides a rich set of information, although it mainly relates only to the

economy of Shenzhen. In what follows, I will try to give an overview of some aspects of sustainability.

A study of Zheng et al.¹⁴² attempted to rank Chinese cities according to their greenness. The authors estimated that Shenzhen was ranked 46 out of 74 cities. However, several efforts have been made by the Shenzhen government in order to reduce negative environmental effects. Following the State Council Circular on “Promoting Efficient and Intensive Land Use” in 2008, Shenzhen was the first city to adopt urban renewal policies which had a positive impact on the environment¹⁴³ (Liu, 2017). It was also the first city in China to adopt a carbon emissions trading scheme, in order to reduce carbon intensity and improve the efficient use of energy, which came into effect on 18 June 2013.¹⁴⁴ All of this coincides with the New Urbanization Plan, launched by the Chinese government in March 2014, which aims to improve environmental conditions of cities, as well as social ones, also through the reform of the *hukou* system.¹⁴⁵ As to the latter, indeed the main challenge to sustainable growth from a social point of view concerns the divide between migrants and residents, not only in terms of income inequality, but also of the access to social welfare.

City-level statistics from SSB¹⁴⁶ show how many environment-related indicators have improved over time. Use of energy has become more efficient. Both energy and electricity consumption per unit of GDP have steadily decreased during 2005-2016. Over the same time, main pollutants like SO₂, NO₂, PM₁₀, industrial sulphur dioxide, and industrial nitrogen oxide have reduced. However, the volume of industrial waste gas emission has increased in the most recent years. In addition, during 2011-2016 the number of civil motor vehicles increased by 63 per cent, from 1,976,164 to 3,225,879. The latter is not a comforting signal in terms of both vehicle emissions and traffic congestion. Traffic corridors and main arterial routes have been the main determinants of the city's expansion. Sustainable forms of public transportation and incentives for not using cars would contribute to the objective of reducing the environmental impact. Polycentric development of the city as envisioned by the most recent urban

master plans may decongest some areas. But the strengthening of a sustainable transport system is basic to discourage the use of private cars and improve environmental quality.

Conclusions

The urban development of Shenzhen and its socio-economic progress have been interrelated since the institution of the Special Economic Zone. Urban planning has driven city expansion. Despite the impressive results in terms of economic growth, some authors remark that not all the planning objectives have been achieved.¹⁴⁷ Population growth has been one main critical aspect, as it has often exceeded what policymakers expected.¹⁴⁸

The rate of population growth, mainly due to migration and the expansion of the city, has progressively limited land availability. This has led to a model of intensive land use in urban expansion. Indeed, agglomeration and urban concentration are influential elements on the growth of a city. Given the impressive economic growth of Shenzhen, one can argue that agglomeration-related processes within the city have been virtuous. However, the negative externalities of urban concentration are still major challenges, and planning documents seem to show awareness of this. There has been increasing attention to social and environmental questions in the most recent urban master plans and five-year plans, and the related improvement of living conditions. After all, paraphrasing Glaeser's words, the scope of urban planning is just affirming the primacy of person over place.¹⁴⁹

Economic inequalities and the concentration of the low-income population in urban villages may create phenomena of social exclusion. Limitation of public services to registered population only is another alarming aspect. In this regard, the New Urbanization Plan is indeed promising, as it wants to reform the *hukou* system to the benefit of nonregistered population.¹⁵⁰ Proliferation of urban villages because of unauthorised buildings is another sensitive issue, as they have become places with lower living



Shenzhen Top View @SZAICE

standards, high crime rates, and extremely high population density.¹⁵¹

The most recent planning documents also pay increasing attention to environmental aspects. Despite the evident improvement of some environmental indicators over time, increasing population density threatens the living standards in the city. The city has mainly developed along traffic corridors, which are then the basis for mobility. This calls for sustainable transportation policies and a system of incentives for the population to use them. The city of Shenzhen has done much in the area of transport improvement,

which, however, remains a key challenge due to the huge and increasing population.

Future challenges of urban planning may still be related to difficulties in managing land use and resource allocation, also because of the discrepancies between state control and market forces.¹⁵² Moreover, modern development requires flexibility, which contrasts with the rigidities of planning.¹⁵³ The determinants that have addressed explosive economic growth now have to face the challenge of addressing the city's growth towards sustainability.

Chapter 5

Basic Services and Local Infrastructure

Werner Lang and Shi Yin

Introduction

Some of the biggest global challenges mankind is facing today include the rapidly growing world population, the increasing consumption of resources as well as emissions of CO₂, and the ongoing climate change with the corresponding consequences for the global ecological balance.

While the ecological footprint of humanity already exceeds the bio capacity of our planet by a factor of 1.7¹⁵⁴, the anticipated increase in the world population from currently 7.6 billion people (2018) to up to 11.2 billion in the year 2100¹⁵⁵ will have a major impact on our living conditions as a result of scarcity of resources and aggravated effects of climate change, especially in economically weaker countries. In addition to political and social conflicts, economic aspects are likely to further contribute to the increase in migration movements worldwide. Particularly noteworthy in that regard is the worldwide increase in urbanization and the tremendous growth occurring in cities worldwide.

More than 50 percent of the world’s population already lives in cities today. By the year 2050, the share is expected to increase to almost 70 percent.¹⁵⁶ While dealing with this tremendous challenge of rapid growth, future-oriented and sustainable cities

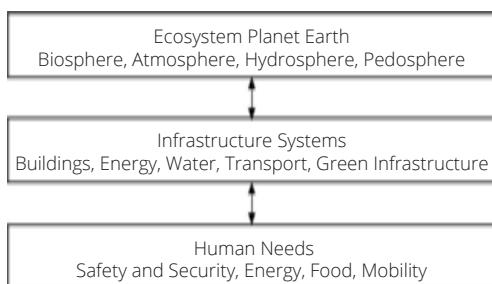
have to create—more than ever—a balance between social, environmental, and economic aspects. Social welfare, including healthcare, social security, education, and employment, is directly related to a city’s environmental and economic qualities, such as clean air and water, appropriate housing, adequate transport infrastructure, and a stable economy.

In order to advance the profound and effective transformation of cities required to secure a sustainable future on a global scale, the satisfaction of human needs, such as protection from extreme weather and the provision of a safe and healthy living environment, energy, food and mobility, has to be achieved in direct relation to the resulting impact on our ecosystem (See Figure 12).

Figure 12 : Hierarchy of needs (according to Maslow)¹⁵⁷



Figure 13 : Infrastructure systems, satisfaction of human needs and interaction with our ecosystem



This requires attention to be paid to the interactions of human activity and the relevant infrastructure systems with the ecosystem of our planet, including our biosphere, atmosphere, hydrosphere, and pedosphere (Figure 13). In doing so, a fundamental reorientation of strategies for the sustainable safeguarding of our living conditions while stabilizing our ecosystem is imperative.

Addressing these challenges, this book chapter will focus on the sustainable provision of basic services, such as the supply of energy, mobility and transport, water, and green infrastructure. The intention of this contribution is to raise awareness regarding the importance of these different sectors of urban infrastructure, to provide information based on the relevant indicators to describe the current status of Shenzhen compared to other cities in Asia and Europe, to analyse how urban infrastructure systems might be developed further to increase the quality of life and the sustainability of Shenzhen and it will summarize the findings in order to provide a potential outlook for the development of Shenzhen towards a sustainability hub in the southern part of China.

Indicators for Evaluating the Sustainable Development of Cities

According to the Brundtland report¹⁵⁸ “Our Common Future”, which was presented to the UN General Assembly in 1987, sustainable development is development which *“meets the needs of the*

present without compromising the ability of future generations to meet their own needs”. Looking at the current global challenges, which are mentioned at the beginning of this chapter, it becomes clear that truly sustainable development does imply limitations. These are imposed by human activities and the resulting consumption of environmental resources, the corresponding emissions and waste, and by the ability of the biosphere to absorb them. While the provision of basic services, such as energy, mobility and transport, water, and ecosystem services provided by green infrastructure, is essential for all humans living on the globe, the effects of the resource consumption required to provide these services is felt much stronger in cities than in rural areas.

To give an example, the population density of Shenzhen is approx. 6.000 people per square kilometre (2017), which is 41 times the national average.¹⁵⁹ As a result of this massive concentration, the provision of basic needs is heavily dependent on the surrounding region, creating a high vulnerability of cities due to their dependency on the hinterland.

Furthermore, the resulting effects of resource consumption for the operation of buildings, the provision of transport, as well as for production and other needs, are felt much stronger in dense urban areas, due to the high concentration of emissions and excess heat, as well as waste and wastewater.

Due to the importance of providing basic services, such as energy, mobility and transport, water, and ecosystem services provided by green infrastructure, the indicators for evaluating the sustainable development of cities are directly related to the sustainable provision of these services *“without compromising the ability of future generations to meet their own needs”*.¹⁶⁰

Looking at the current situation with regard to resource consumption and the corresponding emissions and waste, China’s Ecological Footprint¹⁶¹ is currently at 2.5 gha per capita.¹⁶² This is less than the world average per capita Ecological Footprint of 2.7 gha, but still larger than the world average

biocapacity¹⁶³ available per person, which is 1.7 gha. If everybody lived like the average Chinese, we would need 1.5 Earths.

Looking at the city of Shenzhen, the per capita ecological footprint in Shenzhen (2.5 gha) was equal to the national average in 2011, while the per capita ecological capacity was approximately 0.06 gha. That means that the ecological footprint was about 41,7 times greater than the ecological capacity.¹⁶⁴

As stated by UN Habitat¹⁶⁵, cities are major contributors to climate change. Covering less than 2 percent of the earth's surface, cities are consuming 78 percent of the world's energy and produce more than 60 percent of all carbon dioxide and significant amounts of other greenhouse gas emissions, mainly through energy generation, vehicles, industry, and biomass use.

Considering this tremendous imbalance with regard to the ecological footprint and bio capacity in densely urban environments like Shenzhen, it becomes clear that a fundamental shift is necessary with regard to resource consumption and the related emissions and waste.

To initiate and achieve a transformation towards a sustainable development, the current and future resource requirements with regard to energy, water, raw materials, soil, etc. and the resulting pollutant and waste generation of urban infrastructure systems have to be analysed and related to the limits of our ecosystem's resilience and the corresponding subsystems, such as biosphere, atmosphere, hydrosphere and pedosphere.

To create a robust foundation for developing effective strategies for the transformation of our cities to deliver a fundamentally sustainable approach with regard to the resources at our disposal, a detailed, spatially resolved assessment of current and future resource needs and the long-term existing resource capacities is required. At the same time, the resulting environmental impacts must be recorded and compared with the limits of our ecosystem's resilience. This concerns the following infrastructure systems

and their interaction with the biosphere, atmosphere, hydrosphere and pedosphere.

Looking at the ecological footprint of a city and the corresponding ecological assets that its population requires to produce the natural resources it consumes, the consumption of energy and the resulting greenhouse gas (GHG) emissions is one of the most important parameters affecting our environment with regard to climate change, threatening our biosphere, and therefore, life on our planet as we know it today.

Therefore, one of the most important indicators for evaluating the sustainability of a city is the primary energy consumption and the related greenhouse gas emissions, especially in China, where most of the energy production is based on fossil fuels¹⁶⁶, leading to high greenhouse gas emissions. While this involves a wide range of sectors, such as industry, transport, residential, commercial and public services and agriculture, this chapter will mainly focus on the energy consumption in the building and transport sector.

Next to the consumption of energy, the supply and treatment of drinking water is of particular importance for supporting our lives, including plants and animals.

As Urban Green Infrastructure (UGI) can play a major role, by regulating the microclimate of urban environments via shading and evapotranspiration, and by absorbing rain water in case of heavy rain events, this aspect has to be regarded as a driving element for sustainable cities as well.

Energy Supply Systems

Energy is of utmost importance when it comes to supporting life in our cities. The production of food and goods, provision of water, construction and operation of buildings, infrastructure and transport systems as well as the operation of industrial and commercial activities are dependent on the steady supply of tremendous amounts of energy. According to UN Habitat, cities consume about 75 percent of global primary energy and emit approximately 80 percent of the world's total greenhouse gases,



Transportation Hub of Shenzhen North Station @ Shi Yin

including the indirect emissions generated by urban inhabitants.¹⁶⁷

In 2017, the total global primary energy consumption in China was 13511.2 million tonnes oil equivalent, currently growing at a rate of 2.2 percent/year.¹⁶⁸ With 3132.2 million tonnes oil equivalent, China's share is approx. 23.2 percent, currently growing at a rate of 30.1 percent/year.

In China, energy is generated mainly by using coal (60.4 percent), oil (19.4 percent), gas (6.6 percent) and nuclear energy (1.8 percent). Only 12 percent was produced by renewable energies, such as hydro (8.3 percent) and other forms of renewable energies (3.4 percent), such as sun, wind, and geothermal. As a result, 9232.6 million tons of carbon dioxide were emitted in China, which is 27.6 percent of the global CO₂ emissions¹⁶⁹ and equals 7.1 t of CO₂ emissions per capita.

In order to overcome the devastating impact of greenhouse gas emissions on our ecosystem and end the dependency of our cities on importing and using fossil fuels, a substantial transition to sustainable forms of energy, such as solar-, wind-, hydro- and geothermal energy is urgently needed.

Low carbon technologies on the supply side have to be coupled with low-energy systems on the demand side, reducing pollution and greenhouse gas emissions, thereby enhancing the quality of life in our cities.

Mobility and Transport

Being mobile allows us to interact with other people, and to satisfy our daily needs, getting from our homes to various places within a city, such as locations for work, education, culture, shopping, and leisure. The corresponding transport infrastructure, including walkways, bicycle lanes, streets, roads and railroads, allows us to use non-motorized and motorized vehicles to move around and to transport goods.

With a share of approx. 10 percent of the total CO₂ emissions coming from the transport sector of China in 2010¹⁷⁰, the CO₂ emissions related to motorized vehicles seem to be relatively small, compared to industry production and other sectors. However, the CO₂ emissions from the transport sector increased from 13.1 Mt in 2000 to 74.0 Mt in 2013¹⁷¹ in the Pearl River Delta, indicating the need for controlling the growth of transport dependence.

Apart from increasing levels of congestion and environmental emissions of traffic, including CO₂, NOX, PM and noise, the potential growth of the use of motorized vehicles (MVs), with 2.3 million MVs in Shenzhen in 2015 and MV ownership (2015) of 296 MV/1,000 inhabitants¹⁷² has to be considered.

Alternative forms of mobility, such as walking and biking and the use of public transport have to be supported due to their environmental advantages, thereby securing the liveability of our urban environment. Therefore, a substantial reduction of the negative impact of the use of MVs, such as excessive land-use, noise and pollution caused by gas- and diesel-powered cars, and trucks, must be the goal of a sustainable transport policy. As shown in section 2.4, to achieve the state of a sustainable city, not only does the transport infrastructure and the built environment need to be optimized, but also the adaptation of Urban Green Infrastructure UGI has to be supported.

Water supply

Comparable to the challenges with regard to a sustainable energy supply of rapidly growing mega cities, the sustainable provision of safe drinking water as well as wastewater collection and treatment

are equally important.

Due to the rapid growth of cities, especially in fast growing regions like Asia, the water systems and soil conditions have been fundamentally altered in urban regions and the surrounding land, due to buildings and related transport infrastructure. Although there is enough freshwater available globally to satisfy every citizen's personal and domestic needs, 11 percent of the global population still has no access to water that is safe for consumption.¹⁷³

Especially in dense urban areas in developing countries, we are still facing serious challenges, such as contaminated water due to the absence of adequate sanitation facilities, leading to pollution of the available water resources, thereby creating a serious risk for the health and wellbeing of the urban population.

Therefore, the provision of clean and safe drinking water and the availability of an effective urban waste water management, including water reuse technologies, are crucial elements of urban infrastructure systems.

To minimize the water footprint of urban areas, which typically rely heavily on the provision of clean water



Urban Green Infrastructure in Shennan Avenue @ Shi Yin

from the region surrounding the city, the creation of closed cycles, including water conservation measures and effective water purification systems, is imperative. Due to its potential to alleviate water shortage, wastewater treatment has to be regarded as an important means to reduce the consumption of drinking water where possible.¹⁷⁴

In addition to domestic use, the availability and management of water are crucial, when it comes to the use of Urban Green Infrastructure for the enhancement of the quality of life in cities. Without sufficient water, crucial ecosystem services, such as cooling and shading as well as the provision of food are not possible

Urban Green Infrastructure

Larger and denser cities must deal with increasing air, noise and water pollution, denser urban spaces, heat islands as well as a higher mortality caused by heat waves. As a result of a high concentration of emissions, heat generation by production, building operation and motorized vehicles, the Urban Heat Island might lead to an increase in air temperatures of 3°C during daytime and 12°C during night-time, if compared to the surrounding less densely populated areas.¹⁷⁵ Due to its subtropical climate, Shenzhen is likely to experience increasing air temperatures. This might lead to negative effects, such as higher air conditioning costs, air pollution and greenhouse gas emissions.¹⁷⁶ Furthermore, the population might face heat-related illnesses and a higher mortality, as well as poorer water quality due to flooding and other effects.

The quality of life in densely populated urban areas is increasingly dependent on urban green infrastructure, as the effects of climate change, such as an increase in temperature, will affect large, dense cities the most, especially if located in subtropical and tropical climates, such as Shenzhen.

Urban Green Infrastructure (UGI) can play a major role by regulating the microclimate of urban environments via shading and evapotranspiration, and by absorbing rain water in case of heavy

rain events. Other factors are the promotion of biodiversity, and other aspects directly affecting human health, such as cultural services, e.g. recreational, aesthetic and spiritual benefits. While urban ecosystems can make a substantial contribution to increasing the sustainability and resilience of urban systems, clearly there is a need to develop a much wider approach to meet the global challenges of urbanization, as the current emphasis on city compaction, i.e. increasing the population density of humans without enlarging the city borders, puts great pressure on existing UGIs, resulting in a decrease in urban biodiversity and ecosystem services.

Summary

The previous sections have shown, that urban infrastructure systems are crucial for healthy and productive life in urban environments, especially in large, fast expanding cities, such as Shenzhen.

Through the analysis and discussion of the current situation of the existing urban infrastructure systems, the clear definition of goals, and the development of corresponding strategies for improvement, the sustainable development of Shenzhen towards a truly sustainable city can be supported.

As part of the analysis process, the situation of Shenzhen will be compared to other cities in China and Europe, allowing for lessons being learned with regard to the development of strategies for defining and implementing sustainability goals. An example of such an approach is the 'The China Urban Sustainable Index' (USI), a tool for comparing urban sustainability across China, which in 2011 released its first report on social, environmental, economic, as well as resource-related aspects of 185 Chinese cities, based on five categories, namely, social welfare, cleanliness, built environment, economic development and resource utilization.

In the 2011 version of the USI report, Shenzhen was ranked 6th, in 2013 it was ranked 2nd, and in 2017 Shenzhen was ranked 1st, demonstrating the significance of relevant indicators to enhance the

Figure 14 : The land area of the four cities from 2000 to 2016



Source: Shenzhen Statistical Book, Hong Kong Annual Digest of Statistics, Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

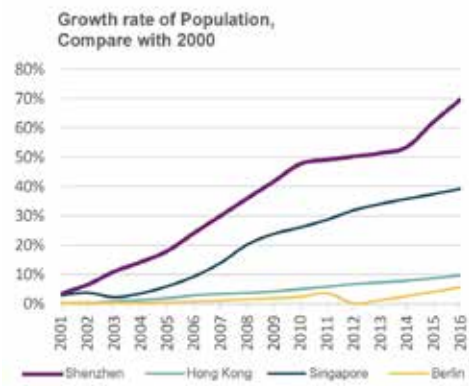
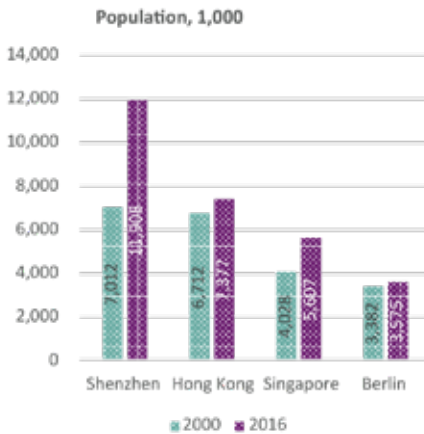
positive development of future-oriented, sustainable cities.

Basic Services and Local Infrastructure In Shenzhen: Measuring Success and Fostering Sustainable Development

Section 3 will discuss the various indicators in detail. The relevant information for the subject areas mentioned above has to be provided by the city administration of Shenzhen. The findings will be – where applicable - compared to similar cities, including international cities.

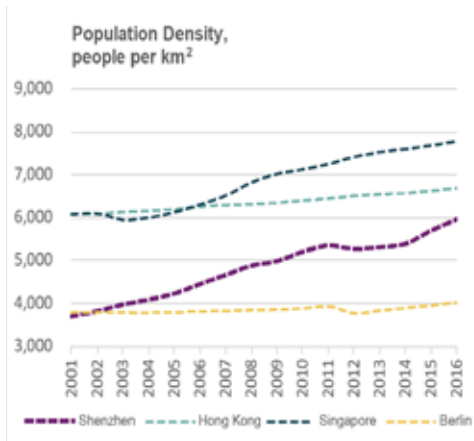
The main aim of this chapter is to analyse the strategies, methods and technologies used for the sustainable provision of basic services, such as the supply of energy, water and public transport, and the related technical as well as green infrastructure, needed for the creation and maintenance of the quality of life in an urban environment such as the

Figure 15 : The population of the four cities (a) and their Growth rate compared to 2000 (b).



Source: Shenzhen Statistical Book, Hong Kong Annual Digest of Statistics, Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

Figure 16 : Population density in four cities

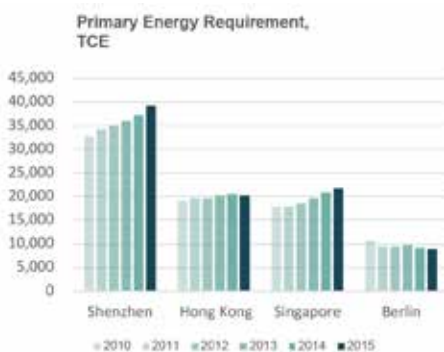


city of Shenzhen. The major goal of a sustainable provision of these fundamental services is to minimize or even avert any negative environmental impact with regard to resource depletion, emissions, or soil sealing, and to maximize the positive impact of green infrastructure with regard to a comfortable urban climate and the regulation of water flows within the city.

In this part, the status quo of the urban infrastructure in Shenzhen is described through indicators of four central aspects, which are the supply of energy, mobility and transport, water supply and green infrastructure.

In order to get a better view of how Shenzhen compares in general to its neighbours, the data obtained for Shenzhen is compared to the data

Figure 17 : The primary energy requirement from 2010 to 2015



of Hong Kong and Singapore, which are in a similar geographical and climatic situation, but are different with regard to their political boundaries and their topography. In addition to this, data for the city of Berlin/Germany is brought in to see how different political, geographical, cultural and climatic conditions might influence the resource efficiency and other factors relating to sustainable development.

In addition to similar conditions with regard to the local climate, Hong Kong and Singapore are the best cases for the benchmark on sustainable development, as these two cities were ranked second and first amongst sustainable cities within the Asian region, respectively, following the latest version report of the Sustainable Cities Index (SCI).¹⁷⁷

Hong Kong is adjacent to Shenzhen and both cities are located in the Pearl River Delta, thus many similarities exist in urban development and resource utilization. Singapore, a country-city, seems to offer a more comprehensive system with regard to urban administration and the management of resources.

Meanwhile, the City of Berlin, as a case study from outside of Asia, might also be highly valuable to see how very different possibilities might exist for achieving sustainable development in a very different context. In the following text, various relevant indicators for all four cities will be compared with each other, and an objective evaluation of the various parameters and the respective performance

Figure 18 : The efficiency of energy consumption

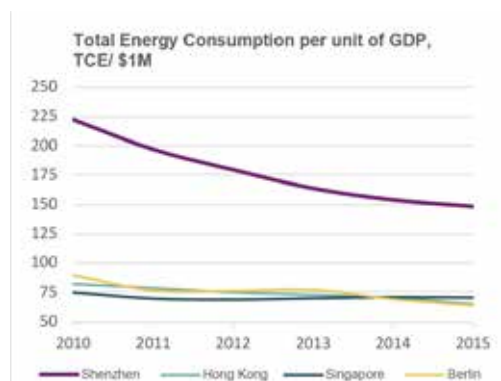
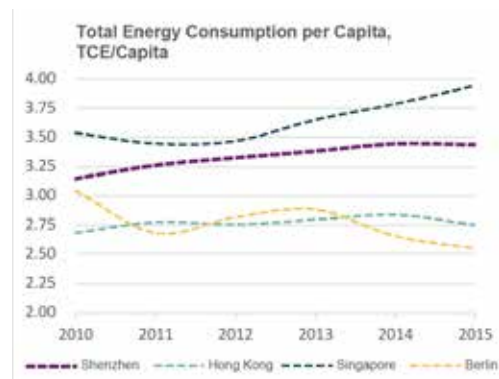


Figure 19 : Energy consumption per capita

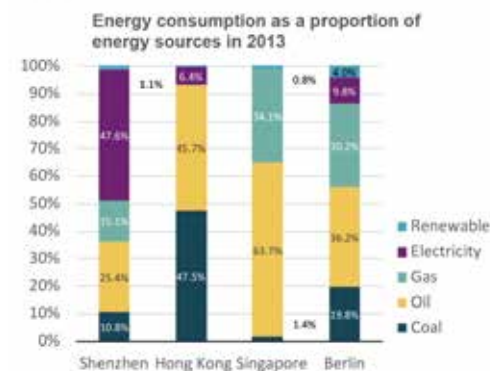
Source: Shenzhen Statistical Book, Hong Kong Annual Digest of Statistics, Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

will allow for the development of rational suggestions for Shenzhen.

General information

Before comparing the indicators on infrastructure, some basic information for the built environment of these cities needs to be interpreted, which is associated with their infrastructure requirements. After entering the millennium, only a few enlargements were achieved in the land area of each city (Figure 14). Among them, Shenzhen possessed the largest land area with 1997 km² in 2016, which is almost twice as large as Berlin, with 1106 km² in 2016. The smallest city is Singapore with 720 km².

While the land area remained almost stable in the four cities during the period from 2000 to 2016, the growth of population in all the cities is rather high, especially in Shenzhen, where the population increased by 70 percent from 7 million in 2000 to 11.9 million in 2016, and is still rising sharply according to Figure 15. In contrast, Hong Kong had a similar population to Shenzhen at the beginning of the millennium with 6.7 million people, but then only around 665 thousand people moved into the city. Although the rate of increase of Singapore was overwhelmingly greater than in Hong Kong, about 2000 percent compared to 40 percent the actual increment was only 580 thousand. Berlin illustrated

Figure 20 : Share of energy supply sources in 2015

Source: Research on carbon emission reduction route for Shenzhen (深圳碳减排路径研究)¹⁹², The 13th five-year plan of Shenzhen's energy development (深圳市能源发展“十三五”规划), Hong Kong Annual Digest of Statistics, Electrical and Mechanical Services Department of Hong Kong (www.emsd.gov.hk), The Energy Market Authority (EMA) of Singapore (www.ema.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

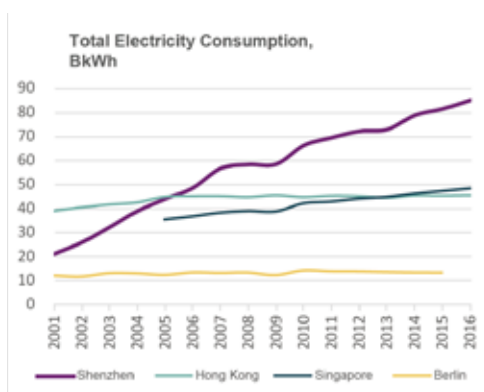
a relatively slower rate of population growth with only 5 percent and fewer than 200 thousand people added to the city's population during this period.

The growth of population, leading to an increasing density of the urban space, is common to all four cases. Figure 16 illustrates that the urban density of Shenzhen started at only 3717 pers./sq.km in 2001, which was a little lower than Berlin's (3799 pers./sq.km). However, Shenzhen jumped to 5962 pers./sq.km in 2016, while Berlin was just over 4000 pers./sq.km at the same time. Hong Kong and Singapore already had high urban density in 2001, with around 6060 pers./sq.km, while a dramatic growth rate can be observed for Singapore after 2004, which reached a population density of 7791 pers./sq.km in 2016. Meanwhile, the population density in Hong Kong only increased by approximately 600 pers./sq.km, reaching 6.670 pers./sq.km in 2016.

Energy Supply

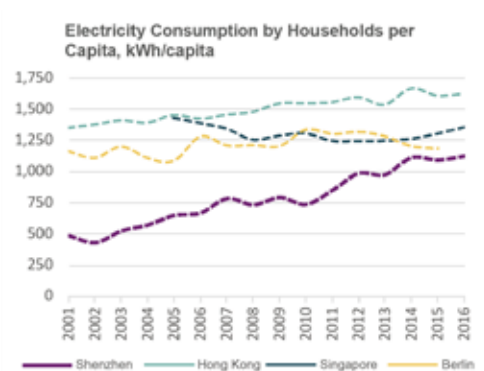
As the most populous city, the energy consumption of Shenzhen reached 39.1 million TCE¹⁷⁸ in 2015, which was almost twice as much as the energy requirements of Singapore, with 21.8 million TCE (see Figure 17). These two cities showed greater

Figure 21 : Gross electricity consumption



Source: Shenzhen Statistical Book, Hong Kong Annual Digest of Statistics, Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

Figure 22 : The electricity consumption by households per capita



Source: Shenzhen Statistical Book, Hong Kong Annual Digest of Statistics, Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

growth rates in energy requirement from 2010 to 2015 than others. Berlin even presented a descending tendency of energy consumption and over 1500 thousand TCE were reduced, comparing primary energy consumption in 2010 with 2015.

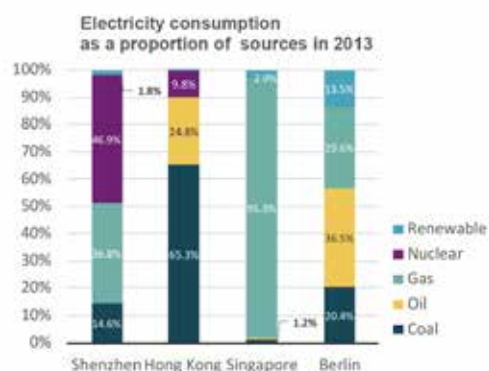
While the differences in primary energy requirement might be easily explained by the differences in the total population of these cities, comparing the

total energy consumption per unit of GDP shows a clearer picture 18). In 2010, Shenzhen consumed 223 TCE/\$1M, which was almost 3 times the amount of Hong Kong, Singapore, and Berlin. Five years later, the total energy consumption per unit of GDP was reduced to 149 TCE/\$1M (2015). Although this was a huge improvement, Hong Kong and Berlin required only 63 TCE/\$1M in 2015, while Singapore reached 70 TCE/\$1M in 2015.

Although Shenzhen consumed more energy to achieve its gross domestic product than the other 3 cities, the energy consumption per capita (ECc) was still lower than Singapore's, with ECc of 3.44 and 3.94 tons of SCE in 2015 for the two cities, respectively (Figure 19). An abnormally increasing trend has emerged in Singapore since 2012, while the ECc of the other cities decreased after 2013. The residents of Berlin consumed the least energy per capita in 2015, only 2.55 tons of SCE, which was 0.2 tons of SCE lower than in Hong Kong.

As shown in Figure 20, the four cities use very different resources for achieving their energy supply. In Shenzhen, almost half of the energy consumption

Figure 23 : Share of electricity generation sources in 2015

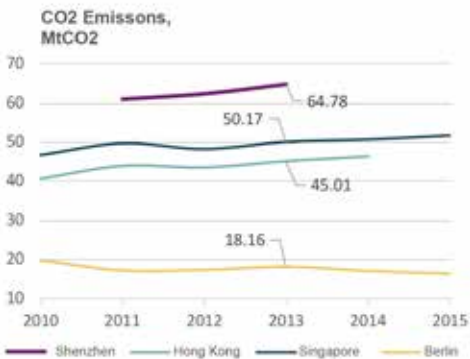


Source: Research on carbon emission reduction route for Shenzhen (深圳碳减排路径研究)¹⁹³, The 13th five-year plan of Shenzhen's energy development (深圳市能源发展“十三五”规划), Hong Kong Annual Digest of Statistics, Electrical and Mechanical Services Department of Hong Kong (www.emsd.gov.hk), The Energy Market Authority (EMA) of Singapore (www.ema.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

was electricity in 2013, which was mostly provided by nuclear power.¹⁷⁹ Hong Kong was also importing electricity from China's mainland to a certain extent. However, in 2015, the energy supply of Hong Kong was mainly reliant on coal and oil, which generated 47.50 percent and 45.75 percent, respectively. In Singapore, oil is the most important energy source, which accounted for 63.69 percent in 2015, followed by gas (34.15 percent). Berlin shows an almost even share of oil (36.2 percent) and gas (30.2 percent), followed by coal (19.8 percent) and electricity (9.8 percent). Berlin showed the highest share of renewable energy use (4 percent), even with only a small percentage. In that context, Shenzhen had a share of 1.1 percent of renewable energy in 2015, which came mainly from waste-to-energy power plants.

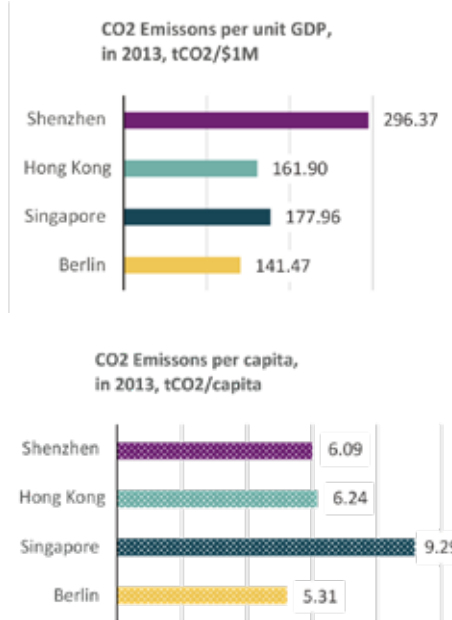
With regard to the development of total electricity consumption from 2001 to 2016, Hong Kong shows an almost constant energy need of about 45 billion kWh/year (Figure 21). In a similar way, this consumption in Berlin was almost constant, and was in the range of 14 billion kWh. In that context, Shenzhen illustrates a very dynamic growth rate, increasing from 21 billion kWh in 2001 to

Figure 24 : The total CO₂ emissions from 2010 to 2015



Source: Research on carbon emission reduction route for Shenzhen (深圳碳减排路径研究), World Bank Group (<https://data.worldbank.org/indicator>), Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

Figure 25 : The CO₂ emissions per unit GDP (a) and per capita (b) in 2013



Source: Research on carbon emission reduction route for Shenzhen (深圳碳减排路径研究), World Bank Group (<https://data.worldbank.org/indicator>), Singapore Department of Statistics (www.singstat.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

approximately 85 billion kWh in 2016. Singapore shows an increase from roughly 35 billion kWh in 2005 to 50 billion kWh in 2016.

Similar to the development of total electricity consumption, per capita electricity consumption of Shenzhen increased from 487 kWh per capita in 2001 to 1128 kWh per capita in 2016 (Figure 21). However, the per capita consumption was considerably lower than in the other 3 cities of Hong Kong, Singapore and Berlin, which was the only city which shows a decline in per capita consumption during recent years, settling at around 1200 kWh per capita, which is almost identical to the value in 2001. With over 1600 kWh per capita, Hong Kong had the largest electricity consumption of the 4 cities in 2016, followed by Singapore with 1353 kWh per capita.

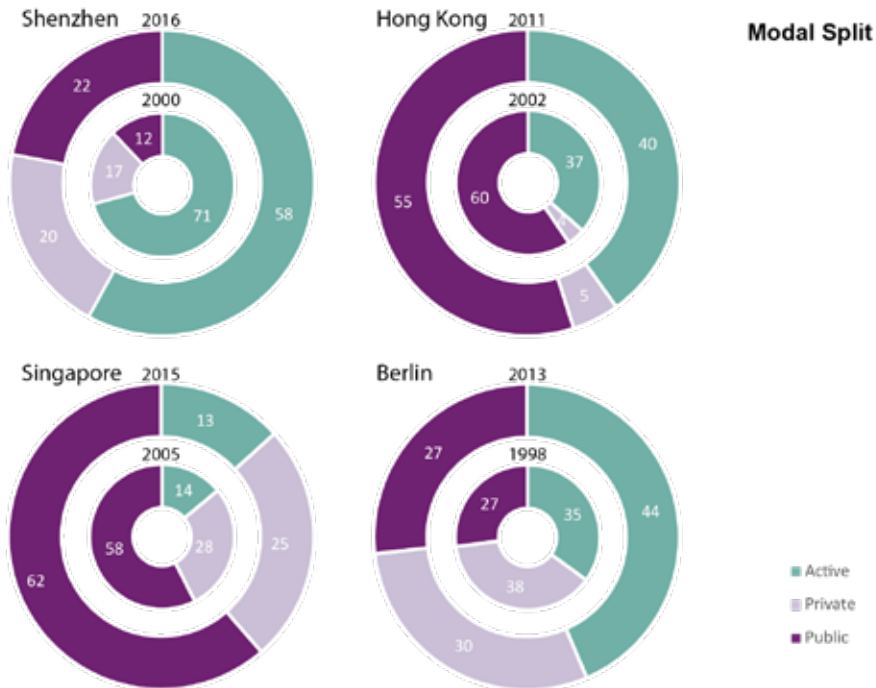
Considering electricity generation, 46.86 percent of the electricity generated in Shenzhen in 2015 came from the local nuclear power plant, followed by the use of gas with 36.75 percent (Figure 23). With a share of 65.3 percent for Hong Kong, coal was the main source of electricity production in 2015, followed by oil with 24.8 percent. In Singapore, 95.3 percent of the electricity was generated by using gas, with most of the remaining electricity supply generated by renewable sources. For Berlin, electricity was generated by using coal (20.4 percent), oil (36.5 percent), gas (29.6 percent) and renewable energies (13.5 percent), pointing in the right direction when it comes to reducing the GHG emissions by turning towards renewable energies in the near future.

Comparing the development of the total electricity consumption of the 4 cities with the development of total CO₂ emissions, it has to be noted, that the 3 cities of Shenzhen, Hong Kong and Singapore show a constant increase in CO₂ emissions, which correlates to the total energy consumption, as shown in Figure

24. That means that hardly any improvement is to be seen in reducing CO₂ emissions, which could have been achieved by integrating green energy into the overall electricity production. Shenzhen has to be ranked first with regard to its CO₂ emission (64 million tons in 2013), with Singapore (50 million tons) and Hong Kong (45 million tons) following. Berlin, being the smallest of the 4 cities, had CO₂ emissions of roughly 18 million tons, while having the largest share of renewable energies in its energy mix.

Regarding the CO₂ emissions in relation to the GDP (Figure 25 (a)), Shenzhen actually emitted much more CO₂ per GDP unit than the other cities. With almost 300 tCO₂/\$1M Shenzhen emitted more than twice as much CO₂/\$1M as Berlin with 141.47 tons CO₂ per GDP unit. However, in terms of tons of CO₂ per capita (Figure 25 (b)), the emission of Shenzhen with 6.09 tons CO₂ per capita was relatively low. Only Berlin was lower with 5,31 tons CO₂ per capita, while Hong Kong with 6.24 tons CO₂ per capita, was slightly higher. However, the CO₂ emission of each

Figure 26 : Modal split of the four cities



Source: Shenzhen Planning Bureau (www.szpl.gov.cn/), *Assessing Urban Transport*



The Metro Entrance of Qiaocheng East Station @ Shi Yin

Singapore resident was much higher than the others and reached 9.29 tons CO₂ per person in 2013.

Mobility and Transport

As mentioned before, the mobility of people and transportation of goods is one of the key requirements in urban environments, providing access to food, work, education, social networks and other activities such as cultural venues as well as recreational facilities and green spaces. While the need for mobility cannot be negotiated, the means for providing access to the various amenities of a city can be very diverse and depend on the policies of a city.

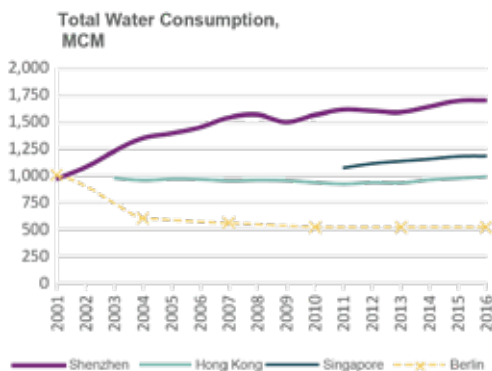
Historically, the transport infrastructure of European and Asian cities developed on the basis of people walking, riding or using horse drawn carriages, leading to an extensive network of narrow streets, supplemented by larger transport arteries when cities became larger. With the rise of motorized vehicles, such as trams and trains, in the late 19th century, and the rapid increase of cars in the early 20th century, the demand for streets, roads and motorways changed our cities rapidly. Especially in the second half of the 20th century, the car became the dominant factor for city planning, leading not

only to a higher share of impervious surfaces for streets and parking, but also to a rapid increase in gas and oil consumption and emissions.

Today we understand that sustainable mobility concepts have to include environmental measures, such as reducing greenhouse gas emissions, air pollution and noise, while providing an attractive environment, including green spaces and parks covering the city. Furthermore, they include increasing the percentage of pedestrian- and bicycle-oriented mobility, supplemented by various forms of public transport systems, allowing for the improvement of the air quality of our cities, and the integration of green and blue infrastructure for dealing with the urban heat island effect and heavy rain events, especially in sub-tropical and tropical environments.

An indicator for measuring the share of environmentally benign and healthy mobility concepts is the so-called modal split, which is the percentage of travellers using a particular type of transportation. This includes non-motorized mobility, such as walking and using a bicycle (active transportation), and public transport, such as buses, trams, underground and suburban trains. The modal split also accounts for the use of individual

Figure 27 : Total water consumption



motorized vehicles, such as cars and motorcycles, which should be restricted to areas where public transport systems might not be available or walking and using a bicycle might not be an option for certain individuals.

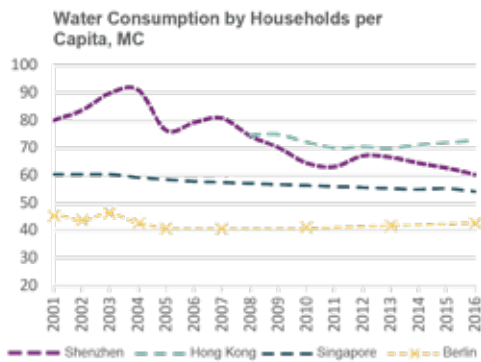
Systems through the Lens of Individual Behaviour: Shenzhen and Hong Kong¹⁸⁰, Singapore Department of Statistics (www.singstat.gov.sg), and Towards new urban mobility: the case of London and Berlin.¹⁸¹

Looking at the city of Shenzhen in the period from 2000 to 2016, people have chosen active forms of mobility, such as walking and cycling, which was the preferred mode of transport, accounting for 71 percent (2000) and 58 percent (2016) of trips, respectively. However, the proportion of public transit in Shenzhen was rather low, ranging from 12 percent in 2000 to 22 percent in 2016 (Figure 26).

In contrast, both Hong Kong and Singapore are the benchmark with regard to the use of public transit, since more than 50 percent of the residents selected public transit as the primary journey method. While only 5 percent of the people in Hong Kong used a private car in the given time period, that percentage was 25 percent in Singapore.

In that context it is interesting to note, that the current “Sustainable Cities Mobility Index 2017¹⁸² ranks Hong Kong as the city with the most sustainable transport and mobility concept, addressing the needs of the people, including social

Figure 28 : Water consumption by households per capita



and human implications of mobility systems. Other aspects include environmental impacts, like energy consumption, pollution and emissions, as well as the efficiency and reliability of a mobility system to facilitate economic growth.

With Singapore following in 8th position, Berlin was ranked 22nd, with the modal split being almost uniformly divided between active forms of mobility, such as walking and cycling, accounting for 35 percent (1998) and 44 percent (2013). Public transport accounted for 27 percent at that time, while private car use can be attributed to 38 percent of the population in 1998 and 30 percent in 2013, indicating a move towards sustainable forms of mobility.

Water Supply

Water helps shape our cities and is directly related to the basic issue of human life. The water shortage problem exists all over the world. As mentioned above, cities, especially those with high density, have to face the challenge of supplying sufficient water for the benefit of their citizens, and at the same time, the level of water security and efficiency should be guaranteed as well.

Following a report evaluating the resilience, quality, and efficiency of water usage in 50 cities across all continents of the world, named the Sustainable Cities Water Index (SCWI)¹⁸³, Berlin occupied 4th position and was among the most consistently high-

performing cities across all categories. Singapore, in 22nd place, succeeded in controlling leakage, treatment and metering, since it belongs to the area with geographic vulnerability. These two cities are considered as desirable references on harnessing water for future success.

As in other Chinese cities, the tap water in Shenzhen is not drinkable. However, the local government is currently aiming at providing drinkable tap water in the near future. According to the national health standards, the pipe water of Shenzhen is acceptable, and the quality is within the risk levels recommended by the International Commission of Radiation Protection.¹⁸⁴

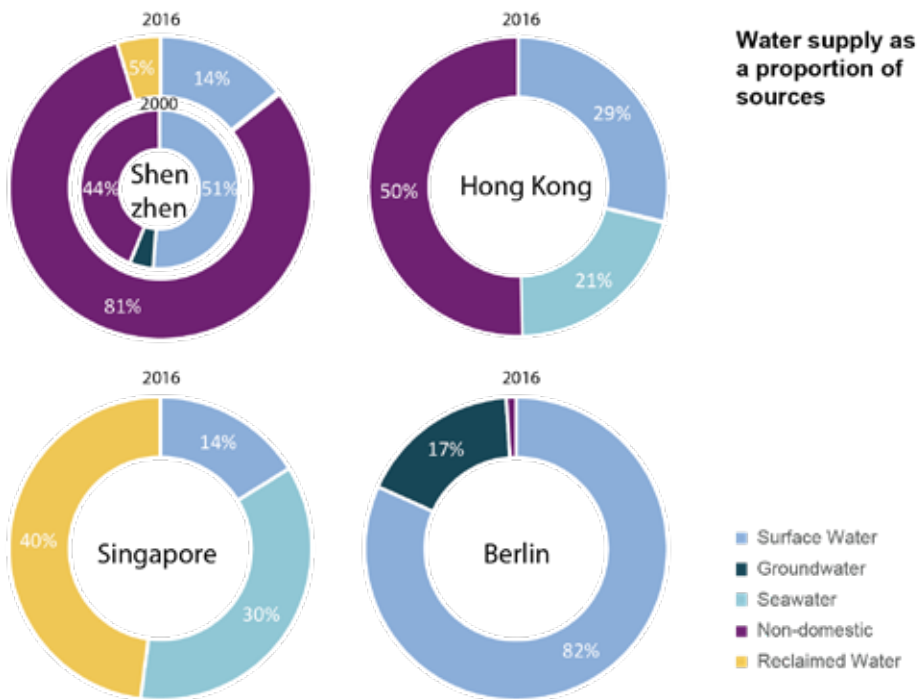
Three additional water supply indicators are selected for assessing the current status of the four cities, namely; total water consumption, to describe the varying demands for water; water consumption by households per capita to illustrate each resident's

water use in a city; and the share of water supply, which not only reveals the sources of water supply in each city, but also indicates the strategies applied in a city to deal with the water supply issue. The results contribute to helping us to gain an overview of our water supply reality and the potential direction we could move towards in the future.

Source: Water Resources Bureau of Shenzhen (swj.sz.gov.cn), Water Supplies Department of Hong Kong (www.wsd.gov.hk), Singapore's National Water Agency (www.pub.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

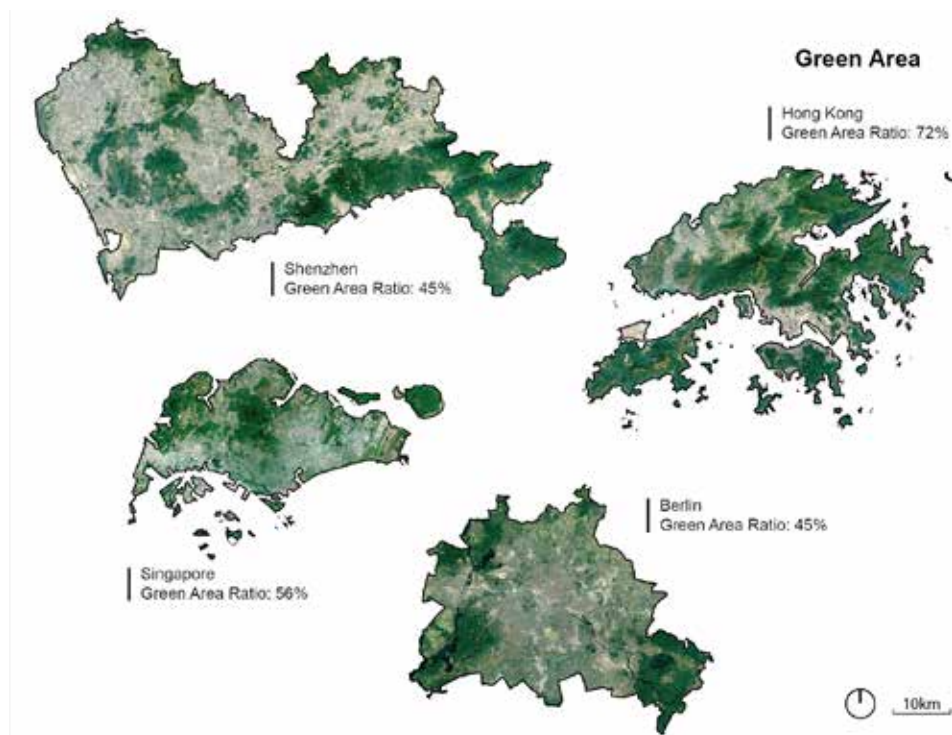
As shown in Figure 27, the water consumption in Shenzhen, Berlin and Hong Kong is similar, around 1000 million m³ (MCM) in 2001. After that, only the water supply of Shenzhen increased dramatically until 2008 and then the growth rate slowed down to 1700 MCM in 2016. In contrast, the consumption

Figure 29 : The share of water supply sources



Source: Water Resources Bureau of Shenzhen (swj.sz.gov.cn), Water Supplies Department of Hong Kong (www.wsd.gov.hk), Singapore's National Water Agency (www.pub.gov.sg), and the Office for Statistics of Berlin-Brandenburg (www.statistik-berlin-brandenburg.de).

Figure 30: The green area distribution and ratio in the four cities (Map images from Google Earth® and captured in 2018)



Source: Shenzhen Statistical Book, Planning Department of Hong Kong (www.pland.gov.hk), National Parks Board (www.nparks.gov.sg), and Senate Department for the Environment, Transport and Climate Protection (www.berlin.de/sen/uvk/).

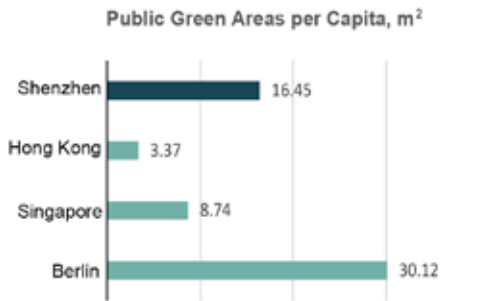
in Berlin has continued to fall since the millennium and the supply of water in 2016 declined to half of the level in 2001, around 530 MCM, which is only 30 percent of the water consumption in Shenzhen. The consumption of water in Hong Kong showed a declining tendency from 2003 to 2013, and then slowly started to ascend to 1000 million m³ in 2016. The same weak growth as Hong Kong was also illustrated in Singapore, where consumption increased from 1082 MCM in 2011 to 1181 MCM in 2016, which is even higher than in Hong Kong, although it has a smaller population than Singapore. Evidently, the water consumption of each city has been relatively stable in recent years.

Figure 28 illustrates that the water consumption for household per capita (WCHc) in Shenzhen rapidly descended with some fluctuations from 2001 to 2016. The peak value of Shenzhen appeared in 2004 with over 90 MC per capita, which is twice the level of Berlin (45 MC) in the same year. In 2016,

the WCHc of Shenzhen decreased to 60 MC, only 6 MC higher than in Singapore, where WCHc declined continuously from 60 MC in 2001 to 54 MC in 2016. The WCHc in Hong Kong presented a growth trend after a short-term reduction from 2008 to 2013, and then increased to 72 MC in 2016.

According to Figure 29, the share of non-domestic water in total water supply in Shenzhen and Hong Kong is much higher than in the other cities. Especially in Shenzhen, the proportion of non-domestic water increased sharply from 44 percent in 2000 to 80 percent in 2016. With the population boom after the millennium, dependence on outside support in Shenzhen was much greater, while Shenzhen also started to minimize its water footprint by adopting reclaimed water, which accounted for 5 percent in 2016, compared to hardly any recycling water in 2000. In 2016, half of the water supply in Hong Kong came from the outside, when it used a volume of treated seawater as flushing water and

Figure 31 : The public green area per capita in 2016



drinking water, which accounted for 21 percent. Berlin was the only city almost self-sufficient in water, only 1 percent of water from outside, but the usage of underground water is at a relatively high level, taking up 17 percent. The benchmark in water supply among these cities is Singapore, which is a world leader in both water recycling and seawater desalination.¹⁸⁵ As an island and also a super high-density population country-city, Singapore had a more severe water shortage problem and a stronger desire for water self-sufficiency, since it affected the country's safety after its independence in 1965.¹⁸⁶ Against this background, Singapore adopted two main measures to minimize its water footprint: the first is seawater desalination, which is also used in Hong Kong but mainly for flushing water. The other one is high-grade reclaimed water, known as NEWater in Singapore¹⁸⁷, which is ultra-clean and safe to drink since it is purified using advanced membrane technologies and ultraviolet disinfection. In 2016, there was no non-domestic water and the use of surface water was the same as in Shenzhen. Instead of importing water from other regions, around 40 percent of water consumption was reclaimed water and 30 percent was desalinated seawater. Moreover, as reported by the Government, almost all urban rainwater is harvested and stored in drinking water reservoirs in Singapore. NEWater is expected to reach 50 percent of the water supply in Singapore in 2030. In terms of increasing the available water, reclaimed water in Shenzhen only accounted for 5 percent and hardly any seawater was used in 2016.

Green Urban Infrastructure

Today, more than half of the global population lives in cities and this number is still increasing. The higher the population density, the heavier the environmental impacts, since the overwhelming population growth demands more land for construction and transport, which leads to the reduction of green areas within a limited land area. With a decreasing share of green area and biodiversity within a certain urban environment, ecological resilience also decreases. This creates a threat to the local ecosystem and the provision of ecosystem related services within that region. Services provided by the green urban infrastructure (GUI) include the amelioration of temperatures, reduction of the rainwater runoff, protection from floods, storing of carbon, reduction of pollution, improvement of the aesthetic appearance and the provision of recreational services.¹⁸⁸ This effectiveness of GUI can be assessed by the distribution characteristics and green area ratio (GAR) within the land area.

As shown in Figure 30, Hong Kong only possessed less than 30 percent of land area for development and construction, but left abundant area for greenery, the GAR of which reached 72 percent in 2016. Its large, continuous green area offers a wide bio-diversity, since the living space for flora and fauna is well preserved, while the developed area is confined to sections within the green land. In Singapore, a large area of green is retained in the middle of the city, surrounded by a ring of built-up land. With a GAR of 56 percent, the percentage of green area is much lower than the GAR of Hong Kong, which is 72 percent. The green area ratio of Berlin and Shenzhen is, in both cases, only 45 percent, with the developed area mainly in the centre, with the green located along the edges.

Shenzhen has a continuous and intensive green area in the south-eastern area of the city, with smaller, isolated green areas dispersed throughout the centre. In addition to large areas of green land and forests, public green spaces (PGSs) are also part of the green urban infrastructure of a city, including

parks, playgrounds with greenery as well as roadside greenery.¹⁸⁹ The public land with its green spaces belongs to the city, allowing the local government to directly influence the quality of life of the local residents. Green islands, dispersed throughout the city, are easily reached and accessed, and therefore, are used more frequently than more distant green land, offering shading, fresh air and entertainment space for the citizens.

Figure 31 illustrates the public green spaces (PGSs) per capita of the four cities, Shenzhen, Hong Kong, Singapore and Berlin. Although showing a lower GAR, Berlin has the largest PGSs among the four cities with over 30 m² per capita for its residents, which is almost twice the amount of the public green space in Shenzhen, which is only 16.5 m² per capita. Although Hong Kong has preserved a huge green area, it has the smallest PGSs per capita, which is 3.4 m², for its citizens. Although, Singapore absorbs more stress on population density, it still has double the PGSs per capita of Hong Kong, around 8.7 m².

Source: Shenzhen Statistical Book, Planning Department of Hong Kong (www.pland.gov.hk), National Parks Board (www.nparks.gov.sg), and Senate Department for the Environment, Transport and Climate Protection (www.berlin.de/sen/uvk/).

Moving Towards A Sustainable Future

The sustainable provision of basic services through the relevant local infrastructure of a rapidly growing urban environment is an extremely challenging task. Using the results of section 3, the analysis of the strengths, weaknesses, opportunities, and threats regarding the sustainable provision of basic services, provides a clear and concise picture of the current achievements and future challenges of the city of Shenzhen.

This analysis has also allowed for the identification of areas, where further development might be necessary, fostering the reputation of Shenzhen as one of the leading sustainable cities in China. Thus,

Shenzhen might serve as a case study for other major cities worldwide, which are facing similar challenges in securing their future in a sustainable manner.

As pointed out earlier, the common challenge of many cities in Asia is constant and rapid growth, demanding more space, building activity, energy, water, transport as well as green infrastructure.

Open space seems to be abundant in Shenzhen, as the city possesses the largest land area of the 4 cities we have looked at. Although Shenzhen accounts for the largest number of citizens, the population density of Shenzhen is still lower than Hong Kong, and even lower than that of Singapore.

With regard to the basic requirements, such as energy, mobility, water and green infrastructure, the large population of Shenzhen certainly creates a tremendous challenge and exerts great pressure on the ecosphere of the city and the surrounding region.

Energy Supply

Due to its large population, the primary energy requirement of Shenzhen is much higher than in other cities. While it is a major challenge to manage total energy consumption and the resulting emissions, it is also a tremendous challenge to increase energy efficiency, compared to other cities, such as Hong Kong, Singapore and Berlin.

While Shenzhen has achieved a considerable reduction in its energy consumption per capita (ECC) during recent years, cities like Hong Kong, Singapore and Berlin only show about 50 percent of the Total Energy Consumption per unit of GDP (TCE/ \$1M).

The need for improving the energy infrastructure and its efficiency in Shenzhen can also be seen in the energy consumption per capita (ECC). In 2010, Shenzhen and Berlin had almost the same total energy consumption per capita (TCE/capita). While Berlin succeeded in reducing its energy consumption per capita during the following 5 years, Shenzhen saw an increase by 0.9 TCE/capita, leading

to a considerable increase in the CO₂ emissions of Shenzhen, as half of its energy is generated by using fossil fuels. Thus, it is critical for Shenzhen to increase the efficiency of energy consumption and move towards the use of renewable energies for producing electricity.

Mobility and Transport

With regard to a sustainable transport infrastructure, Shenzhen has still to make considerable efforts, since in 2016, only 22 percent of the residents in Shenzhen selected public transit as their main means of transport, while 20 percent use their cars. Comparing the modal split of Shenzhen with Hong Kong and Singapore, the percentage of people using public transport was 55 percent and 62 percent, respectively.

Public transit is the most effective and energy-efficient method for transporting people within the city, when it comes to land-use, impervious cover, resource consumption, emissions, noise and safety. This is even more effective, when the different modes of transport, such as suburban and urban trains, underground trains and trams as well as buses are well connected and can be easily reached

by walking and biking, which is the case in compact cities with well-established transport networks. In that regard, Hong Kong has had greatest success in the reduction of private car travel, as only 5 percent of the population chooses the car as their means of transport, whereas in Shenzhen 20 percent choose to use their car, while in Singapore this share is 25 percent and in Berlin 30 percent.

Water Supply

The two major cities in the Pearl River Delta have exceeded their own capacity for water supply. Especially in Shenzhen, where household water consumption per capita has declined dramatically in recent years, the magnitude of the dependency on non-domestic support is still increasing due to the growth in population.

In 2016, over 80 percent of the water supply of Shenzhen came from the surrounding cities¹⁹⁰, indicating its high dependence on its neighbours. In comparison, Berlin and Singapore succeed in meeting their residents' needs by providing sufficient domestic water, using different methods.

While Berlin has an adequate water supply due



The Neighbourhood near the Shenzhen North Station @ Shi Yin

to its local reserves of surface and ground water, Singapore is making efforts to increase its locally available water by reclaiming and recycling water, and by desalinating seawater to a high degree. That way, Singapore could be a role model for the city of Shenzhen in ameliorating the water shortage by increasing its domestic water supply and reducing the rapid growth of the demand for non-domestic water. Moreover, adopting treated seawater for flushing as in Hong Kong, could also be a low-cost and efficient strategy for reducing the import of non-domestic water.

Green Urban Infrastructure

In Shenzhen, large green areas are mainly located at the south-eastern and northern edge of the city. These areas are rather distant from the downtown district, where relatively small areas of green can be found, which are dispersed throughout the central area. While Singapore and Hong Kong have managed to preserve major areas of green in the centre of the city, benefitting the urban environment, the built-up area and urban structure can be optimized only on a neighbourhood scale and on the building level with regard to green roofs and green facades. According to the Shenzhen green system¹⁹¹, the public green area per capita is forecast to increase to 18m²/capita, with all residents within 500m of the nearest park by 2030. Therefore, the quality of life could be enhanced by increasing accessibility and the space experience in these public space areas of Shenzhen.

Conclusions

As one of the economically most successful cities in the south-eastern region of Asia, Shenzhen is also one of the fastest growing cities in the Pearl River Delta. While it has managed to deal with growth in a successful way, it is still facing major challenges, such as providing clean energy to its production facilities and citizens, and providing clean drinking water, while being independent from its neighbouring cities. With further improvements with regard to a well-established sustainable public transport system and intensifying its green urban infrastructure, Shenzhen might well serve as a role model for its neighbours and other cities with regard to the establishment of sustainable urban infrastructure systems in the near future.

Chapter 6

Environment and Eco-City

Wang Dong

Introduction

In less than 40 years, Shenzhen has gone through rapid industrialization and urbanization. In this land of 1997 square kilometres, the population has grown from 310,000 in 1979 to more than 12.52 million at the end of 2017, and there are over 20 million people under its management. Shenzhen is the first city in China to achieve 100 percent urbanization. While the society and economy are developing at a high speed, Shenzhen also made remarkable achievements in sustainable development of eco-city construction and green low-carbon cycle. “Shenzhen Blue” and “Shenzhen Green” have become the brightest colours in the city, and the quality of the ecological environment has continued to improve. The city has won the honorary titles of National Garden City, international “Garden City” and “Global 500” for UN Environmental Protection.

Shenzhen also encountered “urban diseases” in the process of rapid development. Overpopulation, excessive expansion and high density brought about huge environmental bottlenecks and pressures. These problems are mainly manifested in the serious shortage of space resources for development; extremely scarce local energy resources, weak energy self-sufficiency, and high costs. The scarce local water resources pose great

challenges to the stability of water supply, and the contradiction between supply and demand of resources and energy has become a key bottleneck restricting sustainable development.

At present, the environmental pollution problems in some areas of Shenzhen are quite prominent. First of all, water environmental pollution is severe, with black and odorous water bodies, making treatment quite challenging. Pollution is common and severe in some offshore areas. However, Shenzhen lacks infrastructure for water pollution prevention and control, the pipeline constructions are unsatisfactory, and the capacity of local sewage treatment plants is insufficient to treat all the waste water. The sudden increase in household garbage has also raised a serious challenge for landfill.

Shenzhen's development practices adhere to the ideas of harmonious coexistence of people and nature, and establish and implement the philosophy that green mountains and waters are mountains of gold and silver. Shenzhen effectively employs means such as legislation, policy guidance and planning to establish and improve the system and mechanism of green development; it continues to promote the formation of a spatial pattern featuring resource saving and environmental protection. Shenzhen pushes forward the optimization and

upgrading of industrial structures, and strongly advocates for green and low-carbon production and lifestyle to increase the green content in the quality development of the economy. Altogether, it has made outstanding achievements in the construction of a green and low-carbon city, as well as a smart and ecological city.

This chapter first discusses the concept of eco-city and related concepts, briefly examines the related research of Shenzhen's eco-city planning and construction, and reviews the process and main problems of Shenzhen's eco-city construction. Then the paper discusses the following aspects: energy structure adjustment, industrial transformation and upgrading, building green transportation system, promoting green buildings, advocating green and low-carbon lifestyle, strengthening pilot projects of low-carbon cities, and combining policy guidance with market mechanism. In the future, Shenzhen will become one of the three pilot areas of sustainable development in China. Shenzhen has proposed its ambitious goals for the short, medium and long term in accordance with the goals of UN 2030 Agenda for Sustainable Development, and it has begun to promote and implement these goals with various measures and means, trying to create reproducible and transferable experiences for the sustainable development of the world's mega cities.

Eco-City and Related Concepts

Eco-city is a concept put forward by American scholar Richard Register in the 1970s to plan and build an ideal future city (Eco-city Berkeley: Building a City for a Healthy Future). Subsequently, UNESCO launched the Human and Biosphere Project, which also introduced this important concept and attracted wider attention. On June 5, 1972, the first United Nations Conference on the Human Environment was held and the Declaration on the Human Environment was adopted, aiming at appealing to the peoples of the world to protect and improve the human environment. In 1987, the World Commission on Environment and Development formally elaborated the concept of sustainable development in its report

entitled *Our Common Future*. With the increasing attention to global climate change and other issues, many different concepts have emerged, such as low-carbon city, green city, garden city, resilient city, sponge city, liveable city, knowledge city and so on. Several years ago, the author and other international scholars discussed the differences and connections between some related concepts¹⁹⁴. And many scholars have examined the related concepts (Nina Khanna)¹⁹⁵. As can be seen, eco-city does not have a very well-recognized definition and coincides with many of the concepts mentioned above. Therefore, in the discussion of this paper, we do not make a strict distinction between the above concepts and understand eco-city from a very wide range of aspects: that is to say, to get more and higher quality output with the smallest possible environmental cost and least resource consumption, to strive for the harmonious coexistence of man and nature, to let people live in more liveable urban areas, to meet people's higher material and spiritual and cultural needs, and to have a higher sense of acquisition and happiness.

Literature Review of Shenzhen as an Eco-City

There are many works on the eco-city and the related concepts mentioned above. In combination with Shenzhen's green, low-carbon, recycling and sustainable development, especially the planning and construction of Shenzhen's eco-city, we briefly examine some recent works closely related to Shenzhen. In addition, a conceptual analysis framework is simply established for the use of this paper in the follow-up discussion.

Li Tianhong, Li Wenkai and Qian Zhenghan¹⁹⁶ point out that urban expansion significantly affects ecosystem services and functions. Peijun Shi and Deyong Yu¹⁹⁷ assess Shenzhen urban environmental resources and services, in landscape based urban planning and sustainable development. You Heyuan¹⁹⁸ describes the unequal supply of public green space in Shenzhen. Lin Liu, Yaoyu Lin and Lina Wang¹⁹⁹ consider energy allocation and

environmental suitability assessments: outdoor and local climate and thermal comfort conditions in the region should be effectively assessed and analysed to meet the needs of resource conservation and environmental friendliness. Ying Huang, Lei Liub and Xiaofeng Pan²⁰⁰ take Shenzhen as an example, one of the most passionate local governments in China's low-carbon transformation; their paper uses the eio-lca model to evaluate the local scale of carbon dioxide emission structure. Jingru Li and Jian Zuo²⁰¹ study willingness to pay higher landfill fees for construction waste: a comparative study of Shenzhen and Qingdao.

Martin de Jong, etc.²⁰² consider developing robust organizational frameworks for Sino-foreign ecocities: comparing Sino-Dutch Shenzhen Low Carbon City with other initiatives. Changjie Zhan²⁰³ conducts research on financing an eco-city and a low-carbon city: the case of Shenzhen international low-carbon city financing of sustainable urban development has become a major issue, especially in the construction scale and large scale of Asian countries. Ying Liu, Yanliu Lin, Na Fu, Stan Geertman and Frank van Oort²⁰⁴ focus on Shenzhen's inclusive and sustainable transformation: urban reconstruction, migration and displacement patterns as well as policy implications.

Shenzhen's Sustainable Development Process

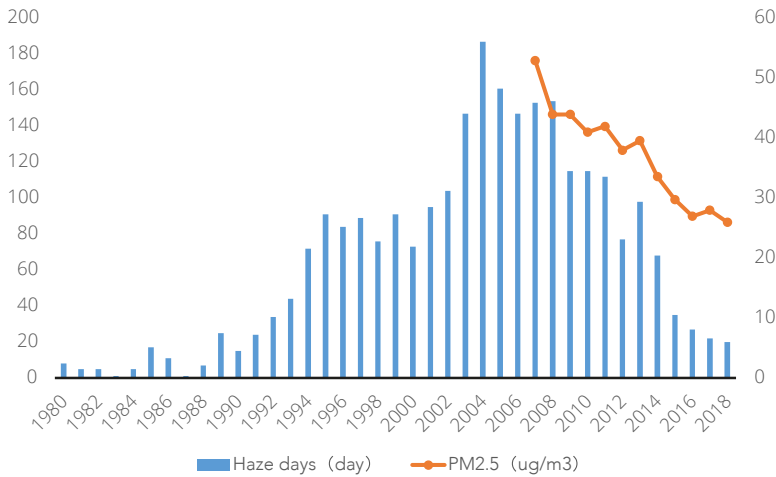
When Shenzhen was established in 1979, there were hardly any industries. On about 2000 square kilometres of land, about 310,000 people were living in Shenzhen (Statistical Yearbook). The GDP of Shenzhen was less than 200 million Yuan, mainly from the income of primary industry. Shenzhen is close to the mountains and the sea, and its natural conditions are good. Generally speaking, though, there is a lack of natural resources. After the establishment of the Shenzhen Special Economic Zone in 1980, industrial parks were set up to carry out urban construction, but in the early 1990s, the main industry was the processing of incoming materials. After Mr. Deng Xiaoping, the chief designer of China's

reform and opening-up policy, visited Shenzhen and other places in 1992, the pace of urbanization and urbanization in Shenzhen accelerated greatly, and the population expanded rapidly year by year. As can be seen from the following figure, before 1992, there were fewer than 30 haze days per year in Shenzhen, and after 1992, the number of haze days per year also increased rapidly, reaching the highest level in 2004, with the number of haze days exceeding one-half of the whole year, reaching 187 days. It was in this year that Shenzhen announced that it had achieved 100 percent urbanization. This is the first city to do so in China. Around this time, everyone, from mayor to citizen, began to attach importance to environmental issues.

In 2017, the green coverage rate of the built-up area in Shenzhen was 45.1 percent, the forest coverage rate was 40.04 percent, and the urban sewage treatment rate was 96.8 percent. Shenzhen has built 942 parks with a total area of 22,000 hectares and a per capita park green area of 16.45 square meters. About half of the city's land is classified for ecological protection. Shenzhen has 2,400 kilometres of greenways and 2,638 hectares of ecological landscape forests; the total area of green buildings exceeded 53.2 million square meters, ranking first in the country; it is one of the largest cities in the world for the promotion of new energy vehicles, and has promoted 120,000 of them. The average concentration of PM_{2.5} is 28mg/m³, which is at the leading level in domestic cities. Shenzhen Carbon Emissions Exchange is the first of its kind in China, with the most active transactions and highest trading volume. Shenzhen International Low Carbon City has become the flagship project of China-Europe Sustainable Urbanization Cooperation and won the "Sustainable Development Planning Project Award" from the Paulson Institute of the US.

The focus of this paper is to discuss how Shenzhen has attached importance to environmental problems since 2004, especially since 2010, and what measures have been taken to tackle them, what results have been achieved, and why the number of haze days in Shenzhen has dropped to fewer than 30 days in a relatively short period of time (20 days in 2018) (Figure 32).

Figure 32 : Haze days and PM_{2.5} concentration in Shenzhen



Shenzhen’s Major Environmental Problems

Besides the air pollution issue mentioned above, Shenzhen’s government has raised the “4 non-sustainability problems” since 2004. The mayor at that time (Li Hongzhong) pointed out the following non-sustainability issues: firstly, Shenzhen has limited land and space; it has only 200km² of land available for development and this area can no longer match the speed of Shenzhen’s development. Secondly, Shenzhen’s energy and water resources won’t be able to support its rapid development, even if we dry up the Dongjiang River. Thirdly, the speed mode of development that Shenzhen currently adopts will require more labour input to realize the target of one billion Yuan of GDP, yet the city cannot bear such a heavy load and fourthly, the environmental capacity is severely overextended, the environment cannot tolerate any more pollution (not with severe water pollution; not to mention that there’s no more environmental capacity left in the land water bodies). Shenzhen has a very clear understanding of its environmental problems (*China Reform News*, January 17th, 2005).

Shenzhen has a quite small land area of 1,997km² with only 760km² available for construction. If Shenzhen maintains its development speed of 10km² per year, there will be a severe imbalance

between land, the denominator, and the population density and economic output, the numerator. Shenzhen will have no land left for any purpose in 20 years.

Shenzhen is one of the 7 cities with severe water shortage in China. The average per capita water availability is only 1/6 of Guangdong and 1/5 of the national average. With the constant increasing of Shenzhen’s population, the environmental load, especially on water resources, is growing rapidly. There were about 332,900 people in the area when the Shenzhen Special Economic Zone was built in 1980. Today, Shenzhen administers over 12 million people, 10.26 million of whom are temporary residents. A series of problems, derivatives of overpopulation, have damaged the city’s environmental capacity. According to the estimation of Shenzhen’s officials, the city will be overwhelmed if the conflict between scarce land and ever-increasing population cannot be solved or gets even worse, and in turn, the healthy growth of Shenzhen’s economy will be gone.

The “4 non-sustainability problems” of land, resources, environment and population greatly restricted the expanded reproduction and structural optimization and upgrade of the enterprises. Shenzhen, the city which garnered its first pot of gold via “three processing and one compensation” with

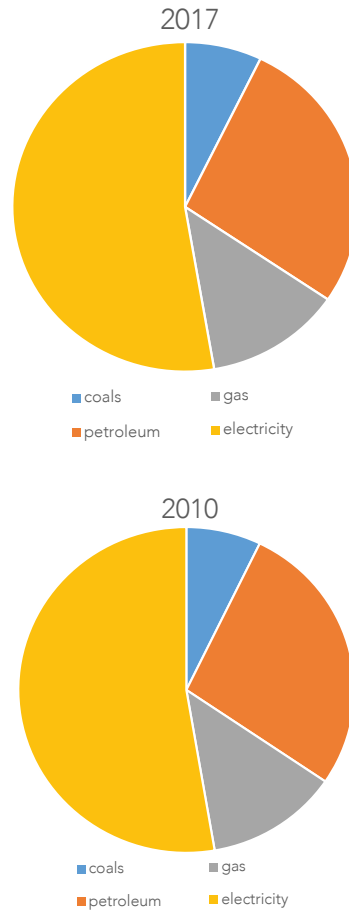
scarce land, severe population pressure and the restricted development of traditional enterprises, was the first to realize that the traditional course and expanding development mode has come to an end; and intensive and high-end transformation becomes an urgent task. Ever since then, Shenzhen is determined to transform from the famous “Shenzhen Speed” to “Shenzhen Benefits”.

Discussions in this chapter will address aspects such as energy structure adjustment, industrial transformation and upgrade, establishing a green transportation system, promoting green buildings, advocating green and low-carbon lifestyle, enhancing the pilot of low-carbon cities and policy guidance and market mechanism. In fact, one of Chapter 4 of this book thoroughly discussed the ideas of incorporating the concepts of eco-city and green, low-carbon sustainable development into the compilation, implementation and dynamic management of the urban planning, land development and reasonable configuration of land resources, making the city's spatial structure, industrial layout and land utilization more compact, intensive and rational, and thus, laying a foundation for the planning and development of Shenzhen eco-city.

Energy Structure Adjustment and Energy Efficiency Improvement

Shenzhen attaches great importance to promoting the energy structure adjustment. It greatly promotes the planning and construction of energy infrastructures and gradually increases the proportions of clean energy, extraneous electricity and natural gas in the city's energy structure. In the primary energy consumption structure in 2017, the proportions of coal, petroleum, gas and electricity were 7.2:27.3:12.8:52.7. Compared with 2010, the proportion of coal dropped from 12.5 percent to 7.2 percent, the proportion of petroleum dropped from 32.4 percent to 27.3 percent, while the proportion of natural gas increased from 10.2 percent to 12.8 percent and the proportion of electricity increased from 45.0 percent to 52.7 percent. The proportion

Figure 33 : Diagram of energy structure



of clean energy was 10.3 percent higher than 2010 and the energy consumption structure continues to optimize (Figure 33).

After the establishment of Shenzhen City, electricity and energy have always been in short supply due to the rapid industrialization and urbanization. By 2000, Shenzhen's self-sufficiency rate of primary energies was less than 10 percent; more than 90 percent of the energies were transported from inland or imported from abroad. In addition to the huge amount of coal, Shenzhen also has to import huge amounts of fuel oil and liquefied petroleum gas. To solve the energy bottleneck problem of Shenzhen, the city convinced the central government to locate the LNG pilot project first introduced to China at the Dapeng Peninsula in Shenzhen. The project cost over 29 billion yuan. It was approved at the end of

1999, officially commenced at the end of 2003 and phase 1 was put into operation in 2006. Natural gas mined from the seabed in Australia is tanked in LNG cargo ships after pressurization, and sent to Shenzhen's receiving station for unloading, storage and gasification. This project represents a great leap for Shenzhen's energy structure adjustment. After that, Shenzhen has constantly enhanced its utilization of natural gas, nuclear energy, solar energy, biomass energy, wind energy and other clean energies and continues to raise the proportion of clean energies. Shenzhen applied high-efficiency power generation technology and trial applied carbon capture and sequestration methods to lower the carbon emission of the energy industry. Shenzhen also piloted smart grid construction to promote the grid connection of renewable energies.

Greatly increase the proportion of utilization of clean energies

Implement the petroleum replacement strategy by introducing natural gas, expand the supply channels of natural gas resources, seize the strategic opportunity of global energy development and strive to develop and utilize nuclear energy and renewable energies.

- Actively introduce natural gas resources. Greatly promote the planning and construction of natural gas source projects, such as the West-East natural gas transmission line 2 Shenzhen-Hong Kong branch, West-East natural gas transmission line 2, Shenzhen LNG emergency load station and Diefu LNG receiving station to form a multiple source of supply pattern. The natural gas supply capacity will exceed 6.5 billion m³ per year and the proportion of natural gas in primary energy structure will increase to around 14 percent.
- Strive to develop nuclear power. Fully utilize the brand and technological advantages of Shenzhen's nuclear power industry, break through the traditional base planning mode and enhance the transformation of concepts from industrial park to the industrial city; and establish an industry cluster with the nuclear power design, R&D, integration and service as the core, and solar energy, wind energy and other new energy and high-end industries as the auxiliaries. Build a national-level new energy (nuclear power) industrial base, and a high-productivity demonstration base of Shenzhen's transformation development, innovation development and low-carbon development, and make it a new window for Shenzhen's external display.
- Promote the utilization of solar energy. All civil buildings with the necessary heat collection conditions must install the solar energy hot water system. Speed up the solar energy-photovoltaic building integration (BIPV) demonstration projects. The area of the solar energy photo-thermal application will exceed 16 million m², and the total installed capacity of solar energy generation will reach 200 MW. Actively carry out the pilot of renewable energy building applications, such as solar energy air conditioning and ground source heat pump. Promote and install new energy products such as solar energy - LED and wind-solar complementary lighting for urban roads and public spaces meeting the necessary conditions.
- Engage in the development and utilization of bio-mass energy. Accelerate the expansion of phase II of the Laohukeng waste incineration plant and the planning and construction of the waste incineration and power generation plant in the eastern part of the city. Enhance the utilization of methane from landfill. Actively engage in the R&D of biodiesel, fuel ethanol and energy plants, and pilot the application of biological liquid fuels at appropriate times. Currently, the four waste incineration and power generation plants operating in Shenzhen can process 5,450 tons of household wastes every day and generate 700 million KWH per year, with emission indexes reaching or exceeding the EU standard. At the same time, Shenzhen is actively promoting

three more waste incineration projects: Bao'an Phase III, Nanshan Phase II and the eastern environmental-protection power plant. The Shenzhen Eastern Environmental Protection Power plant under construction will process over 5,000 tons of waste daily. When completed, it will be the largest single garbage power generation plant in the world. When all these projects are completed, Shenzhen will incinerate all household waste for power generation and will become the first city in China to process all household waste in a "harmless, reducing and recycling" manner.

- Actively carry out the demonstration of wind utilization. Combined with wind energy resources and construction conditions, Shenzhen will research and construct the wind power demonstration projects to lead the development of the wind power equipment industry. And Shenzhen will actively carry out a feasibility study of offshore wind power projects according to the offshore wind power project planning of Guangdong Province.

By 2017, the proportion of non-fossil energy in Shenzhen's primary energy consumption reached 15 percent, while the proportion of clean energy exceeded 90 percent.

Comprehensively lower the carbon emissions of the energy production sector

Encourage the energy production sector to adopt high efficiency power generation technologies, and test the application of carbon capture and sequestration technology (CCS), striving to significantly reduce the carbon emissions of the power industries.

- Accelerate the R&D and application of high efficiency power generation technologies. Encourage power generating enterprises to engage in R&D of high efficiency power generation technology to transform the main equipment of the power generation unit and the important energy-consuming auxiliary

system, while focusing on desulfurization and dephosphorization; install pollution control equipment, improve the utilization efficiency of coal and gas for power generation and lower the station's power consumption rate and carbon emissions. Back in 1999, Mawan power station's No. 4 unit completed the construction of the first set of the seawater flue gas desulfurization system, which was a demonstration project of the State Environmental Protection Administration. According to the statistics, Shenzhen invested 1.423 billion yuan in energy-saving and emission reduction technical transformation of the existing coal power plants from 2014 to 2017. As of now, all ten coal power generation units have completed their ultra-low emission transformation; nine of them passed the ultra-low emission acceptance and obtained a preferential electricity price for ultra-low emission.

- Pilot the energy comprehensive integrated supply mode. Pilot the household type or community type small-scale combined supply of cooling, heating and power. Research regional low-carbon energy planning in combination with the new urban functional areas and parks to promote the complementary development of ordinary energies and renewable energies, and establish an integrated energy supply centre. Encourage the pilot of the distributed combined supply of cooling, heating and power of natural gas in buildings meeting necessary conditions. Encourage the construction of energy storage power stations in important venues, and develop ice storage air conditioning and phase-changing materials and other energy storage forms, and increase the efficiency of the energy supply system.
- In order to reduce the air pollution caused by the diesel generators of the coal carriers in the power plant wharf during unloading, Shenzhen Energy Group Co., Ltd. constructed the shore power facility of the Mawan power plant wharf from 2015 and carried out the transformation

of the shore power facility of the coal carriers of its subordinate transportation companies at the same time. In September 2016, Shenzhen Energy Group completed the transformation of the shore power facility of all four carriers and passed the handover acceptance in November. It is calculated that the harbour area can reduce exhaust gas emissions by about 4,000 tons per year after the shore power transformation and truly achieve “zero emission” of exhaust gas by ships. It is reported that this project was the very first large-scale bulk cargo terminal shore power construction project in China which successfully utilized low-pressure boarding, which has a positive demonstration effect for the promotion of “terminal shore power” in Shenzhen and even across the country. (Source: Shenzhen Energy Group)

Strive to improve the energy utilization efficiency

Take energy-saving and cost-reducing as the important carriers of energy utilization efficiency improvement, and speed up the structural energy-

saving, technical energy-saving and management energy-saving. And intensify the energy-saving and cost-reducing measures in fields such as manufacturing, transportation, building and public institutions, reducing the resource and energy consumption and improving the energy utilization efficiency.

- Enhance the energy conservation and emission reduction management of key industries such as electricity, building materials and manufacturing. Actively adopt advanced and suitable energy-saving technologies to reform traditional industries and improve energy efficiency. By 2015, the energy consumption per unit of industrial added value dropped by 20 percent compared to 2010 and reached 0.394 tons of standard coal/ten thousand yuan; Shenzhen strives to bring down the energy consumption per unit of industrial added value by another 10 percent compared to 2015 and reach 0.355 tons of standard coal/ten thousand yuan.
- Energy-saving of the electric power industry. Promote the technical transformation



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of thermal power generating units and replace them with efficient and clean power generation technologies to bring down the power generating energy consumption and the station service power consumption rate. Accelerate the technical transformation of power transmission, transformation and distribution equipment, as well as the construction of the power grid; gradually eliminate the old equipment with high energy consumption, to lower the power loss during transmission, transformation and distribution. Promote the simplified power grid transformation levels and 20Kv power distribution. Enhance the management of the power-demanding side and carry out energy-saving and power generation scheduling in a comprehensive manner.

- Energy-saving of the building material industry. Speed up the technical transformation of the glassmaking industry; promote advanced technologies and carry out the technical transformation of the residual heat utilization of the glass kiln. Accelerate the elimination of backward kiln types in the ceramics industry, promote energy-saving and environmental-friendly kiln technologies, optimize the fuel structure and encourage comprehensive resource utilization projects such as recycling of ceramics slag and residual heat.
- Electronic equipment manufacturing industry. Intensify the energy consumption diagnosis and the energy-saving transformation of the electronic equipment manufacturing industry; accelerate the elimination of the backward and high energy consumption electronic equipment such as the motor, draught fan, water pump, injection moulding machine and compressor; guide enterprises to adjust their product structure and divert their focus onto low energy consumption and high added value products; raise the access threshold of the electronic equipment manufacturing industry and strictly monitor the energy consumption of energy-consuming equipment.

- Energy-saving and cost-reducing of key energy-using units. Enhance energy-saving monitoring of key units consuming more than 300 tons of standard coal per year; implement the reporting system regarding energy utilization status; promote energy efficiency benchmarking and encourage the pilot of energy-saving management specialists and energy management system. Increase the capital input to guide enterprises to carry out research on energy-saving technology, organize key energy-using units to engage in energy-saving and cost-reducing services, improve the measuring and detection capability and standards of the energy-using units, as well as calibrate their energy measurement devices and verify their energy measurement data.

Industry transformation and upgrading

As of 2017, the proportion of advanced manufacturing, modern service industries and advantageous traditional industries, respectively in Shenzhen was 0: 41.3: 58.6, showing a coordinated development pattern of advanced manufacturing, modern service industries and advantageous traditional industries. As of 2017, Shenzhen's three types of industries of advanced manufacturing, modern service industries and advantageous traditional industries showed a coordinated development pattern in a proportion of 0: 41.3: 58.6, respectively. The added value of the four mainstay industries: high-tech industry, financial industry, logistics industry and the cultural industry was 1.4 trillion yuan, accounting for 63.4 percent of GDP. The advanced manufacturing industry achieved an added value of 573.387 billion yuan, with a growth rate of 13.1 percent. The proportion of modern service industry in the service industry grew to 70.8 percent, and the added value of the six strategic emerging industries of bio-industry, the Internet, new energy, new-generation information technology, new materials and cultural creativity reached 918.35 billion yuan, accounting for 40.9 percent of GDP. Shenzhen has become one of the cities with the largest scale of strategic emerging industries and the strongest clustering effect in China.

Development of low-carbon emerging industries

Assign great importance to the development of low-carbon emerging industries such as new energy, Internet, biology, new materials, cultural creativity, new-generation information technology, energy-saving services and low-carbon services; seize the commanding height of the development of low-carbon industries and create mainstay industries for low-carbon development.

The new energy industry

Earnestly implement the *Revitalization and Development Plan of the New Energy Industry in Shenzhen (2009-2015)* and the *Revitalization and Development Policies of the New Energy Industry in Shenzhen*, and implement technological innovation, industrial cultivation, development and promotion, application expansion and industry service engineering in aspects of solar, nuclear, wind and biomass energy, energy storage power stations and new energy vehicles to rapidly expand the industrial scales, improve the energy supply proportions and optimize the energy structures. By 2015, the output of the new energy industry reached 250 billion yuan, with an annual replacement of traditional energy of more than 15 million tons of standard coal and a CO₂ emission reduction of more than 20 million tons.

The Internet industry

Accelerate the implementation of the *Revitalization and Development Plan of the Internet Industry in Shenzhen (2009-2015)* and the relevant policies, speed up the construction of Internet infrastructures and greatly develop the E-commerce, IT and mobile Internet, strive to promote the integration of the Internet industry and the real economy and bring down energy consumption. By 2015, the output of the Internet industry reached 200 billion yuan.

Bio-industry

Actively implement the *Revitalization and Development Plan of the Bio-industry in Shenzhen*

(2009-2015) and the relevant policies. Focus on fields such as biological environmental protection, biological energy, biological medicine, biological pharmaceutical and biological manufacturing, and accelerate the R&D of the production of biological environmental protection products and the comprehensive utilization of recycled resources, environmental monitoring, waste disposal, water treatment, exhaust gas treatment technology and set products, biodiesel and fuel ethanol. By 2015, the output of the bio-industry reached 200 billion yuan.

The new material industry

Actively implement the *Revitalization and Development Plan of the New Material Industry in Shenzhen (2009-2015)* and the relevant policies. Give full play to the foundation and guiding roles of new materials in low-carbon development. Actively cultivate new material enterprises with promising market potential, intensive technologies, high added values, low resource consumption and environmental friendliness to support the transformation and upgrade of the electronic information industry, the rapid development of low-carbon industries such as the new energy and environmental protection industries, the transformation and upgrade of the advantageous traditional industries and acceleration of the core competitiveness of the low-carbon industry system. By 2015, the output of the new material industry reached 150 billion yuan.

Cultural creativity industry

Actively implement the *Revitalization and Development Plan of the Cultural Creativity Industry in Shenzhen (2009-2015)* and the relevant policies. Highlight the high-end, high added value and low-carbon advantages of the cultural creativity industry. Intensify the support given to it, create a good environment and greatly promote the development of industries such as creative design, anime games, digital audio and video, digital publishing, new media, cultural tourism, film and performance, high-end printing, and high-end industrial arts. Develop the

emerging industrial mode of the cultural industry of “culture + technology” relying on the high and new-tech, and with the digital contents as the main body and proprietary intellectual property rights as the core to increase added value to cultural products. By 2015, the added value of the cultural creative industry reached 220 billion yuan and the total output of the industry exceeded 580 billion yuan.

New-generation IT industry

Adhere to the principles of “market-oriented, innovation-driven, high-end-guided and advantages highlighted”, enhance independent innovation, improve the industry standard, expand the application space, optimize the development environment, promote the interaction and integration of IT innovation, emerging application expansion and new-generation network construction, and promote the rapid and healthy development of the new-generation IT industry. By 2015, the output of the new-generation IT industry reached 1.2 trillion yuan, with an annual growth rate higher than 20 percent; Shenzhen became an important new-generation IT industry base in the world.

Energy-saving service industry

Intensify the support given to the energy-saving service industry and issue supporting policies for the development of the industry; encourage enterprises with a high level of technological and service standard to adopt the energy management contract (EMC) mode and provide “one-stop” energy-saving services of diagnosis, design, financing, reform and operation for the energy-using units. Enhance service innovation, talent cultivation and technological R&D to make the energy-saving service industry stronger, and improve its comprehensive strength and market competitiveness; and establish a batch of large service enterprises with renowned brands and strong competitiveness to promote the rapid development of the energy-saving service industry, and build a national high ground of the energy-saving service industry.

Low-carbon service industry

Cultivate low-carbon service industries such as carbon emission statistics, carbon standard, carbon labelling, carbon certification, carbon finance and carbon emission permit trading. Encourage enterprises to carry out carbon footprint measurement and product carbon certification and engage in the formulation of carbon standards. Encourage financial and insurance institutions to carry out carbon finance (credit) and insurance businesses to provide funding support for low-carbon development. Explore the trading mechanism of carbon emission permits and carry out the pilot of carbon emission permit trading. Encourage domestic and foreign enterprises with a high level of low-carbon technology research and service to settle in Shenzhen.

Transform and upgrade the high-carbon industry

Find breakthrough via technological innovation of the traditional industries and accelerate the update and transformation. Raise the access threshold of carbon emission on the basis of restricted conditions, such as energy consumption and environment. Adopt clean production and product carbon labelling, and promote the low-carbon transformation and upgrade of traditional industries.

Speed up technical transformation and equipment update

Accelerate the removal of backward technology, process and equipment in accordance with the national industrial restructuring catalogue, as well as the industrial guidance catalogues of Guangdong Province and Shenzhen Municipality. Increase production efficiency and energy utilization efficiency to realize the low-carbon transformation of industry. Enhance the review of backward productivity removal, establish the social announcement system of obsolete productivity and report to the public on a regular basis.

Case 1: Shenzhen Emission Exchange

Carbon trading is essentially a financial activity, but more closely linked to financial capital and a green technology-based real economy: on the one hand, financial capital invests directly or indirectly in projects and companies that create carbon assets; on the other hand, emission reductions from different projects and companies enter the carbon financial market for trading and are developed into standard financial instruments.

Due to the small emissions in Shenzhen, the National Development and Reform Commission did not initially include Shenzhen when drafting the first batch of cities. Shenzhen is probably included in the national pilot area because of the special nature of Shenzhen's industrial structure. Compared with other cities in the country, Shenzhen does not have large-scale direct emission sources of carbon dioxide such as heavy chemical industry, steel industry and thermal power industry, while carbon emission trading is a market-based means to promote energy saving and emission reduction at a lower cost, and ultimately achieve green and low carbon development. The methods to make the large number of "indirect emission sources" achieve energy saving and emission reduction goals through the establishment of market mechanisms will be the significance of this pilot in Shenzhen.

Shenzhen Municipal Government attached great importance to this project and set up a leading group and office for the pilot of carbon emission trading. Municipal leaders served as the people in charge and set up a working group led by the Municipal Development and Reform Commission, consisting of several governmental organs to carry out extensive and in-depth research, together with expert research teams.

On September 30th, 2010, the Shenzhen Emissions Exchange was established. The Shenzhen carbon emission trading market was officially launched on June 18th, 2013, becoming the first carbon trading pilot in the "Seven Pilots" to open the market, and once again with Shenzhen playing the leading role in innovation and reform.

On June 18th, 2013, the Shenzhen carbon market was launched. It was the first real carbon market in China, and among all developing countries worldwide. Shenzhen is the very first pilot of special carbon trading laws, and it has become the first pilot in China which has relatively comprehensive carbon trading laws consisting of local laws and regulations and local government acts;

As of December 31st, 2017, the cumulative volume of carbon market quotas in Shenzhen was 29.35 million tons, with an accumulated turnover of 904 million yuan. The total volume of CCER (China's Certified Emission Reduction) was 11.05 million tons, with a total turnover of 148 million yuan. The total turnover of the Shenzhen carbon market was 40.4 million tons, and the total turnover was 1.052 billion yuan. Its trading volume and liquidity have been leading the country for a long time;

The Shenzhen carbon market is bold in opening and brave in innovating. In addition to having the first carbon trading law in China, it also has the first organizational-level code and guidance for quantization, reporting and inspection of greenhouse gas in China; it is the first carbon trading system using the benchmarking method for distribution; the first quota game (use concentrated if not game) distribution system; and the first greenhouse gas information management system, registration

system and trading system. The Shenzhen carbon market created several firsts in carbon financial innovations, and found several carbon financial cases which can be reproduced and transferred nationwide: such as carbon asset pledge financing, allowing foreign investors to participate in carbon trading, buy-back financing of domestic and foreign carbon asset, carbon bonds and green structural deposits and so on.

Shenzhen's carbon market has effectively raised the awareness of emission reductions of enterprises and the public. The construction and operation of this market has enabled more and more Shenzhen enterprises to recognize the issues of climate change and be serious about corporate energy saving and emission reduction, and has encouraged enterprises to incorporate GHG emission reduction into their production management and investment decisions, as well as improve corporate social responsibility. At the same time, with the publicity and promotion of knowledge related to carbon trading, the Shenzhen carbon market not only attracted a number of public welfare members, but also greatly enhanced the public's understanding of low-carbon lifestyles and green travel, and improved energy saving and emission reduction awareness in the whole society.

Control the development of industries with high energy consumption and severe pollution

Implement the management authority linkage mechanism of the newly approved projects and the project approval accountability system. Strictly implement the "Six Necessary Requirements" of projects, i.e. a project must meet the requirements of industry policy and market access standards, project review and approval or filing procedures, pre-review of land usage, environmental impact evaluation and approval, energy-saving evaluation review and credit, as well as safety and urban planning requirements. Fully employ references to energy consumption standard, environmental-protection enforcement, dumping right trading, minimum wage and social security to accelerate the elimination of low-end and backward enterprises, increase the industry access threshold, implement energy-saving access management, strictly control the development of industries with high energy consumption and severe pollution.

Greatly promote clean production

Expand the scale and scope of clean production and bring the concept of clean production into the industry cluster base and the construction process

of the industry belt; and carry out the low-carbon reform of enterprises and production bases via the implementation of clean production. Attach great importance to the clean production of traditional industries such as building materials, electroplating, household appliances, jewellery, painting and dyeing, as well as watches. Implement mandatory clean production review of enterprises with pollutant emission exceeding the national, provincial or municipal emission standard or exceeding the rated total control index of pollutant emission, and use the clean production review as one of the constraint conditions for settlement, expansion, relocation and eligibility for preferential policies; control the consumption of resources and energies throughout the full life-cycle of products to lower carbon emission.

Accelerate the spatial agglomeration of traditional industries

Speed up the cluster development of traditional industries, adjust the industrial spatial structure, realize the rational industrial layout, shorten the product transportation distance and bring down energy consumption. Enhance the core competitiveness of industries, increase product quality, lower the unit carbon emission of the

product and establish a famous low-carbon brand in Shenzhen via constant innovation.

Develop low-carbon urban agriculture

Based on the low-carbon and ecological restructuring of agriculture, develop modern animal husbandry, aquaculture, planting and fishery with Shenzhen's characteristics. Increase the technological management standard and added value products; increase the utilization efficiencies of land, water resources and energies to the greatest extent possible, and lower carbon emission during agricultural production.

Construct A Green Transportation System

By the end of 2017, a total of 120,000 new energy vehicles were put into use, including 16,359 purely electric buses (all buses in Shenzhen are now purely electric), over 10,000 purely electric taxis (all taxis in Shenzhen will be purely electric by the end of 2018) and over 30,000 purely electric logistics vehicles (Shenzhen has the largest number of new energy logistics vehicles in the world).

Strive to promote the energy-saving and emission reduction of transportation by improving the energy efficiency and emission standards of vehicles. Greatly develop rail transit, public transport and non-motor vehicle road transportation and promote new energy vehicles; establish a low-carbon transportation network, effectively lower the energy consumption of vehicles, control exhaust gas emission and realize the gradual lowering of transportation carbon emission.

Strengthen the energy-saving and emission reduction of transportation. Enhance the control of motor vehicle exhaust pollution, improve the quality of vehicle fuels, increase the carbon emission standard of motor vehicles, enhance the monitoring and control of vehicle exhaust and speed up the elimination and upgrading of high emission vehicles; further increase the proportion of buses using clean energies such as LNG, and gradually establish a

monitoring, evaluation and alarm system for motor vehicle pollution. Strictly implement the annual inspection system of vehicles and improve the means of inspection of diesel vehicles, accelerate the elimination of the old high energy consumption vehicles, enhance exhaust gas detection and intensify the punishment of vehicles exceeding the limits in accordance with the applicable laws. Make sure all vehicle fuels reach the national IV standard and pay more attention to the oil-gas recycling of gas stations, oil depots and oil tank trucks; strictly implement the environmental protection classification identification system and the inspection/maintenance system (I/M) of vehicles to reduce the pollutant emission of motor vehicles.

Give priority to the development of public transport. Implement the development strategy of public transport priority and establish a transport development mode dominated by public transport. Optimize and adjust the travel mode of the city and establish an integrated public transport system with rail transit as the framework, conventional transport as the network, taxis as the supplement and the slow-travel system as the extension, building an urban bus system in line with international standards. Enhance the coordination between rail transit and conventional transport; reasonably, orderly and efficiently organize the spatial transfer of the passenger flows of the railway stations; construct a smoothly connected, convenient, efficient and integrated bus system to significantly increase the participation ratio of public transport. By 2015, Shenzhen had built a 229km rail transit network and established a 400km (two-way) special bus line; the participation ratio in public transport of motorized travel reached 56 percent, fuel consumption per hundred kilometres dropped by 10 percent; by 2020, the participation ratio in public transport of motorized travel will reach 65 percent and fuel consumption per hundred kilometres will drop by 20 percent.

Increase vehicles' energy efficiency and the emission market's access threshold. Increase the energy efficiency of new vehicles and raise the access threshold of the emission market; accelerate the

transformation or elimination of the current low energy efficiency vehicles. Strictly implement the fuel consumption limits of passenger cars and light commercial vehicles; and restrict the growth of vehicles with high oil consumption and high pollution.

Pilot and promote new energy vehicles. Take the construction of the national-level energy-saving and new energy vehicle demonstration and promotion city as an opportunity, speed up the implementation

of the *Implementation Plan of the Energy-saving and New Energy Vehicles in Shenzhen*; pilot and promote new energy buses, taxis, service cars and private cars. Accelerate the formulation of the charging station (or charging pile) construction standard and support policies to speed up the construction of supporting facilities, such as charging stations. Actively establish new energy vehicle demonstration areas in Yantian, Longgang and Guangming to create beneficial conditions for the large-scale promotion and application of new energy vehicles.

Case 2: BR Building

The project aims to explore the realization mode of green building featuring low cost and soft technologies, and realize maximum savings, efficient utilization of resources, environmental protection and pollution reduction throughout the entire life cycle of the building. BR Building incorporates the research achievements and patented technologies of Shenzhen IBR over the years, and has the dream of practicing green life and green office working methods. It has become a green R&D office building integrating regional characteristics, green technologies and architectural art.

BR Building is located in Futian District of Shenzhen and occupies 3,000m². It has a plot ratio of 4, a coverage rate of 38.5 percent and a total construction area of 18,170m². The main structure of the building has 12 storeys above ground and 2 storeys underground. BR Building was completed and put into use in March 2009 and has won many domestic and international awards. The building has achieved its original objectives and reached the requirements of Three Stars Level of National Green Building Evaluation Standards and Gold Level of LEED, with a total project cost of 4,000 yuan/m². The building created remarkable social benefits. According to preliminary calculation and analysis, the entire building has a construction area of 18,000m², and can save 1.5 million yuan of operating expenses per year. Compared to conventional buildings, it can save 1.45 million yuan of electricity cost, 54,000 yuan of water cost, 610 tons of standard coal, and reduce 1,600 tons of CO₂ emission. BR Building makes a great contribution to the energy saving and emission reduction enterprise of the whole society.

BR Building made great use of the local natural conditions. Not every green technology costs money. BR Building achieves green and energy saving with “local” and “lean” design principles and suitable design methods and technologies.

As shown by relevant data, BR Building integrated and utilized about 40 green technologies and measures with the idea of “adjusting measures to local conditions”, and fully explored the value of natural ecological environment for “green building”.

BR Building has become a cosy nest for flowers, birds and fish. In fact, there are many such ingenious designs in BR Building. Every flower and water fountain seems to hide a mystery. Taking the water fountain and the aerial garden on the first floor as an example, it is not only a landscape of the building, but also an “artificial wetland”—the reclaimed water treatment system, which turns the sewage generated by the

whole building into “reclaimed water”, is used to flush toilets via biological treatment. The fountain system in the regenerating pool also replaces the cooling tower of the air conditioning system; transparent glass is installed at the bottom of the pool to introduce natural light into the basement garden. Every drop of rainwater falling on the BR Building is collected to water the three-dimensional greenery throughout the building.

Green buildings should be alive and living. BR Building is able to generate energy by itself, recycle and use sewage and waste by itself. At the same time, the appearance of the building is not pure glass and concrete; there is a “living coat” on the outside. On the west side of BR Building, the designers designed the shield flower stand, which is filled with various vines and flowers. These vines have covered the entire wall. When spring comes, these plants become beautiful green outfits of the building, which block the heat of the city from entering the building. The flowers and plants on the flower stand often blossom, and attract hummingbirds and butterflies, which even build nests here and treat it as home.

In addition to the three-dimensional green “natural outerwear”, BR Building’s “artificial outerwear” is also quite distinctive. The outer wall of the low-rise area of the building adopts one-moulding and integrally installed hollow cement fibre extruded board, which is not only environmentally friendly, but also high in strength and light in weight. It can also resist earthquakes and fire as well as insulate sound. This material can serve as interior and exterior decorative surfaces, eliminating the large workload of traditional decoration and making large material savings. Last but not least, it also advocates aesthetics of simple material.

The BR Building saves 1.2 million yuan of operating costs per year. Due to the comprehensive application of low-cost, high-efficiency, localized green building technologies, the comprehensive cost of the BR Building is only 4,300 yuan/m². BR Building achieved the three-star green building standard with the construction cost of an ordinary high-rise office building in Shenzhen. By analysing the operational data, compared with the same type of office building in Shenzhen, BR Building’s air conditioning energy consumption was reduced by about 63 percent, lighting energy consumption was reduced by about 71 percent, conventional power consumption was reduced by about 66 percent, and total energy consumption was reduced by about 63 percent. According to this calculation, BR Building can save about 10.944 million kWh a year. Since the solar photovoltaic system is installed on the roof, the power generation in the first year of its operation was 75,600 kWh, accounting for 7 percent of the building’s annual electricity consumption. With the reduction in electricity charge alone, BR Building can save about 1.17 million yuan a year. In terms of conserving water, the building can save 5,180 tons of water a year because of its reclaimed water and rainwater recycling system. After deducting the operating cost of the reclaimed water system, 15,000 yuan can be saved annually. The utilization rate of non-traditional water is 52 percent, far exceeding the highest standard of 40 percent in the National Green Building Evaluation Standard.

The reason for society’s strong recognition of the BR Building is that, it is a green building constructed with localized and low-cost methods. Green buildings, both domestic and foreign, usually strike us as “luxuries”. The cost of domestic green building often exceeds 10,000 yuan/m², not to mention the more expensive green buildings in developed countries; such a high cost renders green buildings desirable and yet unattainable. The extensive recognition and acceptance of BR Building lie in its moderate cost, 4,300 yuan/m². Many visitors said that they would make their buildings green too, when they heard about the cost of BR Building.

By 2015, Shenzhen promoted 50,000 new energy vehicles and realized an annual carbon reduction of 50,000 tons; by 2020, 100,000 new energy vehicles will be promoted and the annual carbon emission will reach 1 million tons.

Accelerate the construction of pedestrian and bicycle traffic systems. Carry out the planning and construction of slow-traffic infrastructure around railway stations to achieve the extension of the subway and bus services. Promote the construction of slow-traffic passageways and the supporting facilities in combination with Shenzhen's greenway construction and actively create a slow-traffic system atmosphere in the city. Shenzhen built about 200km of bicycle path network to improve the quality of the citizens' leisure time. Research the system demands, implementation conditions, restrictions and feasibility of public transportation and gradually establish a public bicycle system.

Enhance traffic organization and management. Establish and improve the intelligent traffic management system by improving the construction of the road traffic network and traffic signals and traffic information platforms. Establish the statistics and monitoring system of energy consumption and pollution emission of the traffic industry; formulate

effective measures, intensify the control of traffic demands, improve the passing rate of motor vehicles, lower the idling time of vehicles and reduce exhaust emissions.

Promote Green Buildings

Strictly implement laws and regulations such as the *Building Energy-saving Rules of Shenzhen Special Economic Zone* and *Implementation Rules of Public Building Energy-saving Design Standard* and make sure 100 percent of the newly built buildings comply with the energy-saving requirements. By 2015, the proportion of green buildings in all newly-built buildings reached 40 percent and will reach 80 percent in 2020.

Establish a green building life cycle management philosophy. The green and low-carbon concept will be integrated into the whole life cycle of building survey, design, construction, operation, property management and demolition. Research and establish a green building standard system of green survey, green design, green construction, green evaluation, green operation and green property with Shenzhen characteristics.



Lianhua Mountain @SZAICE

Case 3 : GEP Evaluation System Created in Yantian District, Shenzhen

In 2015, Yantian District of Shenzhen first introduced Urban GEP in China. GEP is the abbreviation of Gross Ecosystem Production; it refers to the total economic value of the products and services provided by the ecosystem for human well-being. Unlike GDP which is more concerned with the running state of the economic system, GEP, on the other hand, emphasizes the “price tag” put on the ecological environment by the running state of the ecosystem. It provides a quantitative basis for “Beautiful China”; and switches regional development to the mode of “double account, double operation and double improvement” of both GDP and GEP. This system adds the building blocks to the pilot and demonstration area of national ecological civilization, and won the “2015 Chinese Government Innovation Best Practice” award. Yantian District’s Urban GEP Accounting System consists of indicators of three levels: two level 1 indicators: “value of natural ecosystem” and “value of human settlement ecosystem”; eleven level 2 indicators, including ecological products, ecological regulation, ecological culture, maintenance and improvement of atmospheric environment, maintenance and improvement of water environment, maintenance and improvement of soil environment, maintenance and improvement of ecological environment, value of acoustic environment, reasonable disposal of solid wastes, energy saving and emission reduction, and environmental health; and 28 level 3 indicators, including values of food, timber, water resources, etc., which can be directly utilized by human beings, ecological regulation functions such as conservation of water and soil, carbon sequestration and oxygen production, and air purification provided to humans indirectly, cultural and service functions originating from ecological landscapes, and indicators related to water, gas, noise, slag and carbon emission reduction, and pollutant discharge reduction.

A good accounting system must be both general and specific. Hence, the indicators possess universality, and 28 indicators are set for both rural areas and urban areas; but the specific accounting items can be different. For example, in view of the fact that Yantian Port faces a great challenge of environmental pollution treatment, its main accounting item can be set as energy saving and emission reduction.

Promote the energy-saving standards of new buildings. 100 percent of new buildings will implement building energy efficiency standards. Encourage new buildings to implement building energy efficiency labelling systems. Develop green buildings and promote green construction. Taking affordable housing as a breakthrough, we will promote the industrialization and one-time decoration of residential construction, carry out residential performance and parts certification, foster the modernization demonstration bases and projects of the residential industry, and accelerate the construction of modern production components of the residential industry. Efforts will be made to reduce energy consumption in the construction and renovation of new buildings.

Carry out energy-saving transformation of existing buildings. Implement the *Energy-saving Transformation Plan of Existing Buildings in Shenzhen* and produce energy consumption statistics; carry out energy consumption audits, energy efficiency publicity and energy consumption detection. Mobilize the various departments and units in various districts to establish the existing building energy-saving transformation project database in combination with urban upgrading, large public building transformation, building facade and roof transformation as well as anti-seismic housing enforcement to fully promote the energy-saving transformation of existing buildings and promote the low-carbon transformation of buildings.

Carry out building technology innovation. Encourage the development and use of new building technologies, new materials and new equipment. Encourage the development of high-performance new wall materials and glass curtain wall materials. Vigorously develop high-performance building energy equipment, especially for building air-conditioning energy equipment and power equipment. Encourage enterprises to prepare construction techniques and construction methods.

Promote the application of renewable energies. Implement solar-photovoltaic building integration demonstration projects in public buildings, municipal engineering and high-end residence buildings. Install solar photovoltaic systems and solar-thermal systems on the roofs of the newly-built buildings and existing buildings meeting necessary conditions, such as public buildings, office buildings, industrial areas (parks), hotels, enterprises and residential buildings, and lead the development of solar product application and relevant industries.

Lower the energy consumption of public institutions

Carry out energy-saving transformation of the energy-using equipment in public institutions to eliminate high energy consumption and highly polluting equipment; promote the application of energy-saving equipment and new energy products. Strictly implement energy-saving management, establish energy consumption statistics and a monitoring platform to improve the energy utilization efficiency and reduce the carbon emissions of public institutions.

Promote the energy-saving transformation of public institutions. Attach importance to the energy-saving transformation of air conditioning, lighting and electrical power systems, heating systems, office equipment, elevators, draught fans and pumps and the promotion of clean energies; enhance the daily energy-saving management and carry out energy-saving and emission reduction monitoring, performance evaluation and audit of governmental office buildings and large public buildings; enhance

the energy consumption management of service cars, enhance water saving and material saving intensities and improve the construction of the information system for governmental affairs. Promote the paperless office, and strictly implement the air conditioning control standard of 26°C in summer.

Promote energy-saving lighting products. Gradually eliminate incandescent light bulbs and high pressure mercury lamps in large public buildings, and promote efficient, energy-saving and technically mature LED lamps, T5 lamps and tri-chromatic rare earth fluorescent lamps. By the end of 2015, 70 percent of the main roads in the city have had energy-saving lamps installed or adopted measures such as alternate lighting or intelligent lighting dimming, and realized 30 percent reduction of lighting energy. Promote solar - LED products for urban roads, municipal parks, underground garages, transportation facilities and squares and train stations.

Advocate for A Green and Low-Carbon Lifestyle

Actively carry out low-carbon events such as Land Day, Earth Day, Water Resource Day, Energy Day, Public Transportation Day, Car-free Day, Water-saving Campaign, Plastic Reduction Campaign, and One Hour Blackout to strengthen the public's low-carbon awareness. For example, in March 2010, Shenzhen launched a series of activities including "Green Action, Green Seed" green travel and "Shenzhen Low Carbon Year" and everyone in the city participated in the "Earth Hour" event. According to the real-time statistics of the Shenzhen Power Supply Bureau, the 33,900 kWh of electricity saved during one hour of Shenzhen's blackout was equivalent to 13.56 tons of standard coal. The city is the home of its citizens, while relaxation is very important for urban life. The city needs a relatively relaxed and leisurely living atmosphere. Strolling on the streets, the low tempo is like a slow-moving image, allowing people to re-appreciate the neglected landscape and taste the changing flavours

of the city's four seasons, so that the city's leisure and elegance can be dissipated, thus reflecting its different tastes and connotations.

The slow traffic system not only makes travelling more convenient, but also tangibly connects the cultural landscapes of the city, becoming an extension of its culture and leisure. The characteristic regional landscapes, regional cultures, business cultures and public culture service networks of the city will be connected and integrated organically through reasonable design to make slow walking more of a leisure choice. This is the essence of urban slow traffic systems. The key to a city's slow traffic system lies in the selection of the route. With that, a fast-moving city can still tolerate light paces and comfortable minds, thus demonstrating the cosy and leisurely side of a city.

We might talk about the slow-traffic life in Yantian District, which only has twisted coastlines, but also 253km of staggered, greenway slow-traffic network capturing various scenes along the way, making it the best place for Shenzhen's citizens to have a taste of Yantian District's life. At the same time, 6,000 public bicycles distributed in the district allow the public to enjoy the cosiness of the slow life within 300 to 500m from any point in the built-up area, and this is the green welfare brought to the citizens by Yantian District.

Integration of Policy Guidance and Market Mechanism

At the beginning of its development, Shenzhen attracted a large number of "two-high and one-low" enterprises (high energy consumption, high pollution and low benefit). For example, the Longgang River and the Pingshan River basin brought together a lot of heavy pollution enterprises, which generated 13.86 billion yuan of output and 2.12 billion yuan of taxes, accounting for 12.5 percent and 7.8 percent of the entire basin, yet they produced 61.5 percent of the industrial wastewater and 47.7 percent of the industrial chemical oxygen demand of the entire basin. Industry demonstrated a distinct "high-

carbon" characteristic and the industrial layout was "scattered, disordered and low-end". There were over 900 industrial parks and areas of all sizes across the city (excluding the high-tech zone and bonded area); the total area of these industrial parks and areas exceeded 150km². However, the size of each individual park was rather small; with 74 percent of them having an area of less than 10 hectares and the average plot ratio was only 1.0.

Shenzhen was faced with bottleneck restrictions, with pressures becoming more and more prominent in aspects such as space, resources, population and environment, which the traditional economic development mode could no longer sustain; this called for the elimination and relocation of backward industries and the lowering of emissions of the high-carbon enterprises, making room for traditional industry's transformation and the emerging industry's development.

Shenzhen was able to realize at an early point that the high input and high energy consumption development mode is not sustainable; hence, it stuck fast to the promotion of industrial transformation and upgrading and has always seen energy-saving and emission reduction as an important carrier for low-carbon development. Shenzhen regards industrial structure optimization as the important support of low-carbon development, and built a new Shenzhen path for higher quality growth with lower resource consumption and environmental costs.

It is both a social and economic matter that must be treated carefully for enterprises in the traditional industry to "make room". After all, these enterprises made huge contributions to this city during its early development. The standard for capacity elimination must be defined carefully and scientifically. The standard should neither be too high, hurting a large number of enterprises and employees, and affecting the long-term impetus for economic development, nor too low and failing to generate the effect of lowering carbon-emissions and achieve transformational development.

Case 4: Comprehensive Demonstration Effect of Shenzhen International Low Carbon City

The green and low-carbon development practices which Shenzhen has adhered to for many years laid a good foundation for the planning and construction of the Low Carbon City, as well as the realization of low-carbon development and upgrading. In 2012, Shenzhen International Low Carbon City was officially launched as a flagship project of China-Europe Sustainable Urbanization Cooperation. Pingdi International Low Carbon City adheres to the core concept of low carbon and smart cities, and plans to build “Four Areas”, i.e.: a Pilot Area of a Climate-friendly City, a Clustering Area of New Low-carbon Industries, a Leading Area of Low-carbon Lifestyle and a Demonstration Area of Low-carbon International Cooperation; it seeks to be a national comprehensive pilot site for low-carbon development. Pingdi International Low Carbon City has entered the stage of comprehensive construction.

Shenzhen International Low Carbon City is located in a place with a good ecological environment, but relatively backward economic development, where the urban construction was quite coarse and the infrastructure foundation was weak. Shenzhen International Low Carbon City seeks to explore the leap-type low-carbon development mode for the late-developing regions of the city. It promotes the integrated construction of industries and the city with multi-rule coordinating means; it leads industrial upgrade and transformation toward a low-carbon development direction, and employs a mechanism and system in which domestic and international resource innovations are marketized, finding the path and piloting for the new urbanization and low-carbon and green development of the nation.

In the process of construction, Shenzhen International Low Carbon City abandoned the idea of large-scale demolition and construction; instead, it chose to respect the existing conditions and make magic out of it. The Low Carbon City actively carried out local ecological diagnosis, conducted comprehensive carbon verification of existing enterprises, and compiled a low carbon city indicator system to control the carbon indicators of land auction, project access and development in the Low Carbon City. It also established a public platform for carbon emission monitoring to monitor, manage, supervise and evaluate carbon emissions of enterprises; it created a community sharing model and is exploring the sharing mode of public facilities in communities, campuses and parks.

In 2014, Shenzhen International Low Carbon City became one of the top ten examples of new urbanization in the country, and won the “2014 Sustainable Development Planning Project Award” jointly sponsored by China Centre for International Economic Exchange and the American Paulson Institute. It is the only project in China which has won this award. The advantages of its low-carbon development model, as well as its reproducibility and transferability are highly recognized by the planning experts of the low-carbon eco-city (district). In 2015, Shenzhen International Low Carbon City was selected as one of the first batch of national Low Carbon City (town) pilots and ranked first among the eight pilots.

Since the launch of the Shenzhen International Low Carbon City, the total output value of Pingdi Sub-district, where the Low Carbon City is located, increased from 6.545 billion yuan in 2013 to 10.925 billion yuan in 2017, with an average annual growth of 11.3 percent; the total industrial output value

increased from 18.237 billion yuan in 2013 to 32.743 billion yuan in 2017, with an average annual growth of 9.4 percent; and the unit GDP carbon emission intensity dropped by 12.67 percent. In fact, since the implementation of the International Low Carbon City, Pingdi Sub-district has not suffered from economic decline due to low carbon city construction and industrial transformation; on the contrary, its economic has achieved steady growth.

The first Low Carbon City Forum was held here from June 17th to 18th, 2013. Up to now, it has been successfully held for 6 years and has generated great repercussions, both at home and abroad. Over 6,000 guests from more than 50 countries and regions attended the forums. The very first carbon market of China was born here; the “Blue Sky Award” for Global Leading Technology in Renewable Energy supervised by United Nations Industrial Development Organization was launched here; and the national low carbon technology fair takes place here. The Low Carbon City Forum has become an important window to showcase the effectiveness of China’s efforts to address climate change. It has also become an important platform for exploring the frontier topics in the global low-carbon field, sharing wisdom and developing pragmatic cooperation.

Industrial policy guidance Based on the national industrial restructuring guidance catalogue and local development realities, Shenzhen formulated industrial structure adjustment and optimization and an industrial guidance catalogue, and scientifically defined highly polluting industries and high environmental hazard product standards in terms of energy consumption, emissions, quality and safety. For example, due to its water resource scarcity, Shenzhen established water withdrawal per ten thousand yuan of GDP as a core index of the industrial guidance catalogue; and requested no more than 4m³ of water consumption for every ten thousand yuan of output increase for the communication equipment, computer and other electronic equipment manufacturing industries in their industrial access requirements. Bao’an District has forbidden new projects of high energy consumption, high emission and high pollution, such as chemical engineering, printing and dyeing, electroplating and circuit boards; new enterprises must adopt non-toxic and low-pollution raw materials, and advanced production processes to replace highly toxic materials and backward production processes, thus realizing the efficient utilization and recycling of resources. Since 2008, Shenzhen implemented the management authority linkage mechanism of newly approved projects and the system of project approval accountability, by enhancing the approval and filing of

fixed asset investment projects.

Employ the market price leverage

Enterprises with high energy consumption, high pollution and high emissions are normally very sensitive to the cost input due to their low profits. Shenzhen used the price leverage effects of water, electricity, gas and minimum wage to gradually increase the operating cost of low-end enterprises, and drive those low-end enterprises out of the market using the “invisible hand”. The city carried out comprehensive investigation and screening for elimination and restricted enterprises in the high energy consumption industries; it published the names of these enterprises; implemented dynamic management and strictly implemented the differentiated water, electricity and gas prices. Shenzhen implemented the non-household plan-exceeding and quota-exceeding cumulative price-raise measures for enterprises with energy consumption exceeding the existing unit product energy consumption (power consumption); intensified the charges to increase the pollutant discharge fees. Shenzhen was the first city to establish a water price mechanism reflecting the scarcity of water resources in the country; it adopted a linked adjustment mode of raw water and tap water prices and constantly optimized the price relationship between raw water,

tap water and recycled water. In addition, Shenzhen's minimum wage was increased from 1,000 yuan in 2009 to 2,030 yuan in 2015, achieving "doubling every 7 years"; it continued to maintain the highest level in the entire country. Shenzhen improved the labour cost of labour-intensive enterprises, to force enterprises with low added value to transform. By guiding the low-end manufacturing links to migrate to the outside of the city in an orderly manner, Shenzhen cancelled, revoked and cleaned out over 100,000 low-end enterprises, making precious room for the development of emerging industries and high-end industries.

Employ the incentive role of financial credit

Green Credit is a new credit policy introduced by the Ministry of Environmental Protection, the People's Bank of China and the China Banking Regulatory Commission to curb the blind expansion of high-energy and high-pollution industries. The core is to control credit for enterprises and projects which violate the industrial and environmental policies; the enterprise's environmental protection is taken as one of the necessary conditions for the approval of loans by commercial banks, so the role of finance in promoting environmental protection will be exerted. Through the establishment and improvement of policies and measures of green finance, Shenzhen has strictly controlled the support of bank funds for backward industries, and accelerated the elimination of "two highs and one low" industries.

Shenzhen's environmental protection administration cooperated with the financial system and signed the enterprise environmental protection information provision and information search service agreement, which incorporated the information of enterprises violating the environmental protection laws into the database of basic enterprise credit information of the financial institutions. Financial institutions will stop providing loans to violating enterprises until rectifications are carried out. According to incomplete statistics, Shenzhen stopped providing 5 billion yuan of loans to over 100 enterprises violating the environmental protection laws, and effectively fought environmental protection violations. According to

the *Key Pollution Enterprise Environmental Protection Credit Management Measures of Shenzhen* issued by Shenzhen's government, the city will carry out environmental protection credit evaluation of high pollution enterprises and key, high-volume pollutant discharge enterprises in the electroplating, circuit board and printing and dyeing industries. In 2012, there were 159 green card enterprises among the 760 key pollution enterprises, and the numbers of blue card, yellow card and red card enterprises were 420, 141 and 40, respectively. For red card enterprises, in addition to ordering the enterprise to make rectifications within a limited time, the environmental protection administration may close down the enterprises, refuse to issue subsidies of the special fund for environmental protection or recommend the cooperating banks of Green Credit stop providing loans to such enterprises. The relevant measures of the environmental protection administration significantly incentivized the upstream and downstream enterprises of the industry chain to improve their process and design, which raised their environmental protection standards.

Promote the upgrading and transformation of traditional enterprises via technical transformation

Promoting industrial transformation and upgrading doesn't necessarily mean that traditional industries are to be exterminated; Shenzhen pays equal attention to the green and low-carbon development of traditional industries during its promotion of industrial upgrading and transformation, aiming to raise the scale and benefits of traditional industries to new heights. Taking the fashion consumption industry as an example, Shenzhen adheres to the "three quality" principles of quality brand, quality enterprise and quality product. It has endowed unique cultural values to traditional clothing, gold, jewellery, glass and furniture industries with brand construction as the core and industrial design as the guidance. By doing so, it has enhanced the creativity and design capability of industries, improved the added values of products and constantly promoted the transformation of the traditional advanced industries into fashion consumption industries. After the transformation, more than 70 percent of

the enterprises spend over 5 percent of their sales revenues on R&D; and there emerged one world famous brand, 41 famous brands in China and 30 famous brands in Guangdong. Shenzhen's gold and jewellery industry includes 46 percent of the famous national gold and jewellery brands, while its domestic market share of women's fashions has reached 60 percent.

Technical transformation is an investment activity of enterprises using new technologies, new processes, new equipment, new materials and new design to transform and improve the existing facilities and process conditions to realize connotation development; it is an important approach to realize energy-saving and emission reduction. For a long time, Shenzhen's traditional industries such as furniture and watches have adopted a rather coarse development mode; their products lack technical contents and they have a low technical standard, making them quite sensitive to external environmental changes and vulnerable to the ever-fiercer market competition. Shenzhen provides support for more than 100 technical transformation projects of enterprises every year, and accelerates the urban industrial transformation of gold, clothing and watch industries and the digital equipment transformation of mechanical moulds.

According to incomplete statistics, Shenzhen has invested more than 20 billion yuan in upgrading and transformation in 5 years and has attracted over 300 billion yuan of social investment via financial funds or interest subsidies. On the other hand, Shenzhen introduced the concept of clean production into the construction process of the industrial cluster base and industrial belt; it strongly promoted the clustering development of traditional industries such as building materials, electroplating, household appliances, jewellery, printing and dyeing and watchmaking. Shenzhen upgraded and transformed 18 old industrial zones and established 16 characteristic industrial parks, including industrial design and automobile electronics. Shenzhen implemented mandatory clean production review of enterprises with pollutant emissions exceeding the national, provincial or municipal emission standard or exceeding the rated total control index of pollutant emission, and used the clean production review as one of the constraining conditions for settlement, expansion, relocation and eligibility for preferential policies as well as control of the consumption of resources and energies throughout the full life-cycle of products to lower their carbon emissions.

Chapter 7

Culture and Modern Story

Lawrence Scott Davis and Catherine Kong

A Cultural Desert? What Is Culture?

Although years ago, a notion was sometimes popularly expressed that Shenzhen was a “cultural desert,” by now this view has been soundly silenced by a spate of cultural activities that give the lie to such a pronouncement. Perhaps that earlier criticism stemmed from regional rivalries, or efforts to magnify Hong Kong’s rich cultural tradition and squelch Shenzhen; but whatever the background, currently Shenzhen offers abundant cultural resources with museums, theatres, concert halls with symphony orchestras, a complex, integrated library system, as well as art galleries and art spaces. These cultural institutions are not simply for the edification and enjoyment of city residents. Tourism is a vital, booming industry.²⁰⁵ Shenzhen boasts the world’s largest theme parks, managed by a state-owned enterprise (SOE), Overseas China Town Enterprises (OCT), among other things, presenting to the world the traditions of China and Chinese folk villages. In designing such cultural displays, the emphasis is upon selecting what is unique, invaluable and praiseworthy about Chinese life.

The enterprises of cultural creation and tourism can point to intense activity in the municipality to defend its assumption of culture. For example, there

are many venues for symphonic music, such as the Shenzhen Culture Hall with its Shenzhen Symphony Orchestra,²⁰⁶ and the Shenzhen Grand Theatre,²⁰⁷ home to the Shenzhen Grand Theatre Philharmonic Orchestra. Naturally, there are also venues for local high culture, such as performances by the Shenzhen Cantonese Opera Group.

Shenzhen calls itself the “City of Libraries”: a network of libraries and resources initiated by Shenzhen Library:

“A City of Library” is a visualized concept of constructing a borderless library network in Shenzhen; based on libraries and digital networks, it consolidates all the library and information system, and build [sic] Shenzhen into a literature and information resources sharing network that covers the entire city and facilitates all the citizens, realizing the hybrid library services that spread all over, interconnect, share recourses [sic], offer comprehensive and convenient library services so as to provide rich information resource, support life-long education and enrich cultural life.

Over the past decade, due to the construction of “A City of Library,” public libraries in Shenzhen have made great achievements in the library scale, system structure and service benefit, thus gradually

creating a library service network with advanced ideas, rich resources, advanced facilities, convenient services and interconnection function.²⁰⁸

Prominent among the library sites are the Futian, Nanshan, Bao'an and Luohu District Libraries, Library of the Shenzhen Cultural Creativity Park, and the Branch Library at Xin'an Sub district. "By the end of 2016, Shenzhen [...] constructed 627 public libraries of various levels, including 3 city-level public libraries, 8 district-level public libraries, 616 street-level and grass-root libraries, and 240 Urban Neighbourhood Self-Service Libraries, [so] the total collection in all public libraries in Shenzhen is over 28,000,000 items."²⁰⁹

Museums abound in Shenzhen, including the Shenzhen Museum, the Museum of Contemporary Art and Planning, the Shenzhen Art Museum, the Shenzhen Stone Art Museum, the Shenzhen Paleontological Museum, the Shenzhen Industrial Museum, the Shenzhen Piano Museum, Museum of Contemporary Art, the newly constructed Shenzhen Literature and Art Centre, the Shenzhen Chinese Chess Museum and the Sino-British Street History Museum. Exhibition Halls of both Shenzhen Police and Customs provide venues for presentation of interesting topical material, as does the Exhibition Hall of the Financial Expo Centre. The Xiasha Library displays fine art, and other venues within the OCAT Museums include the OCT Art and Design Gallery, the He Xiangning Art Museum (in OCT), as well as other facilities such as Yachang Art Museum, Guan Shanyue Art Museum and the Yinger Gallery for fashion. For visual art, one cannot forget Dafen Village (including the Dafen Museum), where, at one time 60% of the oil on canvas paintings in the world were created by migrant art workers on the factory floor ("the world's largest production centre for hand painted art, China's model art industry, and the Western retailer's best source for oil reproductions of Western masterpieces"²¹⁰).

The museums, such as the Hakka Culture Museum, shade into entertainment and the exotic theme park offerings, such as OCT's Window of the World, Shenzhen Happy Valley, and Splendid China

Folk Culture Village. The state, through OCT, is a prominent player in repackaging Shenzhen culture and presenting it for tourist purposes from their point of view.

Because the present chapter is concerned with the topic of Shenzhen culture and modern history, the desultory survey of cultural facilities serves to set the problem for the discussion here, by outlining some of the high cultural activities that are often associated with the term "culture." It is of course a matter of great civic pride for residents of Shenzhen that the city boasts architectural monuments, museums and other public buildings that are modern, functional, green and eye-catching. However, the focus of the present chapter is on the culture of Shenzhen, from an ethnographic perspective, and for that reason, we must be clear about our approach to this term "culture" and its technical uses in human studies for the aim of social analysis.

The purpose of this chapter is to examine Shenzhen culture, but it must be stated at once that the technical term "culture" in social analysis has an inexorable ambiguity, usually merging "high culture" (*Bildung*), as in the above examples, with the study of the symbolic matrix that is learned, shared and transmitted from one generation to the next, which dominates our classification and cognition, accompanying human actions, both driving and under modification by them. In this study, it will be the latter view of culture that has the primary claim to our attention. We are really trying to understand the typical experience of being in Shenzhen and certain ways the circumstances of the place lend coherence to the different modes of active cognition that take place within the spaces urban life produces.

Our notion of "culture" is more akin to language than to museums. For instance, in Shenzhen, although the publicly used languages fifty years ago were Cantonese and Hakka, presently Mandarin dominates, since millions of people have flooded into the area from all over China and must use *putong hua* (lit. "common language") to conduct their lives. This fact alone marks off Shenzhen as a great milestone in Chinese history, overcoming strong local



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and particularistic tendencies and building a broader cosmopolitan linguistic environment. Culture, like language, is the symbolic medium of daily human existence, and we are interested in achieving some further clarity regarding the questions of how human action, such as planning and governance, take place in this medium, and how it achieves the outcomes that it has produced there so far.

In the case of a municipality like Shenzhen, we must not overlook an important feature, namely that—having been established by fiat of central government planning—its creation and existence in the world are simultaneously a fact of economic planning and an aspiration towards an imagined, rational city. Although we can recognize that the role of contingencies in its outset and set-up makes the city unique and inimitable, in dealing with discourse about the events and outcomes of Shenzhen development as a mode of narrative, the lessons to be learned from it apply to broader and more abstract understanding of culture: that is, the ways that narrative rationality is produced from the contingencies of circumstances in China are edifying and well worth deeper consideration, in order to clarify our understanding of China, as well as what it means to be human and to plan and act intentionally in the world.

In the following pages of this chapter, we will study the topologies of transformation associated with Shenzhen and suggest that the great changes of this city in the past forty years have transformed but not obviated Chinese culture. The cultural modalities and narrative features we find in our analysis have unquestionable cognates in earlier social assemblages.

From its narratological procedures, we are able to recognize that the story of Shenzhen is not simply the triumphal successes accruing to the brilliance (and luck) of its planners, but something rather more complicated. Let us instead agree with the penetrating characterization that (given the heroic efforts of establishing doubled SEZ borders that would serve as “technologies of differentiation”) “these attempts consciously enact their own failure, thereby allowing for proliferation of gradations of the licit and the illicit.”²¹¹ This statement of the mode of state operation has some corollary features based on a duality in the nature of the project: as both economic planning and construction of an imaginary Shenzhen are both an invention and a discovery, both an experiment and a model. There are various, characteristic patterns of rhetoric that integrate these two aspects, as we will see.

The story of Shenzhen is one of leeway and risk: in the attempt to turn itself inside out, openings occurred and transformations actualized. In the traces of these events we can discern some lessons about narrative and culture.

Turned Inside Out

The purpose of establishing this special economic zone (SEZ) was expressly to change Chinese lifeways throughout the nation: that is, by designating a highly peripheral area on the south coast of China to carry out global functions in manufacturing and trade flows, a qualitative alteration (not simply quantitative enrichment) of the internal organization of China would be accomplished. For example, as it is presented in the Shenzhen Museum, “Not only is Shenzhen seen as the epitome of China’s history, but also of China’s future.”²¹² This striking configuration of external and internal, local and global, should be examined in the context of Chinese sociocultural history.

The story of Shenzhen, the first SEZ, therefore comprises a series of firsts for China: for example, the first real estate company in China (after the leadership of Mao) was founded in January, 1980—the Shenzhen Special Economic Zone Real Estate Company. In 1987, Shenzhen was the first city in China to auction public land for possible use for private purposes; and China’s first land management bureau (*tudi zheng beiju*) was established in Shenzhen.²¹³ Shenzhen was the first city in China, indeed the first city in the world, to use electric powered public buses for 100% of its fleet, in 2017. Put in simplistic terms, the global successes of the SEZ would translate back into improvements in the lives of China’s people, and the 1980s and 1990s were key preparatory periods laying the groundwork domestically for these developments. By altering national governance patterns issued by the centre of power, and inserting this peripheral region into global investment, trade and other economic flows, reconstituting Shenzhen as a new centre of world-wide high-tech manufacturing and exchange, one aim was to transform China inwardly and produce a new Chinese society.

The very notion of the “special economic zone” carries rhetorical effects, because by choosing this term, China differentiated the SEZs from export processing zones as established in other parts of East Asia; unlike the capitalists, these Chinese zones were attracting investment and using their export policies as economic tools for internal reform of their society.²¹⁴ Once this project got underway, “because there was no functioning government in place, that first generation of Shenzhen leaders had leeway with respect to governmental institutions and procedures that they had established, including higher levels of subordinate independence and decision-making authority than were institutionalized elsewhere in the country.”²¹⁵ This circumstance marks the singularity where the Shenzhen SEZ was born. Now we can examine some of the details in the process by which this grand inversion was accomplished.

Along with the age-old spatial administration hierarchy, the dual track model in PRC governance—the urban/rural dimension of land tenure—must serve as the framework for this discussion.²¹⁶ These distinctions provide the coordinate axes for the key urban/rural and industrial/agricultural classifications in Chinese society. In a highly characteristic gesture of Chinese formal thinking, China proclaimed a “one country, two systems” approach to governance. Urban residents were provided a lifetime of employment and full benefits, while rural residents, seen as self-reliant, self-improving and entrepreneurial, were treated unequally and tended to be left to rely upon themselves, peacefully in their collectives. Describing the land tenure policy roughly, urban land allotment limits periods of individual use, up to 70 years, whereas rural land is basically in collective possession permanently; it must be returned to the state and become state land before it can be developed legally. The *hukou* (household registry) conundrum, mentioned below, must also be understood within this dual structure framework.

Accordingly, there is a double torsion evident in Shenzhen’s development: a perfect example of decentring/recentring,²¹⁷ although domestically it had been an extremely peripheral zone of rural Cantonese or Hakka cultures, after the singularity of its inception, it subsequently turned into a global centre

of manufacturing and trade. The economic fervour of investment thus necessarily attracted a massive inflow of migration from other peripheral areas of the country; the migrant workers were needed not only for factory manufacturing but also to build up the very infrastructure of the new city. Although the earliest efforts kept workers in rural villages, employed in town and village enterprises (TVE) nearer home, as the pace of migration picked up to respond to economic opportunities, it meant many millions of people had left their legal households behind and were in various metropolises, including and particularly Shenzhen, without suitable household registration documents.

Meanwhile, however, hundreds of small villages that pre-dated the SEZ (the peripheral city that had been artificially established in doubled boundaries by the national political centre) retained their rural designation and collective land-holding provisions under the classification of the dual structure system. Generally speaking, “the difference between rural and urban property rights has been the foundation for post-Mao reforms, first in Shenzhen and then throughout the country. Moreover, the contradiction between the fact that villages no longer have legal status in Shenzhen and their traditional claims to land rights and social status [...] has constituted a serious political challenge for Shenzhen officials.”²¹⁸ Even with new laws promulgated in the 1990s to eliminate their rural status, these “villages inside the city” (*cheng zhong cun*) continued to be under the control, not of urban individuals with limited use tenures, but of the original clans or other collectives of the villages, who were now shareholders in joint ownership stock companies that administered those villages, built and developed the areas (they were the de facto developers, but their development work was not recognized de jure), and accordingly paid out monthly dividends and other benefits for their original village constituents. Thus, their existence as internal surds (“black holes”, “vacuums of state power” or “blind spots”) in the system was paralleled by the massive influx of labourers who migrated without proper household registration and live a shadow life in these anomalous “villages inside the city.”

In this way, the former farmers became city landlords for the migrants, and instead of farming

fields *geng tian* 耕田, they turned to “farming high-rises” *geng lou* 耕楼,²¹⁹ and the massive influx of migrant workers was provided shelter and even protection by the “rural landlords.” Through this precarious balance of forbidden, yet unenforced, behaviour (“necessary but illegal”²²⁰), rural Chinese clan structures “asserting a pre-revolutionary social identity,”⁹ and other collectives, suddenly pertained to large-scale urban processes. Undocumented migrants from all over China became the annulled and disliked, yet absolutely indispensable labour force—but as tenants under the protection of the new, originally rural, now urban landlords, as China turned itself inside-out in its globalization efforts. Often compared to “cancer,” “malignant tumour of urban development,” “impediments to ‘normal’ (*zhengchang*) urbanization,”²²¹ “eyesore” or “obstacle,” the “rural” villages inside the city became the target of strong opprobrium from immediately outside (not unrelated to the jealousy of others at their sudden good fortune, as well as the frustration of officials who wanted them gone), as areas of chaos and danger to modernizing civilization. Though in the core of the city and absolutely essential to the economy, they are still extremely marginalized. In the eyes of state officials, they have become a “problem”.

Traditional Tensions and their Transformations

As Cartier¹¹ has quite correctly stated, the basic spatial hierarchies relied upon to govern China have not changed throughout millennia, and it is quite feasible to compare traditional and contemporary phenomena in certain structural respects, although the business of governing has changed greatly. “Both dynamic and resilient, the spatial administrative hierarchy is the institutional heart of the historic Chinese empire and modern state.”²²² For this we will need a simplified, schematic account that brings out the topologies of these processes.

It’s important to know that the basis of legitimacy in early Chinese civilization was the relation of the king to his ancestors, as Vandermeersch²²³ thoroughly

demonstrated; step by step, in a millennial process of “democratization,” more and more subjects could memorialize ancestors, so that within the last 500 or so years, the ancestral apparatus was in place throughout China. The family, from the top family down, extruded out over the political domain; political and family organizations were thoroughly imbricated and indeed, the nearly autonomous local clan regimes were like gyroscopes for social order, that the emperor, due to the size and complexity of the empire, could only maintain in a very sparse and conservative way. The centre merely tried to ameliorate disturbances that would lead to enduring local centres of power, bringing chaos, the dynastic cycle’s downward side (this cycle is the temporalization of the torsion in the spatial arrangements we are discussing). The emperor feared the emergence of local power (the growth of powerful local families who offered protection to weaker families who served them), so much that, through the brilliant rule of rotation in civil service, he willingly sacrificed the bureaucratic effectiveness of his magisterial delegates to avoid their developing the key personal relationships at home and thus expanding their influence in their place of origin. The routine assignment of bureaucratic officials to unfamiliar territories put them at a serious disadvantage in achieving any real oversight over their regions. In return, through phenomena such as “full in the middle” (*zhong bao* 中饱), structural corruption occurred in the system so that magistrates could maintain a certain flexible range of misrepresentation vis-à-vis the centre in terms of the return of tax revenue, etc., which worked to their relative advantage. The lack of effectiveness of the magistrates due to the diversity of unfamiliar languages (or if you will, “topolects”²²⁴) and the local customs they faced in their jobs, away from their home regions, was compensated by the near autonomy of the lineage leaders who saw to the collective welfare and ordinary social function at the local level, and in this way acted as gyroscopes for the stability of the state. The key to understanding the structure of governance in traditional China is well summarized in the saying: “The sky is high and the emperor is far away” (*tian gao Huangdi yuan* 天高皇帝远; also *shan gao Huangdi yuan* 山高皇帝远,

“mountains are high and the emperor is far away”).

These schematic features of traditional China have been displaced by the advent of the PRC, of course. Modern China does not insist on the rule of rotation. However, in what has been reviewed, one can see there continue to be characteristic gaps and tensions in the system between top and bottom, centre and periphery. They are played out in what is often described as a “dance.” In Shenzhen, moreover, the relations between the clans and collective leaders of the “villages inside the city” and the city government officials are similarly described as a game of *weiqi* 围棋 (a.k.a. *Go*).²²⁵

Of course, the leaders of the “villages inside the city” often found ways to maximize their groups’ sudden prosperity.

[...] once local villagers realized the discrepancy between the compensation price for expropriated land and the value that land had on the newly instituted property market, they decided to make the most of the land that remained in their hands and develop it with respect to market prices. If any remaining policies continued to restrict their development, they simply ignored them, proceeding to develop their land according to market demands, which in turn led to increasing density and economic vitality.²²⁶

Over decades, state government issued municipal building codes that urban villages deliberately and flagrantly ignored; due to the notion that “law will not punish the masses” 法不責眾 and precedent of action by fiat 既定現實, only a long waiting game will resolve such problems.²²⁷ With some of the densest population concentration on earth (according to 2007 statistics, more than half of the 13 million Shenzhen residents lived in urban villages, giving a population density, as estimated by Huang Weiwen, of 70,000 per square kilometre²²⁸), the substandard housing and environment, heavily criticized by the state for its dangerous influence on the people’s lives, was of course an earnest response to a real situation. “In the new SEZ, China suddenly confronted two forms of excess that could not be

contained or disciplined within the state apparatus: global capital [...] and the villages, whose suddenly anomalous existence became the exception to the exception."²²⁹ In this confrontation with a new reality, we can see what popular resistance looks like in China.

Examining the track record from the administrators' position, we remark:

Successive iterations of the Shenzhen Comprehensive Urban Plan ignored both local rural areas [...] and rural migrants without Shenzhen *hukou*. In fact, the 1982 and 1986 comprehensive plans only addressed the territory within the SEZ and excluded the village settlements [...] within it, because these areas were designated as "rural". This discrepancy between proscriptive planning and the actual population settlement made it difficult (if not impossible) to design and implement a plan for the entire city, because the data only represented a small percentage of the population and total area of the city.²³⁰

Although official estimates at the time called for around 4 million migrant workers, according to 2000 census data, in Shenzhen Municipality, there were 2.56 million migrant workers within the SEZ and 7.04 million in outer districts.²³¹ This is what is known as "Shenzhen's secret of success"—state and municipal planning called for implementing various policies, but without providing for housing for the required labour. In this way it was possible to "build the city at no cost."²³² One cannot avoid the conclusion that "the location of the villages supplemented what the urban plans had clearly overlooked: sufficient housing for low-income workers and recent arrivals."²³³ "The central government's abstract planning on a map and the aerial overview surveys had neglected to take the local people into consideration."²³⁴ This state of affairs presents a real challenge to our understanding of administrative procedures in China. We get the impression that, in view of these unintended consequences, "socialist management was always more 'ad hoc' than Western observers imagine it to have been, and that the urban villages are recombinant adaptations that

express an older Chinese concept of 'cities within a city' in modern form."²³⁵ What was the administrators' awareness of the situation and how exactly did they proceed with such ad hoc policies?²³⁶ And yet we recall that traditionally, bureaucratic officials worked in an already-compromised situation due to the rule of rotation, and for various reasons they always made do with very crude estimates for the actual conditions in the villages. This sort of state oversight is not unusual in the history of China. One must remember that the vital legislation regarding Shenzhen was economic, which is why the status of the rural collectives did not even come up as a problem during early planning. In the meantime, "[t]he urbanized village enclaves [...] developed independently without municipal administration, such as planning, design and building approval, quality control, property registration, or any other regulatory procedure."²³⁷ As a result, the inconsistencies between the economic plan and the social model were not at the forefront of deliberations then. It was an honest mistake.

In as much as urban villages—these vitally important components of Shenzhen—are managed by collectives such as clan leaders (now joint-stock owning corporate groups), part of the culture of the area continues to be centred on clan and ancestral observations, which, as mentioned above, are the core of Chinese civilization. At the birth of the SEZ, in these villages, "the integration of brigades and teams had not been complete and members continued to identify with traditional village identities."²³⁸ Most of these villages maintain ancestral halls (*ci tang*). Accordingly, the heritage of festivals such as the Poon choi 盆菜 ceremony before Chinese New Year, sustains the ancestral orientation, and includes much broader social functions outside the clan.²³⁹ Part of a traditional complex of festivities associated with the ancient and supreme Jiao 醮 ceremony of Daoist liturgy, held to cleanse and renew the world at the end of a sexagesimal calendar cycle, the Poon choi ceremonies are a derived series of ritual activities that function to unify disparate memberships in a clan. They are held at the shrines of the communal ancestral halls of each clan, and are used for integrating new members into the corporate

group, such as welcoming a new bride or solemnly receiving new male babies born before the New Year. During the Chinese New Year, the Poon choi rites in Shenzhen are held on a large scale in various urban villages, the feasting often lasting throughout the day. “Poon” (Mandarin, *pen* 盆) means a cooking vessel; all the ingredients are cooked together in one huge pot and should be served in pots to tables of ten guests each. In this way, the symbolism of the ritual pertains to unity and harmonious integration of disparate members, so its large-scale celebration indicates the thriving life of the relevant clans and their vital position in the communities. Such ritual activities are not simply decorative, nor are they merely pro forma entertainment; in an almost magical way, they trigger the social cohesion that they express. Metaphors of cooking and social harmony are systematically elaborated in Chinese classical tradition, for example, in year 522 B.C.E. of the ancient text *Zuo zhuan* (Chronicle tradition of Mr. Zuo). There is a massive and ancient heritage of careful Chinese thought about cooking, ritual and social integration, and it is alive in Chinese culture and in the clan rituals.

Let us pause and consider that Chinatowns have flourished centrifugally around the world paradoxically due to the strong centripetal family and local ties that link the immigrants to their ancestral groups; even from remote locations around the globe, members of the clans continue to support their home villages financially, spiritually and in other ways. In particular, the south and southeast coasts of China have seen many people relocate abroad over recent centuries, still able to preserve that awesome sense of particularistic social cohesion of the clans. It must be concluded that the phenomenon of “villages inside the city,” although widely prevalent throughout China, is most acute in southern China, in places like Shenzhen, where (unlike in the north) the clans continue as large corporate groups and often are coterminous with the villages of their residence (clan villages). It is for just this reason that these urban villages are a strong, special feature of Shenzhen culture, whereas elsewhere they are of somewhat lessened significance. The awkwardness of the “villages

inside the city” in Shenzhen is particularly due to the strength of traditional family organization in the south of China.

Furthermore, on the southern coast of China, as elsewhere, clan connections are also still important in longstanding international networks, such as through Hong Kong and outwards to the world; ports on these coasts have been major exporting platforms for many centuries. Presently, the widespread covert manufacturing and smuggling of fentanyl from this region is likely to involve such groups operating in “grey” areas in the region. In the 21st century, the state has identified these “villages inside the city” as a kind of no man’s land (“chaos”: *san bu guan* 三不管 lit. “three beyond administration) of prostitution, gambling and drugs—it signifies the absence of the state in general. The state “began a process of ex post facto criminalization” and programmatically accused the urban villages of harbouring illegal migrants, diverting infrastructure, building substandard housing, creating ‘black schools’ for their children, and so forth.²⁴⁰

In Shenzhen, these collectively organized “villages inside the city” are described by one and all as a “grey,” nonlinear area that is out of bounds and cannot be handled by a linear series of straightforward applications of state law. Some officials point out that “tolerance” is a feature of Chinese governance, and it is true that this virtue entails a long, protracted treatment that will be necessary before the “problem” is resolved. Nevertheless, let us just note that this way of functioning in a “grey” area, where the village leaders provide protection to the increasingly dispossessed peasants, is one classic sign of downturn in the dynastic cycle. Although totally hypothetical, this cannot have failed to come to the attention of the pertinent officials. And yet, judging from interview data during a visit in November of last year, the state response in Shenzhen is currently relatively languid and irenic, calling for a long-term process of resolution (both state and village leaders emphasize the positive aspects of their extraordinary cooperative administration). Some state that, at least until 2025, Shenzhen will certainly continue to feature urban villages in the cityscape. It

is obviously impossible for the overwhelming power of the state to be used in a naked display of force to take over the villages and drive out the collective leaders. The outcome must be more nuanced and civilized. For this reason, other views see roles for urban villages long into the future, requiring two or three generations of mediation.²⁴¹ In any event, the municipal government posits a remedial role for itself in resolving the situation:

Creating “neighbourhoods” based on social relations, rather than villages based on “blood relations” is the goal, as one official put it to me. Emphasizing that this was not government policy, he sketched the outline of an internal debate about how to allow the villagers to maintain their quality of life in an urban environment as an alternative to removing the villagers by buying out and tearing down. The trick is to enlist, co-opt, and otherwise engage the villagers in the process of “renovation” of the villages, such that, as this official put it, they “come in peasants but leave citizens.”²⁴²

Nonetheless, in this classic statement of age-old governing strategies in China, it is clear that all things pertinent to the villages inside the city are viewed as “problems,” and the solution is to “reform the villages inside the city” (*cheng zhong cun gai zao*). For example, although Shenzhen boasts enlightened policies regarding *hukou* (household registry) and educating the migrant children, the basic pedagogy is defined as a response to a problem (problems facing the migrant families in raising and educating children), and in this case, it is solved with pronounced emphasis on nationalistic themes.²⁴³ Generally, it can be seen that with such reformist policies the state “seeks to undo [...] thousands of years of village social relations.”²⁴⁴ This is really at the heart of the confrontation we are reviewing here. A millennial practice of benevolent neglect, with occasional co-optation and engagement, of the typically autonomous local villages throughout China was sufficient for the state to get by and often flourish; now, the topological transformations have compressed the players and their slots into one extraordinary municipal region, and the contrasts are very stark. In this configuration, it is now the

rural villager who gets “full in the middle” with regard to the hapless officials. It is likely that both sides stand to learn certain lessons from this microcosm that may guide them in the future into a very different China from the traditional one.

Let us reiterate the important points just reviewed here, and try to articulate a more adequately synthetic conceptualization of them. There was a massive oversight concerning the housing arrangements for the migrant labourers who flooded into Shenzhen.

From 1987 on, the population holding Shenzhen temporary household registration certificates outnumbered the permanent population by 51.8 percent, and by 1994, this proportion of temporary population had reached 72 percent. In 2004, out of a total population for Shenzhen of 5,975,000, 4,324,200 were holding a temporary registration.²⁴⁵

This fact indicates to us that, “By the time that Shenzhen Municipality had elevated New Bao’an County to Bao’an and Long gang Districts in 1990, local collectives had emerged as the de facto urban planners outside the SEZ.”²⁴⁶

As the migrant labourers were a new and not adequately analysed phenomenon, this circumstance could be handled only as a grey area and their housing was taken care of *sub rosa*, in a substandard way, by the urban village enclaves. As an official closely involved in the early stages of Shenzhen’s establishment reflected, the initial design strategies created enclaves of various types for further development, but “this top-down model of delineating circles for independent planning and development was at odds with Shenzhen’s actual population and infrastructure needs.”²⁴⁷ The same official also writes that “over time it became apparent that the relative independence of all these enclaves negated the effectiveness of an overall urban plan for the city”²⁴⁸ resulting in difficulties in traffic and maintaining networks of open intercommunication between enclaves. This point needs to be expanded, as it is a key to the problem of a modern Shenzhen.

There is no doubt that the strong Chinese



Shenzhen International Cultural Industries Fair @SZAICE

preference for clan-analogous enclosed institutions of condominium²⁴⁹ also manifests in its opposite modality, in peculiarities in open social behaviour, where, in spite of frequent calls to return to behavioural norms suitable to clan villages (respect the aged, yield your seat, turn in lost items, “we’re the land of ceremonial propriety 禮儀之邦”), public behaviour is really marred by lack of civil cooperation, low public trust, rudeness or indifference to others, and often crippling traffic manoeuvres. Shenzhen has made sure that the resident pedestrians cross major streets only by sanctioned routes, and not jay-walking, by erecting formidable physical barriers in strategic places everywhere to prevent traffic chaos. Really, the talk of making “citizens” is disingenuous, as we see here and will re-examine later. A civil society is where people maintain a space of mutual respect based on common belonging to the society which they refrain from disrupting as an expression of *personal responsibility* for its maintenance. Such social behaviour does not prevail on the streets of China.

To wrap up this review of the “villages inside the city,” let us examine some of the rhetorical devices that occur as the perspectives shift and the story unfolds. The state’s practice of creating SEZs by fiat is an a priori feature of Shenzhen’s topography, but

of course as a parallel gesture, creation of a huge amount of substandard housing was also done by fiat on the part of the urban villages. In this way, the differentiation of de jure and de facto governance also emerged, since the urban villages were the de facto city planners, and though the de jure authority of the state institutions was often appealed to, clearly the municipality relied on the de facto arrangements of the marginalized collectives to maintain a functioning SEZ.

In the awkward failures to provide rational planning, the state continued to use ex post facto rhetorical devices both to justify successes that it claimed, on whatever grounds, for itself; and to construct an ex post facto account of how these inescapable evasions of state power were dangerous and needed to be criminalized. Produced in this kind of confrontation, we might also see resistance on the part of the people. Let us repeat the point: “the de facto reliance of the city on the informal provision of housing and services is less an unintended consequence than part of what one city official told me was ‘Shenzhen’s secret of success’—the implementing of policies without paying for them, or as he phrased it, ‘building the city at no cost.’”²⁵⁰ Built out of nothing, “Shenzhen’s secret of success” was to maintain the narrative of de jure governance, while the de facto narrative

was suppressed and criminalized. Afterwards, in an equally ex post facto way, the many claims to economic success are supposed to signify successful social planning as a model modern city.

Lefebvre can be quoted here to good effect:

But if you have the ability to take the flows and streams (T.V., the press, etc.) as rhythms among others, you avoid the trap of the present that gives itself as presence and seeks the effects of presences. The latter are the facts of both nature and culture, at the same time sensible, affective and moral rather than *imaginary*.

Through a kind of magic, images change what they reach (and claim to reproduce) into things, and presence into simulacra, the present, the this.²⁵¹

It would be important to avoid this trap of the present and the simulacra that advertise themselves ex post facto as the successful outcome of careful planning, such as it was, and to question oneself again and again: what holds together these attempts to change ourselves? How does it really work?

Modern Story

The iconography of modern Shenzhen is striking and familiar. The famous sculpture “Chuang 闯” [Breakthrough] is a titanic figure breaking apart a large frame within which he is standing: looking like Samson in the temple, but here the movement is expansive and emergent, and there seem to be no negative breakdowns or self-sacrificing consequences in the consideration of the aftermath of the break out. It probably means that traditional limitations are to be bravely overcome and the future belongs to those who can liberate themselves from the irrationality of history. A courageous aspiration! Forward!

Similarly, the iconic sculpture “Tuo huang niu 拓荒牛” [Ox clearing the wilderness] shows the massive working capacity of the beast which expends its awesome energy, uprooting the uncivilized

wasteland that lay before it. This sculpture frequently motivates questions concerning the intended reference to the heavy, gnarled tree-stump the ox is pulling up: what in particular is being signified by the useless old thing as the wilderness becomes a world centre of high-tech manufacture and trade?

Without a doubt, the most fundamentally motivating icon of Shenzhen has to be Deng Xiaoping’s planting of a banyan tree, an image memorializing Deng’s visit to Shenzhen in 1992. In this visit to the municipality, Deng affirmed the correctness of the planning for the SEZ, and pushed China towards quickening reforms. Here, rather than uprooting a tree as in the previous sculpture, Deng Xiaoping in his old age was nurturing the growth of something new; the significance of the banyan is its existence as a rhizome (not just a tree) and its way of achieving harmoniously diversified unity through self-differentiation. Like Deng’s wonderful image of crossing the stream by feeling for the stones to show how intentional action works and doesn’t work, the botanical symbol left a profound visual statement about the variegated path to the future in China.

In this section let us try to conceptualize some issues of tradition and modernity in a huge and ancient culture such as China, and briefly scan the social indicators of new patterns of behaviour that we can detect in ordinary life in Shenzhen.

Another symbol of harmonious integration of differences, *poon choi*, is now available upon demand at many restaurants year-round. It is a good example of a secularization process associated with modernizing society; so now, there are clearly two parallel tracks, ritual and secular, but both deriving from ancient holy rites. What other symptoms of these processes, with similar symmetries, can we find from Shenzhen?

A rule of thumb for cultural analysis is that a traditional society gives precedence to age (as a repository of experience and knowledge); while on the contrary, modern societies based on scientific knowledge value the fresh, creative insights of youth.²⁵² In the Euro American traditions, scientific

knowledge, in its self-correcting mode due to the creative contributions of youth, is reflexively applied to social order, in such a way that traditional patterns are steadily abandoned and eroded away, yielding to new visions.²⁵³ East Asia is generally a granular mix of traditional and non-traditional, with all that these terms imply in terms of age structure and symbolic resources.

In this respect, the overwhelming youth of Shenzhen's population, due both to migration and to high-tech job requirements, points towards future cultural dynamics. The median age of population in Shenzhen is 32.5, compared to the overall median age of 37.4 for the rest of China.²⁵⁴ The median age in Hong Kong is 43 (and at this median age a person in Shenzhen is more likely to be employed than the Hong Kong counterpart²⁵⁵). The relatively low age for entrepreneurs is another such indication (five years below the national average²⁵⁶). Under favourable circumstances, a younger society and a science orientation can indeed result in many innovations and increase self-referential modification of its cultural worldview.

As mentioned above, the Mandarinization of the municipality is a great and rare achievement, a powerful expression of, and influence on, its transformative social regime. Accordingly, the city offers more options for making connections that are not based on place of origin relations as in traditional days. Nonetheless, these place of origin ties are still quite strong. For example, for start-up funding, financial dealings among agents of Chaozhou background can be arranged more smoothly due to their particular expertise. However, Shenzhen is such a special city that more and more people identify themselves as belonging to Shenzhen rather than to the respective place of origin. "Get here and you are a Shenzhener!" [来了, 就是深圳人²⁵⁷] Due to the momentum of growth and the awareness of a shared stake in a unique and exciting history, it claims the loyalty of new arrivals and invites heavy commitment. It is like the Poon choi festival discussed above: the different ingredients all cook up together in a big pot.

As discussed above, strong lineage organization is

found in the indigenous population, including clan connections overseas, but otherwise the municipality is oriented towards urban trends, with many young people thriving with their own talented careers. As we see in other chapters of this book, it is a smart city and with enormous connectivity and potential. Although there are only a few consulates (they are in Guangzhou), Shenzhen has 110 NGOs, more than Guangzhou's 83, four times more than Nanjing and nearly as many as in Shanghai.²⁵⁸ Of course, it goes without saying that on the whole, these NGOs function more like GONGOs (government organized non-government organizations), meaning that members of ordinary society are advised to "keep in touch" with the state on a very regular basis—but they are active nonetheless.

Shenzhen therefore, is currently composed of some traditional and some modernizing processes. To get a more detailed analysis of this point, let us now turn back to the "villages inside the city" and examine their futures.

The "villages inside of cities" have never been only for migrant labourers. They provide sensible, low end housing for students, artists and even young workers in the state bureaucracies. As Shenzhen implements its Peacock Plan of special incentives to attract highly skilled foreign workers, migrant labourers may feel even less welcome than before, and the costs of housing will zoom. The outcome of the awkward stalemates we have been reviewing is uncertain, in terms of timing and particular solutions, but there are certain well-established pathways along which the urban villages can be reabsorbed into the city. Even though "the robust life in the urbanized villages was, in fact, the best representative of Shenzhen's unique urban character,"²⁵⁹ and therefore these areas could convey something important to the outside world about China's soft power, still, trends predict that many areas in these villages have been and will be returned to the municipality—i.e. converted to state land—so that gradually, although not soon, with suitable commercial development, the "problem" will disappear. For instance, almost ten years ago, many residents of Da Chong Village profited greatly by allowing the state-owned enterprise China Resource

Group to begin to develop its land. In one of the largest village reconstruction projects in Shenzhen, the 1200 substandard residential buildings comprising the village were completely demolished and rebuilt;²⁶⁰ of late, “fancy multiplexes such as China Rich City (*Hua Run Cheng*) [now sit] on top of Da Chong Village.”²⁶¹ The urban village of Tianmian agreed to return part of its land to the municipality, upon which an office complex with an international hotel was built, as well as an area devoted to a “City of Design” complex, all in exchange for numerous new residential buildings to provide an architectural upgrade. In other words, the administrative problem of urban villages will, over a rather long time, perhaps requiring several generations, and in many creative ways, most likely become a real estate situation and be “solved” by market forces. Against this, though, one should consider that, “The question of approaching the symbolically ‘rural’ part of cities as something other than a space to be wholly assimilated or physically excised is a key challenge for the rapid urbanization happening around the globe.”²⁶¹ In other words, there may be alternatives to the final common pathway of all municipal land into the real estate market: for example, innovative policies which preserve the special cultural expressiveness of the various villages, and manage to facilitate continuation of the positive aspects the villages embody (including provision of affordable housing). An insightful policy based on such a cultural appreciation may emerge, but in the meantime, the most likely outcome on the other hand is inexorable land commoditization through the real estate market. In today’s Shenzhen, “increasing areas of land have been segregated for use by an increasingly smaller percentage of the population. In turn, more and more migrants have had to make do in ever-smaller enclaves composed of residual rural holdings.”²⁶² This process of progressive land acquisition will probably eventually wash away the anomalous villages and relegate them to curiosities of history.

Examining the city of Wuhan, which has a somewhat more aggressive policy towards land commodification than Shenzhen, William Buckingham has offered some very trenchant observations about the nature and rationale of the procedures to conduct the

reform and remaking of these villages inside that city (*cheng zhong cun gaizao*). We must realize that, “Moving from rural to urban spatial categories is not just a conceptual change, but is predicated on the introduction of a greater state presence at the local level in the form of more cadres, increased funds for public construction, and stricter regulation of society.”²⁶³ Officially characterized as converting “agricultural people to [urban] residents” (农民转为居民 *nongmin zhuanwei jumin*), one could look on these policies and procedures as a crucible for transforming collective quasi-traditional social organization into what might provisionally and euphemistically be called “citizens.”²⁶⁴ As Buckingham describes it, “the [original] arrangement between the formal urban sector and *chengzhongcun* is a trade-off, an implicit understanding whereby city governments forego some of the immediate profits they could accrue through immediate and wholesale expropriation of village property, while villagers surrender any claims on the city budget.”²⁶⁵ Under these terms, he remarks, in the process of reform there is no real integration of villager inhabitants into the state, but instead are outcomes “in favour of a more passive concept of *jumin* or resident”: “*Gaizao* [reform], as it is conceived by the municipality, does not actually seek to create *citizens*, but passive subjects whose rights remain understood as a matter of *nongmin quanyi*—peasants’ rights and interests” (as opposed to the rights of entitlement devolving on urban residents).²⁶⁶ Targeting villagers’ collective rights, urban village reform “minimizes their ability to secure socioeconomic rights”: “villagers’ rights are not a set of principles for individuals to act on or claim *from* the state”; rather, they are “defined by the state that reduces villager interests to a negotiated sale price of collective assets.”²⁶⁸

It is likely that these transformative procedures rest on archaic understandings of justice. The brilliant sinologist Marcel Granet long ago, in *La Pensée Chinoise* (1934), captured the best interpretation of the key ancient concept of *yi* 义 as “equitable proportion” in the crucial gift-giving ceremonies, when victorious kings handed out relics and booty to their allies.²⁶⁹ In other words, as now, such practices focused upon *distributive justice*: “rights

and interests' are defined, not by the villager, but by the state with an emphasis on *distributional* rather than *social* justice.²⁷⁰

Accordingly, it is no surprise that the individual villager is not directly involved with negotiations with the real estate organizations:

[...] developers in China often do not negotiate with villagers in land transactions. Instead, developers negotiate with agents of the district and municipal government and joint-stock companies that represent the collective economic interests of the village. Individual villagers are rarely consulted directly, unless they resist expropriation in the form of "nail houses."²⁷¹

"Nail houses" and *qiang jian* (强建 last-minute refurbishing of a property in order to slow down and claim a higher value in compensation) are tactics of the villagers to delay and resist the neighbourhood reconstruction, mainly consisting of holding out for a better deal from the municipal redevelopers.²⁷² Buckingham points out that the municipal strategy of reform, though trying to "placate villagers," actually "triggers a kind of 'citizen consciousness' among them as they draw on a variety of discourses to legitimate their own resistance to expropriation."²⁷³ Thus, rather than taking "rights and interests" as basic, "[t]he entire process of *chengzhongcun* transformation is itself oriented toward creating a negotiated agreement on collective land's exchange value"²⁷⁴—the real estate negotiations do not include the individual villager in question, but rather his (or her) collective management group. The mode of reformation of Chinese cities is to "develop in a way that reduces rights to a bundle of economic benefits reflected in expropriation negotiations or access to mass-consumer goods in new malls and shopping centers."²⁷⁵ This suggests a deep traditional attachment to distributional justice in terms of displays of complex numerical values, as well as an underlying materialistic symbolism of prestige emblems, a kind of thinking about justice that has been seen in China for millennia.

Buckingham objects that these procedures do

not reform the inequitable situations created by the dual structure of Chinese administration, but rather that transformation of urban villages "uses the dual structure to justify their elimination and then reproduces the injustices that led to their creation in the first place."²⁷⁶ "The dual structure is employed by urban officials discursively to justify the elimination of *chengzhongcun*, while the process of *gaizao* [transformation] relies on the dual structure to minimize the costs of expropriation."²⁷⁷ This is the second question we have encountered about the dual structure's role economically. Finally, it is not the case that the reform and reconstruction of the urban villages is a policy to reconstitute a new class of citizens: "rather than taking down the barriers between rural and urban space and population, however, [for urban village transformation and reform] in Wuhan a select group of villagers moves from one category to the other."²⁷⁸ No matter how momentous the change may be to the individual villager, in the overall society these procedures have to do with recognizing the new status of a special group, are quite limited in scope and influence, and are certainly not a general or progressive way of creating "citizens."

It is an opportune moment to remark upon the discursive emphasis on economic success that seems to be an axiom of Chinese development, as opposed to a focus on, for instance, social order and the personally responsible role of individuals in maintaining it for one and all in ordinary life.

Ultimately, what we see in Shenzhen is the continued evolution of a strategic ambiguity that works because nearly everyone can project their fantasies onto the city—and act upon them. This works precisely because of a double movement that rests on the public secret of the economy as a space outside of politics—everyone knows that it is not, but everyone pretends that it is.²⁷⁹

Another secret of Shenzhen! The "strategic ambiguity" also, in secretive fashion, took care of housing migrant workers, at no economic cost to the city. In the area of health care, too, Mason states, "an analysis of the value, production, and implicit

dangers of ‘Shenzhen speed’ within the context of an epidemic makes salient how so-called economic values have shaped the city’s administration of what are (usually) taken to be noneconomic values, such as public health.²⁸⁰ Obviously, the economic planning aspect of municipal work is the easy part: easier than the social aspect. The challenges for the Chinese population do not hang on top-down reinforcing of the elitist concepts of *su-zhi* [素质, “refined character”] or *junzi* [君子, “noble or lordly person”]²⁸¹ but on inducing people to care more about their broader society than about their particularistic ties to it (e.g. family, clan or place of origin). It is a compelling goal! The development of a civil society on the basis of rule by law. But until that wonderful day when it is accomplished (it will come), the constant trumpeting of economic success rings a little hollow. There are awesome changes still awaiting this glorious society. Perhaps Shenzhen will play a key part in them.

Observations on Chinese Culture and Modernization

In conclusion, let us look briefly at a few cases as ways in which Shenzhen points to future outcomes for China and the world. It must be remarked that in a burst of investment over the last century, the education system throughout China has already established leading universities, such as those in Beijing, Nanjing, Shanghai and elsewhere, and these articulate with other aspects of public education (e.g. pedagogy and the testing system) in a highly hegemonic way. Accordingly, Shenzhen’s even more recent institutions, beginning with the founding of Shenzhen University in 1983, have had to find alternative goals and methods, possibly more creative ones, to avoid direct, futile competition with the older schools which work within a long-standing and widespread educational model.

These challenges could be met because Shenzhen from its first moment has had a distinctively magical quality, like Swayambhunath, the “self-sprung.” “Nearly everyone can project their fantasies onto the city—and act upon them.”²⁸² A city created out

of nothing by fiat suddenly arises and becomes gargantuan. Without paying for enormous housing costs, the state tacitly relies on the grey areas of society to do so: it is something coming from nothing, like the way financing and innovation are wedded together to fund start-up products. In the same way, due to the heroic work of Luo Zhengqi primarily in the 1980s, Shenzhen University exemplifies the character of a university that built itself and makes itself the top resource as it goes on to study itself. Students themselves had designed and built the earliest university buildings on the empty plot of land. In Luo Zhengqi’s opening address for academic year 1987-88, students were designated builders of the new SEZ. Thus, the university was inspired by the heroic efforts of a leader participating in national reform, working closely alongside the students themselves on a momentous historical project.²⁸³ This was indeed a breakthrough, and the result was as if innovation and reform were being materialized before the eyes of the participants. This is a worthy beginning of a university.

Shenzhen University, as well as Southern University of Science and Technology and others, have in this way become top-tier institutions of higher education in China, with plenty of expertise in scientific research, technological innovation and environmental science. Certainly, students of sciences and technology here get abundant hands-on experience during their training, which means they are personally participating in the birth of the field of science studying special economic zones, which has been heralded at Shenzhen University, and has become a prominent aspect of research here, as their China Centre for Special Economic Zones Research is a leader in this field of study worldwide, with enormous data resources pertaining thereto.²⁸⁴ It is a good image for the way institutions come into being in the reflexive moments of creative work, producing themselves and the fields that are based on them.

Another instance of creative science coming from Shenzhen higher education was not so auspicious. Between November 25 to 27, 2018, biophysics researcher He Jiankui of the Southern University of

Science and Technology revealed to the world that he had used CRISPR genetic editing techniques to modify two or more new-born babies' susceptibility to HIV infection, with the result that the babies were partially immune to such infection. He expressed pride in his own achievement, but this monstrous experiment has been widely condemned and He has been removed from his research post with the university. Investigations are pending. For us, what is of interest pertains to the secrecy, lack of transparency and vague or apparently false statements in the background of this research. In such a case, Shenzhen appears to have been a favourable site for such work, with biotechnology giants such as B.G.I-Shenzhen as a top player in the region, with a keen interest in genetic alterations that could "boost [one's] offspring's IQ. [...] The company clearly believes there's huge potential demand for such a service."²⁸⁵ We do not know who the sponsors of Dr. He's research were (the source of funding has not been revealed and He claims to have paid for the research himself), but the culture of Shenzhen might be seen as abetting a kind of "brook no obstacle" mentality that pushes the limits of conventional progress. For those fighting on the front lines of creativity, perhaps there is no time to accept criticism anymore.

The issue of creativity is currently being actively promoted as a political initiative throughout China. Shenzhen is presented as a zone of creative experimentation for the "China dream." In Shenzhen, the OCT has established clusters of "cultural-creative industries" such as the OCT-LOFT, where small and medium enterprises (SME) flourish, such as design industries, alongside other relatively youth-oriented creative programs. It is a good place to hang out and perhaps even find a connection with Japanese "doujinshi" 同人誌 style creative (self-marketed) work.²⁸⁶ Many music events and live concerts are held here too. This is a creative use of urban village areas and can appeal to improvements in the environment for aesthetic well-being, "inner city chic," as well as increased productivity. Gentrification is like eugenics: an attempt to improve the real estate stock and bring in a more acceptable population of residents.

In Shenzhen, gentrification is not a passively undergone phenomenon, but may be the policy goal in dealing with the enclaves. In the stories of each "village inside the city," varying degrees of cooperative partnering between the villages and a real estate company occur, and to various degrees, acts of resistance against an externally imposed



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takeover of the community occurred. SOE or former SOE real estate companies such as Gemsdale (in the difficult Gangxia project), or China Resource Group (Da Chong), are major agents in taking over the urban villages. The role of OCT in the development of OCT-LOFT in an enclave is similar, although it had nothing to do with “villages within the city.”

The background of OCT-LOFT is an interesting story. In 1985, east of the grounds for Shenzhen University and Da Chong Village, the former collective farm at Shahe on the Nantou peninsula was divided into an area for OCT (5 km²) and for Baishizhou (7 km²), which is one of the largest of the urban villages in Shenzhen.²⁸⁷ The OCT area included a district of industrial warehouses in a former manufacturing zone, and these were taken over directly, with minor modifications, to provide a “post-industrial” ambience for OCT-LOFT.

As a state-owned enterprise, oversight of OCT is through SASAC (State-owned Assets Supervision and Administration). In the development of OCT-LOFT, SASAC “played the dual roles as a ‘local government’ and developer” according to O’Connor et al. [16].²⁸⁸ SASAC was an absolutely vital intermediary agent in the development of this creative space, as it often is elsewhere in a range of functions.²⁸⁹ Such government initiatives as OCT-LOFT and redevelopment of urban villages include real estate manipulations to increase the property values in the neighbourhood and magically improve prospects for government success in its projects.

In this way, we can foresee how, very gradually, the joint-stock holding clans are relinquishing “building farms” on the land of the urban villages; eventually, but very slowly, they will merge in the complexly coordinated real estate projects as just described.

OCT’s theme parks try to capture images of traditional China in miniature for tourists. There are certain aspects of this situation that invite comparison with what happened in Japan after the Second World War, a time when the various regions of Japan finally began to discuss themselves as variations on something called “Japanese culture”

and NHK started to play “Japanese folk music” named as such for the first time on national radio broadcasts. At that time, local rituals such as the Hakata Matsuri (Gion Yamakasa) in Fukuoka were co-opted by Tokyo, and injections of big money came from the national centre to local neighbourhoods to re-purpose traditional ritual celebrations (with all their millennial symbolic functions) as “tourist events.”²⁹⁰ This policy was part of the preparations for “Japan Inc.” and resulted in a tendency towards homogenized disneyfication of indigenous culture: great for photography! But the end of autonomous traditional local culture.

Similarly, playing on the ambiguity mentioned at the start of this essay, the ambiguity between “high culture” and the technical sense of “culture,” this top-down inside-out assemblage presents “culture” in the theme parks and clusters, often as a Disneyland spectacle to attract far-flung domestic tourists, show the foreigners in the world and to entertain the young. In this it joins a large number of artificial Chinese villages around the country, widely viewed by tourist visitors, but which generally fail to replicate even architectural principles of their models.

Succeeding is great. Congratulations! Learning is better. *Jia you!* (加油 work harder). It’s clear from the text pertaining to Confucius, the *Analects*, through learning we realize the medium of our lives is culture, and naturally, culture includes economic activities as one part. Chinese culture includes complex accumulations and resonances between ancient and modern, that are actively influencing the behaviour and outcomes in the region. There are many respects in which Chinese culture can teach us to be patient, while we slow down and reflect on why we act the ways we do or why we want to do that—and certainly in the *longue durée* of this remarkable culture, we will find clues to balance our cultural impulses and learn to respect the traditions that have brought us to this pass.

Chapter 8

Shenzhen: A Comparative Analysis

William Donald Coleman

Introduction

This paper is one of a number of studies that look at the recent history of Shenzhen, a city in China. This history will demonstrate the remarkable changes in Shenzhen that have led to its becoming the third largest city in the world. And these changes in the city are worthy of study because these accomplishments have taken place in only thirty years. Seldom does this level of change, in turn, have impacts on the whole world. As the third largest city in the world, its accomplishments and its failures are likely to affect the lives of millions of people.

Various forms of study could be called upon to carry out this work. I propose to use the technique of comparison. By focusing on two cities from very different parts of the world, we can draw upon their similarities and their differences to gain a clearer view of what has happened in Shenzhen. The comparator that I have chosen to add to our understanding of Shenzhen is the city of Toronto in the province of Ontario.

The Beginning of Toronto and Shenzhen

Both Shenzhen and Toronto were regional market towns. The name “Shenzhen” dates from at least 1410. Eventually, it developed into a regional market town. Local inhabitants called the nearby fields “zhen” or “deep drains” which were part of the nearby paddy fields. These fields were part of nearby Bao’an County to which Shenzhen belonged, which was promoted to prefecture level Guangdong province. The new changes led to the renaming of the city to Shenzhen.

Toronto

The historical development of Toronto begins somewhat later than Shenzhen. British explorers arrived in the 1780s in what eventually became the United States (The Puritans were the first to arrive in 1620 when they established the Plymouth Colony which gave rise to Thanksgiving). After losing the American War of Independence, and with the gradual development of the United States, some English explorers moved north to find new territories for managing trade and to find new settlements in the “new world”. Parts of this more northern territory had already come under the control of the French.

In response, the British explorers moved further west and north, where they were able to put down claims to parts of land held by Indigenous peoples. In 1867, British and French settlers worked together to begin independence for a new country, Canada.

The four initial provinces were Ontario, Quebec, New Brunswick, and Nova Scotia. Upon Confederation in 1867, the name *Canada* was officially adopted for the new country. It would be commonly referred to as the Dominion of Canada until after World War II.

The initial capital for the area had been set up in a place that is now called “Niagara-on-the-Lake” on the British side of the river, with what would eventually become the United States of America. With significant parts of this land being so close to the early “United States”, the British sought to relocate to a site with a protected defensive harbour on the east side of what came to be called “Lake Ontario”.

The word “Toronto” is a corruption of the Iroquois indigenous peoples’ word “Tkaronto” which means “where there are trees standing in water”. A new capital was established in a place named “Fort Toronto” or “York”. In 1834, the population had reached five thousand people, sufficient to

incorporate the town as a city still carrying the name “Toronto”.²⁹¹

Gradual Development: Toronto, 1834 to 1965

The old city of Toronto lasted from 1834 to 1990²⁹². For our comparison of Shenzhen and Toronto, I will focus at this point on the period from 1834 to 1980. Similar again to Shenzhen, the old City of Toronto absorbed adjacent villages and townships into the City. By 1912, Toronto had taken on “the rough form of an inverted T”. As it spread along the shore of Lake Ontario, it reached north along “Young Street” and by 1940, it had reached a population of 670,000²⁹³.

The old city of Toronto had gradually been surrounded by five largely rural townships still referring to British names: York, East York, North York, Scarborough (named by Queen Elizabeth), and Etobicoke (an indigenous name from the Mississauga indigenous peoples living 20 kilometres away and extending hundreds of kilometres west and north of the city).

After World War 2, the development of residences, as well as increased industrial development, spread rapidly into these townships²⁹⁴. In 1953, in a



proactive step to control urban growth in the region, the Province of Ontario, which oversaw Toronto, linked these townships into a two-tier system of regional governance. They called the system the “Municipality of Metropolitan” or “Metro Toronto”. This development was the first legally constituted metropolitan government in North America²⁹⁵. The changes left the city with two municipal jurisdictions: Metro and the old City. In short, Toronto in the 1950s underwent a period of extensive change of the city²⁹⁶. Following the Second World War, a booming city built its first subway line under Yonge Street²⁹⁷, welded together its downtown expressway, and created new downtown land by infilling land south of Front Street. Toronto opened its subway in March 1954²⁹⁸.

In the 1960s, two buildings, a new City Hall in 1965 and the TD Centre in 1967 were structures that were the work of accomplished international architects and both were unlike anything the city had seen before. Nonetheless, the city remained a quiet place in comparison to today, and far more conservative. The dawn of apartment block housing had come into play²⁹⁹. Between 1959 and 1969, large-scale concrete apartments appeared, to house the city's growing population, which was less tied to the downtown core than before. In short, the Toronto of the 1960 period had been termed a “boom town” for all the changes that took place in such a short period of time³⁰⁰. With a new subway and expressways, the city grew up a lot in the 1960s, a process that would only increase in the decades that followed.

Shenzhen

The roots of Shenzhen can be traced historically to 330 and the Dongguan Prefecture. For our purposes, we will begin with the year 1573, when 7,608 families or 33,971 inhabitants lived in the Dongguan Prefecture. Dongguan is still a prefecture-level city in Central Guangdong Province and it is close to the Pearl River Delta. Earliest known records of the name *Shenzhen* date from 1410 during the Ming dynasty. But several times, the city was affected by British armed forces. Between July 1842 and April

1898, the Qing government in China and the United Kingdom signed the “Nanjing Treaty”, the “Beijing Treaty” and the ZhanTuo Hong Kong Boundary Zone. In 1899, Shenzhen was occupied by British forces and its governor was based in (still under British control) Hong Kong. Similarly, Shenzhen was used as a place for Hong Kong workers leaving the colony during a Canton-Hong Kong strike in 1925.

The above history indicates that Hong Kong remained under British control much longer than Toronto. And when Canada became independent of British control by 1931, the British remained actively in control of Hong Kong. What is more, Shenzhen was under Japanese occupation during the Second World War. The Japanese used much of southern China as a base for gaining control of Hong Kong.

After the Second World War: 1950 To 2018

Toronto

Population growth of Toronto can be studied by focusing on the concept of “global cities”. To be considered a global city, an urban centre must prove it enjoys a significant global advantage over other cities and serves as a hub within the world economic system. Initially, global cities were ranked depending on their size. Both Toronto and Shenzhen fit into this concept.

Linked to the City of Toronto, in addition to its traditional original core, there are a number of cities that grew out of the beginnings of Toronto's growth. Edward Relph, in his book, “Toronto: Transformation in a City and Its Region”, uses the term “Greater Golden Horseshoe” to point to the remarkable growth that surrounds the original city of Toronto. The idea was “to create a multi-central urban structure, with each centre multifunctional, complete and pedestrian oriented”.

Although immigrants were a longstanding feature of the growth of Toronto, the sources for these migrants changed significantly after 1980. The local economy

of Toronto grew rapidly, which led to the arrival of more and more immigrants from many parts of the world to Toronto and the many towns and cities nearby. In accepting so many new immigrants to the city and nearby towns, Toronto also moved away from being a home primarily for British and French immigrants. With Toronto accepting a highly ethnic diversity of new immigrants, the city moved far away from being only a traditional white, Anglo-Saxon, and Protestant province and city. As these changes took place in the province and in its largest city, Toronto overtook the city of Montreal in the province of Quebec as Canada's largest city. Consequently, the rapid growth of immigrants from around the world has fundamentally changed the city of Toronto from a conservative, protestant city to a large, diverse and globally sourced one.

According to the 2016 Canada Census, the racial Census composition for Toronto in 2018 is as follows:

White: 50.2 percent, East Indian: 12.7 percent, Chinese: 10.8 percent, Korean: 1.4 percent, Japanese: 0.5 percent, South Asian: 12.3 percent, Black: 8.5 percent, Southeast Asian: 7.0 percent, Filipino: 5.1 percent, Latin American: 2.8 percent, West Asian: 2.0

percent, Arab: 1.1 percent, Aboriginal: 0.7 percent (0.5 percent First Nations, 0.2 percent Metis), Two or more races: 0.3 percent.

The most common ancestry groups were: English (12.9 percent), Chinese (12.0 percent), Canadian (11.3 percent), Irish (9.7 percent), Scottish (9.5 percent), East Indian (7.6 percent), Italian (6.9 percent), Filipino (5.5 percent), German (4.6 percent), French (4.5 percent), and Polish (3.8 percent). Other common groups include Portuguese, Jamaican, Jewish, Ukrainian and Russian.

Given its diverse population, Toronto is home to many ethnic neighbourhoods such as Little India, Greektown, Corso Italia, Chinatown, and Little Jamaica. With these circumstances, foreign-born people account for nearly half of the population of Toronto. As such, Toronto has the second-highest percentage of foreign-born residents of all world cities after Miami. But unlike Miami, Toronto has no dominant culture or nationality, which also makes it one of the world's most diverse cities. 49 percent of the city's population belong to a visible minority group (compared to 14 percent in 1981), and visible minorities are expected to hit a majority close to 65 percent of the Toronto CMA population by 2019.



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Finally, another indicator of global prominence is the number of skyscrapers in cities. Here, Hong Kong has the largest number (365), with New York City in second place with 257. Shenzhen is sixth with 138, and Toronto has 59 skyscrapers.

Shenzhen

The earliest known recorded mention of the name *Shenzhen* is as early as 1410 during the Ming dynasty. Local people called the drains in paddy fields “zhen”. “Shenzhen” meant literally “deep drains” because the area was once crisscrossed with rivers and streams, with deep drains within the paddy fields. “Shenzhen market” was one of the 28 market towns of the Xin’an (Bao’an County), along with other places like Nantou. For half a year in 1899, Shenzhen was occupied by British forces based in Hong Kong. From 1941 to their surrender in 1945, Shenzhen, along with much of “Southern China”, was occupied by the Japanese, who used it as the base for the occupation of Hong Kong.

Although the end of the Second World War gradually led to the revitalization of many countries such as Canada and the United States, China was still ravaged by a century of foreign invasion and civil wars. Both

urban and rural communities, as well as agriculture and industry workers, experienced significant growth between 1949 to 1959. Mao’s government carried out mass executions of land owners, instituted collectivities, and implemented a rigorous rural labour camp system.

Economically, China followed a model of Five-Year Plans, developed in the Soviet Union. Its first plan was followed by China from 1953 to 1970. China went through a process whereby means of production were transferred from private to public programs. With this step, the state controlled the economy. The Soviet Union provided considerable economic aid and training to China during the 1950s. Many Chinese students were sent to study in Moscow. Soviet Union designs for factories and infrastructure were mostly based on Soviet designs. In 1958, Mao introduced a new economic programme that would raise industrial and agricultural production. None of these policies ever really succeeded, leading to disaster throughout the country. This story is complex and detailed. At the end of this story, Mao Zedong died in 1976. His position ended up in the hands of Deng Xiaoping, as determined in the Third Plenum of the 11th Party Congress on December 22, 1978.

Shenzhen officially became a city in 1979 and roughly



Shenzhen Government Office Building @SZAICE

followed the boundaries of Bao'an County. Prior to this change, Shenzhen was a regional market town that had been the county town of Bao'an since 1953. In 1979, Bao'an County was promoted to "Prefecture Level". Next, Shenzhen was established as China's first "special economic zone" (SEZ). In May 1980, Shenzhen was singled out to be the first of the five "Special Economic Zones". In March 1983, Shenzhen was promoted to a Sub-provincial City. The Special Economic Zone comprised only five districts (Luohu, Futian, Nanshan, and Yantian) until July 1, 2010, when the Zone was expanded to include all the other districts, thereby increasing the size five-fold. On July 2010, Shenzhen's SEZ was expanded to the whole city. In 2017, Shenzhen's economic output totalled \$338 billion, as a result of which, for the first time, the city ranked third in China, behind only Beijing and Shanghai.

Conclusion

Two Different Cities and two different Countries: What have we learned?

History

The history of Shenzhen can be traced at least over 2000 years that led to the present-day country of China and eventually the city of Shenzhen. Remarkable changes in culture, size, relations with different parts of the world, language, and wars with other parts of the world took place. In contrast, Toronto began its history in the 1780s when British explorers landed in what is now the United States and then moved north to the area where the present-day city of Toronto began its development.

Location

It could be said that the two cities are located on opposite sides of the world. The city of Toronto is located in the country of Canada, in the province of Ontario. Ontario is Canada's fourth largest province. The city of Shenzhen is located in the south east part of China, just north of the well-known city of Hong Kong, a longstanding port for the British army and navy.

Area

The area of China is 9.597 million km. Canada is similar, with an area of 9.985 million km.

Languages

In China: 13 major languages; in Canada: two major languages, English and French.

Immigrants

Shenzhen: Number of immigrants 2016: 10 million

Toronto: 2016 Census numbered 2,705,550 foreign-born individuals in the Toronto Census Metropolitan Area (CMA) in 2016, the largest number of any CMA in the country

Indigenous peoples

Toronto area

The Agencies for indigenous people in Toronto estimate that there are about 70,000 residents of the city who identify as indigenous. Canada's last Census in 2016 counted 46,315 in Toronto. However, other research has shown that Indigenous peoples are undercounted by the national census. The census often relies on a fixed address and many Indigenous people move frequently or are homeless. There is also a reluctance among Indigenous peoples to fill out censuses. Moreover, they are split into three categories: First Nations, Métis, and Inuit.

Shenzhen

Determining the number of Indigenous people in Shenzhen is also difficult to establish clearly. Whereas the situation of Indigenous people is relatively clear in Toronto due to the legal status of Indigenous people in Canada, this legal status is less clear in Shenzhen. Generally, they are considered as "migrants" in Shenzhen, meaning persons coming from elsewhere to the city. "Migrants" do not have the same legal status as in Toronto/Canada.

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