



Shenzhen Sustainable Development Report (2021)



Research Institute for Eco-civilization, Chinese Academy of Social Science
United Nations Development Programme

Disclaimer

The designations and the presentation of the materials used in this publication, including their respective citations, tables and bibliography, do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication are those of the authors and do not necessarily represent the work's basis of those of the Chinese Academy of Social Sciences, the United Nations, including United Nations Development Programme, or UN member States, including China. The authors have made every effort to guarantee the accuracy of the data included in this publication and accept no responsibility or liability for any consequence of their use.

This report was authored during 2020, and updated in 2021 that used data up to 2020 from official sources.

Co-drafted by

Research Institute for Eco-civilization, Chinese Academy of Social Sciences
United Nations Development Programme Representative Office in China

Contributions by

Asian Development Bank
Shenzhen Society for Sustainable Development
Sustainable Development Research Center, Chinese Academy of Social Sciences
Thinktank for Eco-civilization Studies, Chinese Academy of Social Sciences
China Society of Urban Economy

Research Team:

Lead Author:

Pan Jiahua, Standing Member of CASS Academic Board, and Director, Institute of Urban and Environment Studies of CASS

Executive Authors:

Wang Mou, PhD, Secretary-General of Research Center for Sustainable Development CASS

Wang Dong, Policy Advisor and Programme Director for SDG Localization, UNDP China

Research Team:

Zhuang Li, Director of Editorial Department, Institute of Urban Development and Environment, Chinese Academy of Social Sciences

Liu Junyan, Sustainable City Expert Consultant, Asian Development Bank

Zhang Bin, Associate Researcher, Agricultural Economic Research Center, Ministry of Agriculture

Liu Zhe, Associate Researcher, Policy Research Center for Environment and Economy, Ministry of Ecology and Environment

Zhang Zehou, Research Associate and Programme Consultant for SDG Localization, UNDP China

Kang Wenmei, Graduate Student, Institute of Urban and Environment Studies, University of Chinese Academy of Social Sciences

Acronyms

ASEAN	Association of Southeast Asian Nations
CCSAI	Chinese City SDG Assessment Index
CNY	Chinese Yuan
CSD	Commission on Sustainable Development
GEP	Gross Ecosystem Product
GNI	Gross National Income
HEI	Higher education institution
HLPF	High-Level Political Forum on Sustainable Development
IAEG-SDG	Inter-agency and Expert Group on SDG Indicators
IoT	Internet of Things
MDG	Millennium Development Goal
OECD	Organization for Economic Cooperation and Development
OEM	original equipment manufacturer
OWG	Open Working Group
PCIC	People Centred Integrated Care
R&D	Research and Development
SDG	Sustainable Development Goal
SUC	Sustainable Urban Development
UN	United Nations
UN DESA	UN Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific

Executive summary

“Sustainable development” has evolved from a theoretical discussion, to a critical strategy and practice, guiding growth and development in all countries, across three pillars – the economy, society and environment. In 2015, the United Nations (UN) Sustainable Development Summit adopted the 2030 Agenda for Sustainable Development globally, including the 17 Sustainable Development Goals (SDGs), to end poverty, reduce inequality and protect the planet. Countries and regions across the world, as well as international organizations have been promoting the 2030 Agenda’s implementation through the release of action plans and evaluation reports.

In China, the Government issued *China’s Position Paper on Implementation of the 2030 Agenda for Sustainable Development* as early as April 2016. In September of the same year, Premier Li Keqiang released the National Plan for the Agenda implementation, while in December, the State Council issued the Notice on *the Plan of China Implementing the 2030 Sustainable Development Agenda Through Constructing Innovation Demonstration Zones*. These initiatives, along with the latest climate pledges by President Xi Jinping at the UN General Assemblies in 2020 and 2021 – to peak greenhouse gas emissions before 2030 and achieve net zero emissions before 2060, as well as to stop building overseas coal power plants – reaffirm China’s commitment to the SDGs.

Given China’s demography and development path, building inclusive, safe and sustainable cities – SDG 11 – is a key part of China’s national development strategy. China’s urbanization rate recently topped 60 percent, generating more than 80 percent of its GDP. Cities are centers of economic, social, cultural and political activity, along with innovation. Ensuring green urbanisation that includes everyone is critical to achieving every SDG, in all countries. Against this context, this sustainable development report focuses on Shenzhen’s progress on SDG attainment, as a leading Chinese city in sustainable development that could offer an example to others.

Located on the coast of southeast China adjacent to Hong Kong, Shenzhen is one of the pioneering cities of the Reform and Opening-up period, identified by the Government as a demonstration area for socialism with Chinese characteristics. In 2018, Shenzhen’s gross domestic product ranked third among mainland Chinese cities. It also plays an important role in China’s hi-tech, financial services, import and export, maritime transport, creative and cultural industries. In February 2018, the State Council approved Shenzhen’s proposal to make the city a national Sustainable Development Agenda demonstration zone, led by innovation. Under the guiding principles approved by the State Council, Shenzhen issued the Shenzhen Sustainable Development Plan (2017-2030) and the Plan on Constructing a National (Shenzhen) Innovation-driven Demonstration Zone under the Sustainable Development Agenda (2017-2020). To put these into practice, Shenzhen is pursuing the “two systems” approach – innovative service support and talent diversity support, implemented through “four projects” – efficient resource use, eco-environmental governance, ‘Healthy Shenzhen’

and social governance modernization. It aims to build a safe and efficient production space, along with comfortable and liveable residential spaces, while protecting and nurturing the environment. Consequently, Shenzhen is accumulating valuable experience in sustainable development challenges in an urban environment that it is sharing with other mega-cities and the international community.

This report examines Shenzhen's experience in putting into practice sustainable development, the actions taken as well as challenges encountered. It serves to help Shenzhen identify gaps and shortcomings, as well as ensure the SDGs are met in a balanced way. Shenzhen's progress is also expected to inspire confidence and provide a model to other cities to implement the SDGs.

The evidence-based evaluation of sustainable development progress presented in the report is both a review of the achievements made and experiences gained, as well as a foundation to explore issues and solutions. As part of the United Nations Development Programme (UNDP) series "The SDGs in Chinese Cities: Progress Assessment Report", this is the first comprehensive SDG assessment of a city in China, based on an evaluation indicator system designed to be broad-based, forward-looking and suitable for urban-level assessments of SDG implementation. Comparability, replicability and data availability were key criteria considered while building such an indicator system.

The paper combines this indicator system with the Chinese City SDG Assessment Index (CCSAI) for Shenzhen. Developed by the Research Institute for Eco-civilization at the Chinese Academy of Social Sciences (CASS), the CCSAI applies the UN assessment report methodology guidelines to the Chinese context. To gauge Shenzhen's degree of success in moving towards realising the 2030 Agenda, this study evaluates implementation progress between 2000, the baseline year, and the end of 2020, along with the implementation gap to the 2030 target. It then calculates and analyses Shenzhen's Chinese City SDG Assessment Index. The conclusions are as follows:

Firstly, Shenzhen has made good progress in implementing the SDGs, moving faster than expected. The overall completion rate is 91.5 percent. Focusing on the 5Ps – the broad classification often used to group the SDGs – targets for Planet-based indicators have been met, while People-, Prosperity-, Peace- and Partnership-based indicators have reached 79.1 percent, 84.7 percent, 99.4 percent and 94.3 percent of their targets respectively.

Secondly, Shenzhen has already met the SDG 2030 targets for 28 of the 52 selected indicators, including: share of population under the national poverty line, basic medical insurance participation rate, maternal mortality, urban registered unemployment rate, and energy consumption per unit of GDP. On the other hand, areas such as education and medical facilities access have seen relatively slower achievements.

Thirdly, comparison with progress in other cities and regions is difficult, due to lack of harmonised methodology and data. That said, its performance and track record make Shenzhen stand out. The results shown in this assessment report are evidence of Shenzhen leading by example as a

demonstration area for the SDGs in China and beyond. According to the 2019 US Cities Sustainable Development Report, for example, the best performing cities are 60-70 percent of the way to meeting the SDGs fully¹. Similar results were found in the 2021 Brazilian Sustainable Cities Development Index².

BOX – Report's limitations:

1. The lack of available data is a key challenge in progress assessment, particularly at the city level. This resulted in a relatively small number of feasible indicators, limiting the breadth of the analysis, in particular for Partnership – that counts only two indicators, and Peace – one indicator.
2. The selection criteria for the 2000 benchmarks and 2030 targets, also constrained by data and benchmark availability, may skew CCSAI results towards a higher score.
3. Comparison with other cities indices is limited by the lack of a standardised methodology and data comparability.
4. The report uses data up to 2020. However, given the short time elapsed, the impact of COVID-19 may not be fully reflected in the analysis.

Contents

Chapter 1 SDGs Overview

- 1.1 Adoption of the 2030 Agenda for Sustainable Development12
- 1.2 The 17 Sustainable Development Goals13

Chapter 2 Global Implementation Framework of the SDGs

- 2.1 Implementation of the SDGs: Shared Responsibility and Global Partnership18
- 2.2 Monitoring and evaluation of the implementation progress of the SDGs19
- 2.3 Global, regional, and national sustainable development assessment reports and implementation progress20

Chapter 3 Shenzhen's Actions and Measures for Implementing the SDGs

- 3.1 Shenzhen Sustainable Development Plan: the Goals26
- 3.2 Shenzhen's strategies for implementing the SDGs27
- 3.3 Shenzhen's sustainable development experience30

Chapter 4 Methodologies for Assessing the Implementation of the SDGs

- 4.1 Creating a methodology for assessing SDGs progress in urban areas35
- 4.2 The Chinese City SDGs Assessment Index: The Methodology36
- 4.3 Traditional Sustainable Development Assessment Methods37
- 4.4 The Chinese City SDG Assessment Index: The Methodology39

Chapter 5 SDGs Implementation Progress Assessment in Shenzhen

- 5.1 Overall Assessment50
- 5.2 Assessment of 5Ps indicators51

Chapter 6 Conclusions and Implication

- 6.1 Overall progress for the CCSAI indicators has been higher than expected58
- 6.2 54% of the indicators have met their 2030 targets; 77% have been higher than the expected implementation progress59
- 6.3 Key indicators' implementation was higher than expected60

Annex Shenzhen Sustainable Development Case Studies

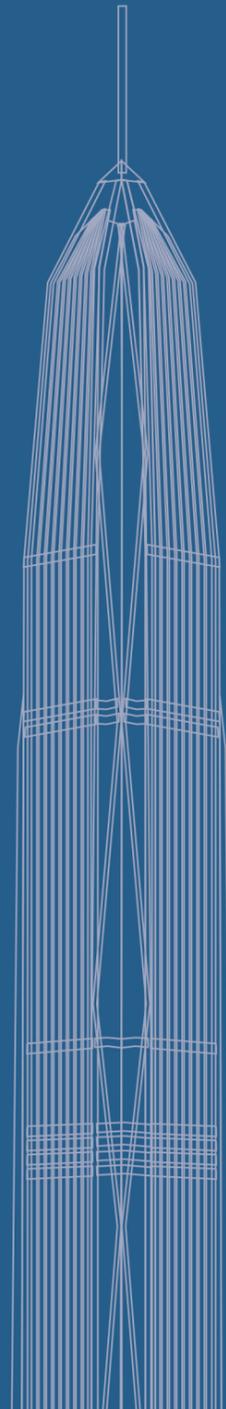
- 1 Effective use of resources: The "Shenzhen Model" for domestic waste classification64
- 2 Environmental management: Restoration of the Futian Fengtang Estuary River Mangrove Reserve67
- 3 Environmental management: The Port of Shenzhen Shore Power69
- 4 Environmental management: Development of an Urban GEP Accounting System in Yantian District71
- 5 Environmental management: New energy vehicle promotion in Shenzhen75
- 6 Health: A high quality and efficient medical and health service system78
- 7 Modernization of social governance: Smart Futian83
- 8 Inclusive and open international cooperation: BGI "Laos-China Modern Agricultural Science and Technology Demonstration Park"86
- 9 Innovative development case: Shenzhen as a global innovation capital88

The Shenzhen CCSAI Indicators listed according to the 5Ps

CHAPTER ONE

SDGs Overview

- 1.1 Adoption of the 2030 Agenda for Sustainable Development
- 1.2 The 17 Sustainable Development Goals



Abstract:

This chapter summarizes the history of the negotiations and adoption of the *2030 Agenda for Sustainable Development*, and the main framework and indicator system of the Sustainable Development Goals (SDGs). It describes the innovations and the main characteristics of the Agenda: the change in focus from development to sustainable development; the expansion of coverage and scope from the eight Millennium Development Goals to the 17 Sustainable Development Goals and from developing countries to all countries. This chapter also notes some challenges in the actual implementation of the SDGs, such as addressing the fragmentation of SDG indicators, finding comprehensive indicators that reflect the relevance and synergy between different development challenges, and developing a methodology suitable for assessing SDG progress by local governments and non-state actors.

1.1 Adoption of the 2030 Agenda for Sustainable Development

Sustainable development – meaning development that our planet can sustain, while leaving no one behind – was formulated in response to historical changes and the needs for social and economic development. It is the result of humanity’s reflection on the paths followed since the development of industrial civilization. The concept of sustainable development can be traced back to the launch of the modern environmental movement with the publication of *Silent Spring* in 1962 by Rachel Carson. In 1972, the first United Nations Conference on the Human Environment was held, which formally incorporated environmental issues into the international development agenda. Over the following four decades, sustainable development has transformed from a simple concept into an important strategy and practice, guiding economic and social development globally. In 2000, at the United Nations Millennium Summit, the Millennium Declaration, which aimed to clarify the development orientation of the new century, was adopted. The Declaration included the eight Millennium Development Goals (MDGs), to be achieved by 2015, and focused on poverty alleviation in developing countries.

The Millennium Development Goals came at the time of strong global growth and injected momentum into efforts on reducing poverty and hunger (MDG 1) and aiming at improving living standards, through greater access to education (MDG 2) or health (MDGs 4, 5 and 6), placing human development at the centre of social and economic progress, while ensuring environmental sustainability (MDG 7). They also fostered gender equality promotion (MDG 3) and a global partnership for development (MDG 8). However, despite many successes, by 2015, “progress has been uneven across regions and countries, leaving significant gaps. Millions of people are being left behind, especially the poorest and those disadvantaged because of their sex, age, disability, ethnicity or geographic location.”⁸ A series of problems also arose as developing countries were pursuing development paths similar to already industrialized countries: environmental degradation, global resource depletion, ecological insecurity and environmental unsustainability escalated. To a large extent, these problems are not confined to any specific country, but are severe challenges faced by all humankind. It is in this context that the post-2015 development agenda changed the focus to sustainable development, not just development, in both developing and developed countries alike. The latter countries continue to support the former, but also face sustainability challenges of their own, including the need to reduce their global footprint and impact, due to their unsustainable patterns of production and consumption.

In 2010, the UN General Assembly mandated initiation of consultations and discussions on the Post-2015 Development Agenda. In 2012, the UN Conference on Sustainable Development, also known as Rio+20, suggested the establishment of an Open Working Group (OWG) to develop a new set of goals, the Sustainable Development Goals (SDGs), to replace the MDGs. After nearly three years of negotiation, the UN Summit on Sustainable Development, held in September 2015 in New York, adopted the outcome document, Transforming Our World: The 2030 Agenda for Sustainable Development. On January 1, 2016, the 2030 Agenda officially entered the implementation phase. It is a programmatic document to guide global sustainable development for the next 15 years, opening a new chapter in global sustainable development governance. The concept of development has evolved into one where the three pillars

8. United Nations, The Millennium Development Goals Report, 2015. Available from: [https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20\(July%2015\).pdf](https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%2015).pdf)

– economic, social, and environmental development - coexist peacefully and harmoniously.

The outcome document contains a preamble, a declaration, the Sustainable Development Goals and targets, means of implementation and global partnerships as well as a request for follow-up and review. The preamble clearly lays out the vision for People, Planet, Prosperity, Peace and Partnership, known as the 5Ps. It is a global commitment to end poverty and hunger, protect the planet from degradation, ensure shared prosperity for all, foster peaceful, just and inclusive societies and build a new global partnership to “leave no one behind”. The declaration reaffirms common principles and commitments, as well as outlines basic considerations for developing and implementing the new Agenda.

1.2 The 17 Sustainable Development Goals

The 17 Sustainable Development Goals and related 169 Targets are at the heart of the 2030 Agenda for Sustainable Development. They are the result of more than two years of rigorous negotiations between governments and have attracted worldwide attention. The Goals can be divided into five groups based on their content, corresponding to the 5Ps:

People: Goals 1 to 7 address poverty and hunger eradication, the right to education, gender equality, and access to water, sanitation and energy services, reflecting mainly the basic needs of human development, especially the basic rights of vulnerable groups.

Prosperity: Goals 8 to 12 address sustainable economic growth and employment, sustainable industrialization and innovation, reducing inequalities, building sustainable cities and human settlements, along with sustainable consumption and production, with a focus on promoting sustainable economic growth and social inclusion.

Planet: Goals 13 to 15 address climate change, as well as conservation of marine resources and terrestrial ecosystems, emphasizing environmental sustainability.

Peace: Goal 16 involves institutional development and institutional guarantees for social justice and economic transformation and development.

Partnership: Goal 17 involves strengthening the means of implementing the goals through crucial partnerships between governments, businesses and society, along with international cooperation.

Compared to the MDGs, the SDGs have expanded the breadth and depth of their scope, showing the transition from development to sustainable development. In particular, their key differences can be summarised as following:

Firstly, although both emphasize poverty eradication, the MDGs focus on eradicating poverty in developing countries, while the SDGs concentrate on improving development rights and capabilities in all countries. The SDGs are universal, and universally applicable.

Secondly, although both consider global environmental security important, the MDGs are more general, while the SDGs are more specific and clear about the sustainable use of global shared resources, the atmosphere, oceans and biodiversity.

Thirdly, although both address the means of implementation for sustainable development, the MDGs focus more on how developed countries help developing countries to achieve this. Conversely, the SDGs emphasise two-way exchange of ideas and experiences between developed and developing countries, along with the initiatives and responsibilities of all stakeholders across society.

Fourthly, improving and maintaining development opportunities require sustainable use of natural resources, especially water resources and energy, which are not addressed in the MDGs.

Finally, the MDGs rarely connect development and sustainability drivers, which are systematically addressed in the SDGs.

	MDGs, 2001-2015	SDGs, 2016-2030
People	1. Eradicate extreme poverty and hunger; 2. Achieve universal primary education; 3. Promote gender equality and empower women; 4. Reduce child mortality; 5. Improve maternal health; 6. Combat HIV/AIDS.	1. End poverty in all its forms everywhere; 2. End hunger, achieve food safety and improved nutrition and improve sustainable agriculture; 3. Ensure healthy lives and promote well-being for all at all ages; 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all; 5. Achieve gender equality and empower all women and girls; 6. Ensure availability and sustainable management of water and sanitation for all; 7. Ensure access to affordable, reliable, sustainable and modern energy for all.
Planet	7. Ensure environmental sustainability.	13. Take urgent action to combat climate change and its impact; 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development; 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
Prosperity	8. Global partnership for development.	8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; 9. Promote sustainable industrialization; 10. Reduce inequality within and among countries; 11. Make cities and human settlements inclusive, safe, resilient and sustainable; 12. Ensure sustainable consumption and production patterns.
Peace	—	16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
Partnership	—	17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Table 1-1 The Evolution of the Development Goals

1.2.1 Sustainable Development Goals: Key Features

Universal applicability: The 2030 Agenda affirms that “The SDGs and targets are integrated and indivisible, global in nature and universally applicable, taking into account different national realities, capacities and levels of development In respecting national policies and priorities”⁹, clearly stating the universal nature and universal applicability of the Goals.

Leave no one behind (LNOB): The basic meaning of universal applicability is for the SDGs to enable each individual to be lifted out of poverty and access development opportunities. LNOB goes beyond extreme income poverty and highlights the need to fight discrimination along with rising inequalities within and amongst countries, as well as their root causes. It is set as a principle and is the central, transformative promise of the 2030 Agenda.¹⁰

Integration: As development challenges are complex and interconnected, the Sustainable Development Goals too need to be integrated to avoid being defined and approached in silos. The Agenda reflects this, describing the SDGs as “integrated and indivisible”¹¹, balancing the three dimensions of sustainable development: economic, social and environmental.

1.2.2 Sustainable Development Goals: Issues to be Addressed

Compared with the eight Millennium Development Goals, the content and scope of the Sustainable Development Goals are deeper and more extensive. The SDGs aim to not only eradicate extreme poverty, but also to achieve shared prosperity; they call not only for global partnership, but also for specific and practical means of implementation. It is worth noting that the SDGs include economic growth drivers and indicators, such as sustainable industrialization, urbanization, production and consumption, directly addressing the driving forces of human development and challenges with environmental sustainability. However, there are many issues that require further discussion.

Fragmentation of targets. As the SDGs have many targets, there is a risk that the efficacy of those targets may be weakened. Local context therefore must be taken into account during implementation. Development priorities must be identified, with corresponding and coordinated policies as well as measures formulated, to ensure the SDGs are implemented effectively.

Lack of attention to integration. The interconnection between the current 17 Goals has yet to be improved. Ways to strengthen their integration include increasing cross-sectoral, cross-theme and urban-rural interconnections, as well as more comprehensively addressing the interconnection between the social, economic and environmental dimensions of sustainable development.

Sub-national capacity to implement the SDGs. Urban and local governments, along with non-state actors, are critical to carrying out the SDGs. However, less than half of the current (2019) 232 SDG indicators are directly applicable to cities or covered by city-level data, posing a challenge to the follow-up and review of city-level SDGs.

9.Transforming our world: the 2030 Agenda for Sustainable Development. <https://sustainabledevelopment.un.org/post2015/transformingourworld>

10.United Nations Sustainable Development Group. “Universal Values, Principle Two : Leave No One Behind”, April 2019. Available at: <https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind>

11.Transforming our world: the 2030 Agenda for Sustainable Development. <https://sustainabledevelopment.un.org/post2015/transformingourworld>

CHAPTER TWO

Global Implementation Framework of the SDGs

- 2.1 Implementation of the SDGs: Shared Responsibility and Global Partnership
- 2.2 Monitoring and evaluation of the implementation progress of the SDGs
- 2.3 Global, regional, and national sustainable development assessment reports and implementation progress



Abstract:

This chapter introduces the global implementation framework of the SDGs focusing on the work of two entities: the UN-led High-level Political Forum (HLPF) and the United Nations Department of Economic and Social Affairs (UN DESA) Partnership Exchange. The former involves a political process largely engaging national governments, while the latter mainly involves enterprises and other market entities making voluntary commitments to support SDG implementation. The monitoring and assessment process for implementing the SDGs has started. The Statistical Commission is charged with developing a global monitoring indicator system, while UNDESA, UNDP and other agencies have released assessment reports on implementation progress at global and regional levels. Model cities in Europe and the US have also conducted city-level SDG implementation progress assessments. However, the methodologies of the assessment reports differ, and further harmonisation is needed.

2.1 Implementation of the SDGs: Shared Responsibility and Global Partnership

High-Level Political Forum on Sustainable Development

The adoption of the 2030 Agenda for Sustainable Development was widely welcomed by the international community, and followed by intense discussions on how to implement the Sustainable Development Goals in all walks of life worldwide. The UN and related agencies are playing an important role in this. As former UN Secretary-General Ban Ki-moon noted at the 2015 UN Summit on Sustainable Development, the 2030 Agenda urges people to take united and cross-border actions for long-term benefits and development. Facing global challenges, countries can no longer effectively act on their own and the UN strongly supports member states in this ambitious collaboration.

After Rio+20, the High-Level Political Forum on Sustainable Development (HLPF) replaced the Commission on Sustainable Development (CSD) as the main platform for the UN to lead the global process supporting sustainable development. The HLPF provides political leadership, facilitates sharing of experiences and successes, as well as recommendations for implementation, follow-up and review of achievements by 2030¹².

Global Partnership for the SDGs

The implementation of the 2030 Agenda for Sustainable Development is a long-term and challenging task, especially for developing countries. Firstly, global poverty reduction still has a long way to go. The MDGs have not been met in this respect. Secondly, development levels vary from country to country. While the “one-size-fits-all” indicators must be adapted to conditions in each country, individualized implementation plans add to the difficulty of comparability of the results. Thirdly, a lack of funding remains a major obstacle. Multi-channel international financing is critical. Lastly, the collection and analysis of relevant development data should be further improved.

Strengthening global partnerships and supporting action by countries are key paths to achieving the SDGs. Multi-stakeholder partnerships are an important part of mobilizing all stakeholders to implement the new Agenda. Multi-participatory partnerships have contributed to formulating and implementing the 2030 Agenda for Sustainable Development, as well as monitoring its achievements. In addition to governments, companies, local governments, scientific associations, civil society and non-governmental organizations (NGOs) have all taken an active part in formulating the new Agenda. The UN Development Group has conducted a wide range of consultations and discussions from the grassroots level up, including national consultations in more than 100 countries and 11 thematic dialogues. More than 1.3 million people worldwide participated in various ways, including on-line. The resulting report, A Million Voices: The World We Want, documents the aspirations of global citizens for the post-2015 development agenda¹³.

On September 2, 2015, the UN Department of Economic and Social Affairs launched an online platform to support

12. United Nations, “Monitoring and Progress: High-level Political Forum on Sustainable Development”. Available at <https://www.un.org/sustainabledevelopment/zh/monitoring-and-progress-hlpf/> (accessed in 2019).

13. UN Development Group, “A Million Voices: The World We Want”. Available at [https://www.undp.org/content/undp/en/home/librarypage/mdg/a-million-voices--the-world-we-want.html\(2013\)](https://www.undp.org/content/undp/en/home/librarypage/mdg/a-million-voices--the-world-we-want.html(2013)).

an open partnership for the Sustainable Development Goals, encouraging stakeholders to establish partnerships, make voluntary commitments to support implementation of the SDGs, as well as share experiences and information.

2.2 Monitoring and Evaluation of the Implementation Progress of the SDGs

2.2.1 SDG Indicators

Since the 2030 Agenda officially entered its implementation phase, the UN system has developed a detailed work plan and some important progress has been made. The establishment of a global sustainable development indicator framework to monitor and review progress towards the Agenda’s 17 Goals and 169 targets has been a key priority.

In 2015, at its 46th session, the UN Statistical Commission approved and created the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) to develop the Global Indicator Framework for the goals and targets of the 2030 Agenda. In the process of developing the indicator framework, national statistical offices of all countries have played a leading role, as they were invited to participate in an open and transparent manner. Regional and international organizations and institutions participated as observers in the follow-up process¹⁴.

In 2016, the Global Indicator Framework was established by the UN Statistical Commission and adopted by the Economic and Social Council and the UN General Assembly¹⁵. The Framework, to be refined annually, is to be complemented by indicators at the regional and national levels, as governments are also developing their own national measurements to monitor progress in implementing SDGs.

2.2.2 SDG Voluntary National Reviews

Voluntary national reviews are part of the monitoring and review mechanisms of the 2030 Agenda for Sustainable Development. Paragraph 84 of the Agenda states that the High-Level Political Forum shall carry out regular reviews, which will be voluntary and State-led and provide a platform for partnerships through the participation of all countries and other relevant stakeholders¹⁶. Voluntary national reviews are designed to track the progress of countries in implementing the 2030 Agenda, including the 17 SDGs and 169 targets, as well as identify challenges and promoting international SDG cooperation. It calls for SDG reviews to be substantive, data-based, available to all, inclusive, participatory and transparent, with a focus on the poorest, most vulnerable and least developed groups.

14. United Nations, “Inter-agency and Expert Group on SDG Indicators”. Available at <https://unstats.un.org/sdgs/iaeg-sdgs/> (2020).

15. A/RES/71/313 and E/CN.3/2016/2/Rev.1*.f

16. A/RES/70/1.

2.3 Global, Regional, and National Sustainable Development Assessment Reports and Implementation Progress

2.3.1 Progress in Implementing of the SDGs at the Global Level

Since 2015, multiple countries and regions, guided by the 2030 Agenda for Sustainable Development, have actively taken action to implement the Goals and targets. In 2021, the UN issued the latest Sustainable Development Goals Report, which systematically assesses progress in implementing the SDGs globally. According to the report, the world has made great strides in terms of the implementation of specific goals since 2015, in areas such as child mortality, immunization, power supply, clean energy generation and the establishment of marine conservation areas. Regarding policy advancement, 71 countries and the EU have announced 303 policies to promote sustainable consumption and production. 194 states and the European Union have signed the Paris Agreement, making a positive commitment to advancing the global response to climate change.

However, in many other aspects, the world is not on a sustainable path. Already, before COVID-19, the world was off-track to meet many of the goals, such as ending poverty by 2030, or ensuring zero hunger, with the population affected by moderate or severe food insecurity rising to 25.9% in 2019 from 22.4% in 2014¹⁷. Climate change, unsustainable exploitation of natural resources and degradation of the ecological environment have all accelerated in recent years, bringing the world to the brink of an environmental crisis. These challenges were exacerbated by the pandemic and its impact on people and economies. The global average SDG Index score for 2020 decreased from the previous year, for the first time since the SDGs' adoption in 2015¹⁸.

These gaps require the world to step up the 2030 Agenda's implementation, through ambitious and positive actions in the coming decade. On January 22, 2020, the UN launched a 'Decade of Action' for the SDGs¹⁹. It calls for accelerated sustainable solutions globally, enhanced global leadership, as well as transformed policies and local governance mechanisms. The UN calls on all stakeholders to take action to address global challenges within the next 10 years.

17. The Sustainable Development Goals report 2020 (United Nations publication). Available at <https://unstats.un.org/sdgs/report/2020/>

18. Sustainable Development Report 2021. June 2021. <https://www.sustainabledevelopment.report/reports/sustainable-development-report-2021/>

19. United Nations, "The UN launched the Decade of Action for the Sustainable Development Goals, and the Secretary General warned about the great four threats in the 21st century", January 22, 2020. Available at: <https://news.un.org/zh/story/2020/01/1049671>

2.3.2 The Road Map for Sustainable Development in the Asia-Pacific Region

Successfully achieving the SDGs requires a high level of synergy at global, regional, national and local levels. At the regional level, regional intergovernmental fora have been successively held in the Asia-Pacific, Europe, Africa, Latin America and West Asia, where discussions were conducted on how to efficiently push SDG implementation across countries and regions, in addition to knowledge exchange about each other's development experiences.

The Asia-Pacific is a critical region for achieving the SDGs globally. With two-thirds of the world's population, it is the most widely representative among the UN's five regional commissions. Progress in implementing the SDGs in the Asia-Pacific will determine whether or not the global goal of "leave no one behind" can finally be achieved. In 2018, the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) took the lead in proposing a regional SDG roadmap based on its baseline report, aiming to support comprehensive SDG implementation in the region. The roadmap highlighted support for carrying out the 2030 Agenda in the developing world, especially in least developed countries, landlocked developing countries, small island developing countries, countries experiencing conflict, post-conflict countries and countries with special requirements. The *Regional Road Map for Implementing the 2030 Agenda For Sustainable Development in Asia and the Pacific Progress Report 2019*²⁰ notes that the region needs to accelerate implementation of all SDGs. On the current trajectory, none of the 17 SDGs will be achieved by 2030. The report even found setbacks in clean water and sanitation (Goal 6), decent work and economic growth (Goal 8), and responsible consumption and production (Goal 12).

2.3.3 The European Union's Sustainable Development Strategy and Implementation Process

The European Union (EU) was an important driving force in creating the 2030 Agenda and 17 SDGs. Following its adoption, the EU proposed establishing the European Sustainable Development Forum based on the principles of responsibility and transparency. This Forum is a platform to support participation of all governments and non-governmental organizations in sustainable development to oversee the EU's implementation of the SDGs. More recently, the European Commission presented a new growth strategy, the European Green Deal: an action plan to achieve zero net greenhouse gases emissions by 2050, decoupling growth from the unsustainable use of resources and leaving no one behind²¹.

The EU and its member states are also facing many challenges. The 2020 report *Sustainable development in the European Union*²² shows that the EU has made substantive progress in areas such as poverty reduction (SDG 1), public health (SDG3), sustainable cities (SDG 11) and employment (SDG 8), due largely to improving the European economic

20. United Nations Economic and Social Commission for Asia and the Pacific, Regional Road Map for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific SDGs Progress Report 2019 (United Nations publication, Sales No.). Available at: https://www.unescap.org/sites/default/files/Regional_Road_Map_SDG_in_A-P_Progress_Report_2019.pdf

21. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

22. European Commission, Sustainable development in the European Union (2020 edition). Available at: <https://ec.europa.eu/eurostat/documents/3217494/11011074/KS-02-20-202-EN-N.pdf/334a8cfe-636a-bb8a-294a-73a052882f7f?t=1592994779000>. Most of the analysis on the SDG indicators is based on data up to 2019 and does not include the impact of the pandemic, which "is likely to have negative implications for the EU's overall progress towards the SDGs".

conditions until 2019. Strongest progress was recorded towards SDG 16 in “fostering peace and personal security, access to justice, as well as trust in institutions.” However, relatively large gaps remain in clean energy (SDG 7), as well as sustainable and responsible consumption and production (SDG 12) and protecting biodiversity (SDG 15). Two goals, in particular, SDG 13 on climate action and SDG 5 on gender equality, recorded a stagnation or moderate regress over the previous five years.²³

Implementing the 2030 Agenda is a step-by-step process, requiring countries to keep revising and adjusting their internal and external policies. In the EU, efforts centre around four areas: aligning national and regional strategies with policies and plans, coordinating and revising national and regional indicators, developing a mechanism for following-up implementation and evaluation, along with an effective governance system. However, the EU still faces obstacles to advancing in these areas.

2.3.4 China’s Sustainable Development Strategy and Implementation Process

China submitted its *National Plan on Implementation of the 2030 Agenda for Sustainable Development*²⁴ in 2016, and *China’s Progress Report on Implementation of the 2030 Agenda for Sustainable Development* in 2017 and 2019²⁵. The reports review China’s achievements and experiences in implementing the SDGs, as well as analyse the opportunities and challenges in doing so. They also put forward its guiding thoughts, general principles, and implementation pathways, while elaborating on specific approaches to implementing the 17 SDGs and 169 targets going forward.

The Chinese government opted for a step-by-step approach to include the 2030 Agenda in its strategies and actions, identified by seven focus areas:

- 1. Alignment of strategies:** this aims to integrate the 2030 Agenda into China’s mid- and long-term development strategies, as well as create synergies and complementarities between the international agenda and domestic strategies.
- 2. Institutional arrangement:** this focuses on institutions, mechanisms and policies that support implementation of the 2030 Agenda.
- 3. Social mobilization:** this seeks to strengthen the general public’s understanding and recognition of, as well as participation in, implementing the 2030 Agenda, which are key to doing so consistently and effectively.
- 4. Resource input:** this aims to effectively utilize domestic and international markets and resources, leveraging both public and private sector capabilities in implementation efforts.
- 5. Risk management:** despite being the world’s second largest economy, China still has a modest gross national income (GNI) per capita, unbalanced inter-regional and urban-rural development, as well as daunting development tasks calling for effective risk evaluation and management.

23. Ibid.

24. Government of China “China’s National Plan on Implementing the 2030 Agenda for Sustainable Development”, September 2016. Available at <http://www.gov.cn/xinwen/2016-10/13/5118514/pls/4e6d1fe6be1942c5b7c116e317d5b6a9.pdf>

25. China, Ministry of Foreign Affairs, “China’s Progress Report on Implementation of the 2030 Agenda for Sustainable Development”, paper prepared for the Ministry of Foreign Affairs, Beijing, China, August 2017. Available at: [www.chinadaily.com.cn/specials/China%27sProgressReport2\(CN\).pdf](http://www.chinadaily.com.cn/specials/China%27sProgressReport2(CN).pdf)

China, Ministry of Foreign Affairs, “China’s Progress Report on Implementation of the 2030 Agenda for Sustainable Development”, paper prepared for the Ministry of Foreign Affairs, Beijing, China, September 2019. Available at: https://www.fmprc.gov.cn/mfa_eng/topics_665678/2030kcxzyc/P020190924780823323749.pdf

6. International cooperation: the 2030 Agenda takes into account common interests of the international community as much as possible and is universally applicable. China joins the international community in deepening international development cooperation for effectively implementing the 2030 Agenda.

7. Effective monitoring and evaluation: these are key to assessing the achievements, challenges and inadequacies in the process of implementing the 2030 Agenda, allowing optimized policy options and best practice summarization.

2.3.5 Sustainable Development Assessment at the City Level

Cities are vital to achieving the SDGs, as centres where the population, economy, energy, consumption, production and public services are concentrated. In terms of setting priorities and developing strategies aligned with the SDGs, as well as monitoring and assessing progress, a few cities and jurisdictions are leading the way.

In 2017, the Sustainable Development Solutions Network released the first US Cities SDG Index²⁶, ranking the top 100 American cities in terms of population based on their performance on 16 out of the 17 SDGs, aiming to help city leaders meet myriad sustainable development challenges impacting their cities. The latest report, *The 2019 US Cities Sustainable Development Report*²⁷, shows that clean water supply and health are indicators in which cities generally have made progress, while still facing great obstacles in realising affordable clean energy. In general, there is room for improvement in gender equality and income parity, while comprehensively meeting all SDGs remains a challenge. There is still a long way to go before American cities, even those at the top of the ranking, could fully realize the SDGs.

Progress assessment at the city level is essential for effective SDG implementation, as it can guide and motivate local governments to take action. The Cities SDG Index helps administrators and planners analyse progress and gaps, as well as prioritize policy and investment areas, so as to realize the SDGs in their cities in a balanced way. Furthermore, the Index can also be used as a communication tool through media coverage and promotion, to encourage civil society to play an active part in supporting the goals.

26. Prakash, M., and others. *The U.S. Cities Sustainable Development Goals Index 2017: Achieving a Sustainable Urban America* (New York, Sustainable Development Solutions Network (SDSN), 2017).

27. Lynch, A., LoPresti, A., Fox, C., *The 2019 US Cities Sustainable Development Report* (New York, Sustainable Development Solutions Network (SDSN), 2019).

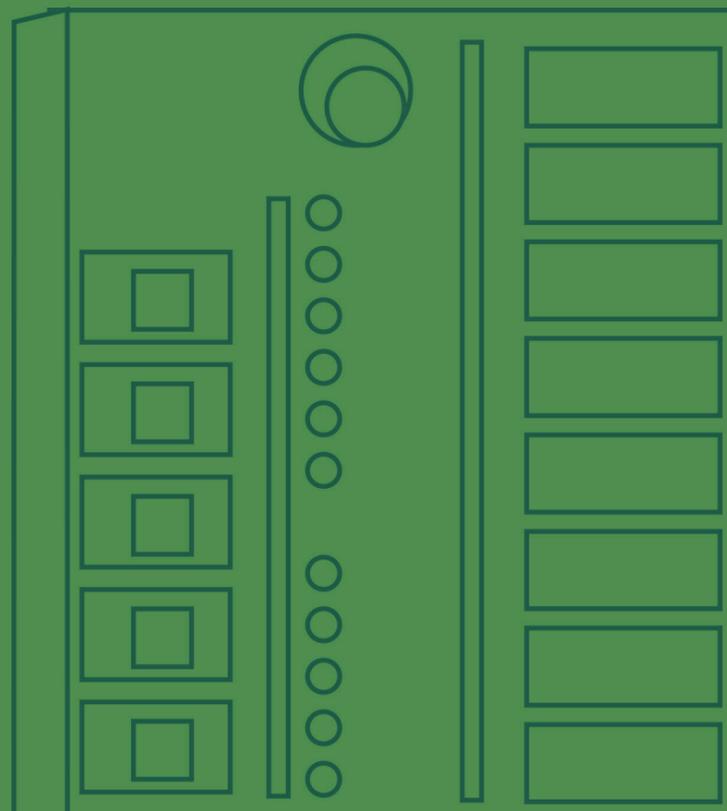
CHAPTER THREE

Shenzhen's Actions and Measures for Implementing the SDGs

- 3.1 Shenzhen Sustainable Development Plan: the Goals
- 3.2 Shenzhen's Strategies for Implementing the SDGs
- 3.3 Shenzhen's Sustainable Development Experience

Abstract:

Guided by concepts put forth by the Chinese government on ecological civilization and sustainable development in the new era, Shenzhen has comprehensively benchmarked the UN SDGs and phased its strategy to achieve the SDGs in different stages (by 2020, by 2025, and by 2030). It has planned and implemented six strategies, namely: "Innovation-led high-quality development," "Innovative environmental management," "Innovative social security," "Innovation and modernization of social governance," "A support service system for innovation" and "A talent support system for innovation." As well as these strategies, there are a series of matching policies and measures to promote implementation and evaluation of the SDGs. Through this strategic, phased approach, other Chinese cities can learn from Shenzhen's sustainable development experience.



Building inclusive, safe and sustainable cities is an important goal of *the 2030 Agenda for Sustainable Development* and a common development theme for cities across the world. In 2018, China's State Council approved the establishment of a national innovation demonstration zone for implementation of the 2030 Agenda. Shenzhen was one of the first cities selected for this pilot and chose the theme "Innovation-led Megacity Sustainable Development", with a focus on building resource and environmental carrying capacity and social governance support. Its projects in integrated sewage treatment, comprehensive waste utilization, ecological restoration and artificial intelligence technologies are good example of an efficient use of resources, ecological governance, healthy development and social governance modernization for the sustainable development of megacities (See case studies in Chapter 7 for more details).

Shenzhen is moving forward as a demonstration pilot zone for socialism with Chinese characteristics and striving to become a pioneer in sustainable development at the same time²⁸. In doing so, Shenzhen is fostering and practicing the idea that "lucidwaters and lush mountains are invaluable assets," in efforts to create a safe and efficient production space, a comfortable living space while protecting and valuing natural capital and resources. In providing practical experiences for implementing *the 2030 Agenda for Sustainable Development*, Shenzhen also wants to become a workable, replicable and scalable sustainable development model.

As a megacity formed by migration, with an economy and population expanding rapidly, Shenzhen faces many problems in its economic, social and infrastructure development model. These include the rapid expansion of the urban population, an increasing number of residents without official household registration, an inadequate supply of public services, such as education and medical care, unbalanced and uncoordinated regional development, as well as increasing urban security and social governance pressures. These challenges have become bottlenecks to the sustainable economic and social development of the city.

To address them, based on Chinese concepts, such as ecological civilization, and sustainable development principles, the Shenzhen municipal government issued the *Shenzhen Sustainable Development Plan (2017-2030)*, with the SDGs as benchmarks. It launched a series of major projects for effectively implementing the SDGs, and high-quality urban development. The Plan identified three stages and set related goals to be achieved by 2020, 2025 and 2030, in line with the city's 5-year plans.

3.1 Shenzhen Sustainable Development Plan: the Goals

3.1.1 Development Goals for 2020

By 2020, Shenzhen should be a leader in China in the quality of economic, social and environmental sustainable development; explore and formulate a systematic solution for the modernization of environmental and social

28. Demonstration Polit Zone for Socialism with Chinese Characteristics is an initiative proposed by the State Council of China to build an innovation-driven metropolis striving for high-quality development and SDGs achievement. On the background is China entering a new era of socialism development with Chinese characteristics since the 19th Communist Party of China (CPC) National Congress in 2017. Announced in 2019, Shenzhen is the only demonstration zone at the time of publication of this report.

governance; become a model city among national innovation demonstration zones for implementation of the 2030 Agenda for Sustainable Development and share its experience and lessons. To meet this vision, the Plan identifies five main development goals: **(1) further improve the innovation ecosystem; (2) improve people's livelihoods; (3) create a safer and more liveable modern city; (4) continue to improve the environment; (5) improve its level of internationalization.**

3.1.2 Development Goals for 2025

By 2025, Shenzhen aims to become an international leading city for sustainable development, further improving its green development model, and constantly enhancing the internal innovation impetus for economic growth. The aim is for emerging industries to be more prominent engines of growth to benefit all citizens. The main development goals by 2025 are as follows: **(1) a dynamic and innovative city; (2) a fair and accessible public service system; (3) a liveable and business-friendly environment; and (4) an open and inclusive international city.**

3.1.3 Development Goals for 2030

By 2030, Shenzhen aims to become a global innovation city for sustainable development, creating a series of sustainable development experiences that can be replicated globally, with substantial contributions to China's implementation of the 2030 Agenda. The main development goals for 2030 are for Shenzhen to become: **(1) an emerging global city that connects to the world; (2) a flourishing and inclusive international city of innovation; (3) a prosperous and fair city full of vitality; and (4) a liveable and harmonious green city.**

3.2 Shenzhen's Strategies for Implementing the SDGs

3.2.1 Innovation-led High-quality Development

To drive innovation-led high-quality development, Shenzhen has and will continue to accelerate and strengthen efforts in four key areas:

Green transformation and development. Since the Catalogue of Investment Guideline of Shenzhen published in early 1995, Shenzhen has restricted labour-intensive production with high water and energy consumption and pollution. The *Catalogue of Industry Guidelines for Shenzhen* published in 2003 and the *Catalogue of Adjustments and Optimization of the Industrial Structure and Industry Guidelines for Shenzhen* published in 2016 raised further the requirements for industrial development to speed the transition to green sectors. The elimination of industries with high levels of energy consumption, pollution and emissions along with low-end manufacturing industries has accelerated. Meanwhile, high-tech, energy-saving and environment-protecting industries have been promoted.

Strengthening the efficient use of land resources. Shenzhen has and will continue to speed up land quality

improvement and advance its efficient utilisation. Further, Shenzhen is constantly researching and formulating policies for efficient land use, strictly adhering to the environmental protection red line, a national strategy to demarcate areas with unique ecological functions and protect them. The city reinforces efforts to investigate and demolish illegal construction projects, strengthens implementation in land preparation and urban renewal, accelerates the upgrade and transformation of old industrial areas, as well as improves land-use efficiency.

Optimizing the business environment. Shenzhen has issued *20 Regulations on Business Environment Reforms* and the “Four hundred-billion-yuan” plan to support private sector development, by reducing the burden of local enterprises, expanding the scale of lending risk compensation and providing billions in enhancement funds. It has also carried out a series of policies to create an environment more open to trade and investment, more cost-effective for industrial development, more attractive for talent development and with a more efficient and transparent government, to strengthen the vitality of market players and encourage high-quality development.

Promoting the “Shenzhen Quality” strategy: building a quality-oriented city. This strategy guides all departments, trade, and fields in quality improvement. Production license management for industrial products is also being implemented as part of the strategy.

3.2.2 Environmental Governance

Shenzhen is striving to break through core environmental protection technology challenges and key bottlenecks, enhancing pollution prevention and control, while accelerating water, atmospheric and marine environmental protection along with ecological construction.

In terms of water governance, the water quality of major rivers in the city continues to improve. Shenzhen has adopted the river chief, lake chief and bay chief systems, supporting volunteer river chiefs as an important public force for water governance and establishing a China Volunteer River Chief Institute (Shenzhen) and Academician Workstation.²⁹

For air quality, Shenzhen has implemented the “Blue Shenzhen” Sustainable Action and has built, in accordance with national standards, its first grid-based air monitoring system covering all streets. As of June 2020, Shenzhen’s comprehensive air quality index ranked third among the 168 key cities across the country.³⁰

For marine environmental protection, Shenzhen has taken the lead in China in issuing the *Decision on Acting as the Pioneer for Building China into a Maritime Power and Expediting the Construction of a Global Maritime Central City* and its supporting implementation plan, as well as released the Shenzhen Marine Environment Protection Plan (2018-2035). It has also obtained approval for building a marine economic development demonstration zone.

3.2.3 Social Security Development

Shenzhen is focused on improving the health and well-being of its citizens through:

Advancing institutional development in the health sector. Shenzhen has advanced legislation in the health field

29. Since 2016, the Chinese government implemented a policy designating local government officials to be in charge of the management and protection of main waterbodies in their jurisdiction. The responsible person for the waterbodies is referred to as river chief, lake chief, bay chief.

30. Ministry of Ecology and Environment data available from http://www.gov.cn/xinwen/2020-07/17/content_5527706.htm

through laws and standards, improving the assessment evaluation system, and incorporating health into all policies.

Improving disease prevention and control system. Shenzhen has fully implemented the integrated service model for “prevention, treatment and management” for key chronic diseases such as hypertension and diabetes, rolled out tuberculosis screening programs among people over 65 years old and diabetics, and has newly implemented a sequential poliomyelitis immunization program for children.

Continuously increasing health care resources. A modern hospital management system has been established. Shenzhen was one of the first national pilot cities for the reform of public hospitals and is a national model city for the comprehensive reform of public hospitals. It also leads in reforming grass-roots medical groups and the “Luohu medical reform model”³¹ has been selected as a best-practice case for deepening national medical reform at the district-level by the National Health Commission.³²

3.2.4 Social Governance

Shenzhen has made efforts to modernize social governance at the community level, provide more professional social services, use information technology in municipal management, carry out targeted safety supervision and scientific emergency management. By doing so, it has created a social governance system based on collaboration, participation and common interests.

Providing professional social services. There are more than 13,000 civil society organizations and 8,700 professional social workers in Shenzhen. They play an increasingly important role in social assistance, legal aid, dispute mediation and other key fields of social governance.

Promoting the use of information technology in municipal management. Shenzhen took the lead among the first-tier cities and established a large dynamic database that integrates data on population, companies, housing and geospatial information.

Promoting targeted safety monitoring. Shenzhen investigates and manages municipal public safety risks, as well as implementing projects to improve and strengthen safety in production processes.

Promoting corporate social responsibility. In recent years, Shenzhen has issued the *Opinions on Further Promoting the Building of Corporate Social Responsibility* and the *Working Plan on Taking the Lead in Creating Social Governance Patterns Based on Collaboration, Participation and Common Interests*.

3.2.5 A Support Service System for Innovation

Shenzhen has accelerated development of a framework system for science and technology industrial innovation, promoted the construction of state-level independent innovation demonstration zones and piloted innovative reforms across the board.

31. Luohu medical reform model refers to the Luohu District’s grassroots, health-oriented medical community model and the introduction of two key provisions related to the division of different level of institutions and managing and awarding medical funds.

32. China, National Health Commission, “Key Cases for Deepening Medical Reform”, June 2017. Available at: [In Chinese] <http://www.nhc.gov.cn/wjw/mtbd/201706/685e8b46e2944424a61a9871acf6943c.shtml>

Continuing to deepen reform of the science and technology management system. Shenzhen has established evaluation measures and tools for major science and technology projects, established the Shenzhen Municipal Science & Technology Review and Management Center, announced the *Regulations on State Independent Innovation Demonstration Zones in the Shenzhen Special Economic Zone*, set up management methods for the “Shenzhen-Hong Kong Innovation Circle” project promoting cooperation in innovation and hi-tech industries, as well as issued 20 management regulations on research fund management, giving universities and research institutes greater autonomy in managing science and technology funding.

Launching the “Race to the Top” Project for major science and technology research breakthroughs. Shenzhen has carried out core technology research in key areas, investing a total of CNY 738 million (USD 104 million) in recent years.

Attracting and cultivating influential experts. 13 teams were newly selected to be part of the “Pearl River Talent Program” to support innovation and entrepreneurship teams. Shenzhen has also brought in a total of 57 Guangdong innovative research teams and more than one hundred domestic and overseas high-level innovation teams of influential experts.

Creating a “core hub” of innovative platforms to implement innovation-driven projects that bolster areas of weakness in technology. With a focus on large-scale scientific facilities and high-calibre organizations in cutting-edge fields, Shenzhen has carried out major scientific research projects, stepped up construction of two nationally renowned government-backed laboratories at the forefront of science and innovation – the Peng Cheng Laboratory and the Shenzhen Bay Laboratory, as well as pushed forward the establishment of 10 basic research institutions.

3.3 Shenzhen’s Sustainable Development Experience

Shenzhen grew from a processing trade-based city with few traditional resources to a city, economy and society that pioneers innovation. Its successful experience in becoming a national demonstration pilot city and the first national innovation demonstration zone for sustainable development deserves to be learnt from and provides a valuable reference for the sustainable development of other cities.

3.3.1 The Regulatory Framework

Shenzhen was among the first cities to integrate the concept of sustainability into its development approach and planning, paying attention to the coordinated development of the economy, society and environment. In the *Shenzhen Sustainable Development Plan (2017-2030)* and *Plan on Constructing a National (Shenzhen) Innovation Demonstration Zone under the Sustainable Development Agenda (2017-2020)*, a design and implementation mechanism for sustainable development was proposed. A coordination mechanism among departments at the municipal level was put in place, paving the way for implementing the sustainable development plan.

3.3.2 Innovation-driven Transformation and Development, and Quality Economic Growth

Relying on innovation for economic transformation and industrial upgrading has been the main driver behind Shenzhen becoming a world-class manufacturing and production base for high and new-tech companies. As early as the 1990s, Shenzhen made the decision to develop its high and new-tech industries, while restricting the development of low value-added sectors (i.e., sectors that process imported raw materials, manufacture products according to imported samples, assemble imported parts and repay loans for imported equipment and technologies with products).

At the same time, Shenzhen also had an overarching strategy of revitalizing the city through science and education, by prioritizing resources for these two sectors. In doing so, Shenzhen quickly transformed scientific and technological achievements into concrete production outcomes. Around 2000, due to a shift of investments from the Pearl River Delta to the Yangtze River Delta, foreign investments in Shenzhen slowed, and the city’s development was under considerable pressure. Rather than compete for foreign investment by lowering standards, Shenzhen decided to shift its focus to foster innovation, releasing its *Decisions on Improving the Innovation System in the Region, and Promoting Sustainable and Fast Development of High and New-tech Industries*. The Decisions encouraged local companies to master core technologies and cultivate core competitiveness. As a result, Shenzhen gained market-share in these sectors and realized high-quality economic growth.

3.3.3 Green Development

Shenzhen took the lead in establishing a management system for protecting the environment in 2005, defining 974 square kilometres, or nearly half of Shenzhen’s 1,953 square kilometres of land, as ecological protection areas. The Administrative Regulations of Shenzhen Municipality on the Basic Ecological Control Area stipulated that no construction activities are allowed in ecological control areas, except the construction of major road facilities, municipal public facilities, tourism facilities and parks. Moreover, to increase per capita public green areas and green coverage rates, greenbelt parks and corridors were to be built in urban areas. By connecting these green corridors, ecological functions of the green areas was enhanced. The improved urban environment was proven to attract people, eventually becoming a driver of the city’s economic growth and social progress.

3.3.4 Diversity and Inclusiveness Culture

The long-term influence of a market-oriented economy and Shenzhen’s history as an immigrant city gradually formed a pragmatic and inclusive urban culture and a favourable environment for innovation and entrepreneurship. A good business environment based on the rule of law helped to foster a strong and fairer economy, attracting workers from across China.

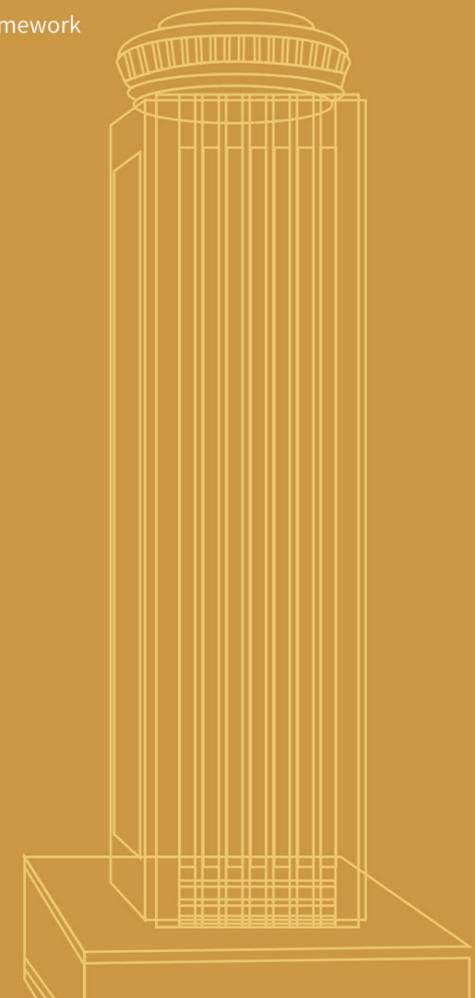
3.3.5 Sharing the Development Dividend Through Opening-up and Cooperation

As a pioneer city, Shenzhen has always positioned itself in relation to global partnerships and competition, setting goals and expanding development areas according to international standards. To promote international cooperation, it established the Shenzhen Foundation for International Exchange and Cooperation, through which Shenzhen paired with 65 cities as international friendship cities or sister cities. The level and scale of international conferences held in Shenzhen continue to increase each year. In the case of Shenzhen, opening-up was the basis for enhancing the free flow of inputs of production, in particular high-quality production factors, to increase the value addition of its products. Through cooperation, development dividends can be shared, and development costs can be lowered. Opening-up and cooperation allowed Shenzhen to narrow the technology gap and share its experiences with other cities in China and the world.

CHAPTER FOUR

Methodologies for Assessing the Implementation of the SDGs

- 4.1 Creating a Methodology for Assessing the Implementation of SDG in Urban Areas
- 4.2 Traditional Sustainable Development Assessment Methods
- 4.3 Chinese City SDGs Assessment Index (CCSAI): The Theoretical Framework
- 4.4 The Chinese City SDG Assessment Index: The Methodology



Abstract:

The SDG assessment index system developed by the United Nations is more suitable for national level evaluations and needs to be adjusted when dealing with assessments at city-level. This chapter develops a 5P-based methodology combining the requirements of ecological civilization and the quantitative assessment of SDG implementation progress developed by the UN. It describes the methodology to build the Chinese Cities SDG Assessment Index (CCSAI) based on 108 indicators. For Shenzhen's assessment, 52 indicators are selected on the basis of data availability. All indicators are compared to a 2000 baseline for the assessment of progress and evaluated against their 2030 targets to calculate implementation gaps.

Cities are vital vehicles for human beings to develop civilizations and wealth, as they are where most economic and social activities take place. They are thus critical to effectively achieving the SDGs. As such, assessing implementation of the SDGs in urban areas is of great value. However, of the 232 SDGs' indicators, more than half lack corresponding data at city-level. Therefore, the methodology for assessing the SDGs at global and national levels is not directly applicable to assess SDGs progress at the urban level, calling for a new methodology. In this chapter, we will use the 5Ps, namely People, Planet, Prosperity, Peace and Partnership, to create a methodology and indicator system for assessing SDGs implementation in urban areas.

4.1 Creating a Methodology for Assessing SDG Progress in Urban Areas

Cities are critical to realizing the 2030 Agenda

As key places for driving social progress, civilizational development and economic gains, cities play a leading role in global development. Therefore, whether cities develop sustainably determines sustainable development prospects for the whole world. In past centuries, the proportion of the global population living in urban areas relative to the entire population doubled every 50 years. The urban population rate was 6.4%, 13.6%, and 28.2% respectively in 1850, 1900, and 1950. In 2008, the urban population reached 50.5% of the total, exceeding 50% for the first time. By 2018, this rate reached 55%, and is estimated to reach 68% by 2050.³³ As the world's population moves to urban areas, making cities and human settlements inclusive, safe, resilient and sustainable is key for realising sustainable development globally, represented by the 11th SDG, Sustainable Cities and Communities.

Emerging urban problems call for an urban sustainable development model

Urbanization coincides with rapid economic and social development, the process of which has often increased people's living standards and quality of life. However, given the limitations of resources and environmental carrying capacity, there are many problems unique to cities. For years, cities in developing countries have sprawled, resulting in urban challenges that draw increasing attention from governments and the public, including land, water and air pollution, among other challenges. Making urban development more sustainable, improving people's well-being and the co-existence of humans with nature have become areas of major concern to the international community.

The global SDG assessment methodology is not directly applicable at the urban level

Since the World Commission on Environment and Development (WECD) first proposed the concept of sustainable development in the report *Our Common Future* in 1987, there has been no shortage of methodologies and indicator systems for assessing sustainable development. Given different understandings of sustainable development, there has been disagreement in choosing assessment methods, indicators and weightings, making it difficult to establish a globally recognized and universally applied methodology. The 2030 Agenda and subsequent assessment system made

33. World Urbanization Prospects 2018 Highlights (United Nations publication, Sales No. E19.XIII.6). Available at: <https://population.un.org/wup/Publications/Files/WUP2018-Highlights.pdf>

up of 232 indicators (as of 2019) helped establish a standard system with unified evaluation methods and comparable evaluation results.

However, issues still exist when the methodology for assessing the SDGs at the global and national level are directly applied to SDG evaluation in urban areas. Indicators selected and designed for assessing SDGs at the national level may not be applicable to assessing SDGs at the urban level. For example, indicators for assessing the proportion of renewable energy consumption out of the total energy consumption are difficult to manage at the city level, as the type and source of electricity provision is managed at the provincial or regional level. In contrast, an indicator for assessing SDG progress in an urban area may not be a good indicator for assessing national SDG progress. A new methodology is required for appropriately assessing SDGs in urban areas that is based on SDG indicator systems and takes into account urban characteristics.

4.2 Traditional Sustainable Development Assessment Methods

Comprehensive indicator assessment method: weak comparability

The comprehensive indicator assessment method is one of the traditional methods commonly used for assessing sustainable development. Sustainable development pursue economic performance, social equity and environmental sustainability. So, comprehensive indicator assessment methods are based on an assessment system composed of 3E goals: economy, equity and environment. Economic performance refers to a high economic growth rate at the macro-economic level, or maximization of profits or income at the micro-economic level. Social equity refers to equity among different social groups or individuals of the same social group, including intergenerational equity. Environmental sustainability is defined as meeting future needs for human development within natural boundaries.³⁴

Some research based on the 3E assessment framework proposes a multi-dimensional assessment system focused on the economy, environment and (social) equity, including resources, ecosystems, population and society. Some simplify the 3E framework to use fewer dimensions, such as resource and environment input, economic and social output, along with sustainable development status and dynamics. There is no standardised method: assessment systems often use different indicators, they attach different weightings to the indicators, while biased by considerable subjectivity in choosing the level of dimensions and complexity of the assessment itself. Overall, these assessment systems produce non-comparable results.

Monetary value assessment method: poor applicability

The monetary value assessment method evaluates the overall value of a city over different periods by converting it to monetary units. It measures the market value of basic factors for sustainable development such as resources

34. Jiahua, Pan, "Rethink on Economy of Sustainable Development", Renmin Daily, 29 May 2015.

and environment. The values of each factor are added up to reflect the overall performance of a city's sustainable development. Traditional economics theories assume that decision-makers are rational, and that ecological problems are the result of market failures to account for the externality of environmental impacts in resource pricing. As remedies, various methods can be used to restore the values of different environmental factors, to effectively evaluate the overall sustainability of a city. For example, we can assess ecological losses based on market inputs, such as ecological restoration and environmental governance; as well as assign economic values to social development based on consumers' explicit preferences for social equity and fairness. The World Bank's national economic accounting, started in the 1980s, is based on such an assessment method. In 2004, the Chinese government launched a green national economic accounting based on the same principles.

The monetary value assessment method is not widely accepted by the academic community and public, and is not applicable universally. Three reasons can explain why. Firstly, it lacks a basis in ethical values. There is no basis in ethics for measuring the market value of one's health, life, or the extinction of a species.³⁵ Secondly, it lacks scientific support. There is not enough research on the pricing mechanism for heavy metal pollution in soil and air pollution, for example, to effectively incorporate the harm in the cost of production. Thirdly, methods for determining the monetary value of different environmental goods vary considerably and are often complex, resulting in un-comparable results.

Overall, existing sustainable development assessment methods, whether the comprehensive indicator assessment method or the monetized value assessment method, are based on the theory of value in classical economics, which is the development paradigm of industrial civilization. The latter emphasizes economic growth over environmental sustainability and intergenerational equity. Both the 3E-based indicator assessment method and ecological monetized value assessment method measure development primarily by economic growth, neglecting environmental sustainability and intergenerational equality. The application of such methods in policy-making results in increasing challenges in implementing environmental sustainability.

4.3 Chinese City SDGs Assessment Index (CCSAI): The Theoretical Framework

Sustainable development: the paradigm of ecological civilization

Sustainable development under the paradigm of industrial civilization has been explored in theory, method and practice for years, but still faces multiple challenges and difficulties. China is proposing to move from a development paradigm based on industrial civilization to one based on ecological civilization, focused on achieving harmony between humans and nature, and improving the theoretical underpinnings, research methodologies, policy decisions and practices. China's innovation in introducing and mainstreaming ecological civilization concepts and systems have some important lessons for the global realization of the 2030 Agenda.

35. Jiahua, Pan, "Rethink on Economy of Sustainable Development", Renmin Daily, 29 May 2015.

As China's economy and society transform and develop, the environment is no longer considered valueless, but is gradually being recognized as an important part of social welfare and productivity. Conclusions such as "the environment is the people's livelihood", and "lush mountains and clear waters are our invaluable assets" illustrate the transition, reflecting a dialectical unity that acknowledges and emphasizes the value of nature.

According to the Chinese conceptual framework, the core of sustainable development lies in ensuring the peaceful co-existence of humanity and nature. Human activities must respect, comply with and protect nature; otherwise, dire consequences could ensue. The theory of sustainable development under the paradigm of ecological civilization emphasizes respecting, complying with and promoting human-nature harmony, instead of transforming, monetising or destroying nature for humanity's sake. As Chinese experts see it, the ethical basis of the paradigm of ecological civilization is no longer utilitarianism, as it is currently perceived for the paradigm of industrial civilisation. That is replaced with respect for human beings and nature and the pursuit of eco-equity and social justice. As a result, promoting production and accumulating wealth go hand in hand with environmental protection, pollution control, and an efficient use of natural resources. The theory for assessing sustainable development under the paradigm of ecological civilization requires seeking social and ecological equity and ensuring ecological security.

The 5Ps

In the UN 2030 Sustainable Development Agenda the development of the 5P concept is an important innovation and key conceptual framework for sustainable development. The 5Ps include:

"People" stands for everybody in the sense of "leave no one behind"; it does not refer to individuals or ethnic groups, nor to the public or groups in general. The "People" concept focuses on human beings, including eliminating poverty and hunger in all forms, so that all people can fulfil their potential in a healthy environment, equally and with dignity.

"Planet" refers to the natural resources and habitat for human development. It addresses not only local environmental pollution, ecological degradation and resource exhaustion, but also emphasizes issues affecting the future survival of humanity, including climate change, a healthy marine environment, and ecosystem biodiversity. This means maintaining a peaceful coexistence between humanity and nature, building global environmental security, pursuing sustainable consumption and production, effective management of natural resources, taking prompt action to address climate change and ensuring global climate security.

"Prosperity" goes beyond simple economic growth and enrichment of material assets, embracing sustainable, green, and common prosperity. It aims to promote economic transformation and progress, realizing sustainable prosperity so that everyone can live a prosperous and fulfilling life. It also seeks to achieve economic, social and technological advancement, while coexisting peacefully with nature.

"Peace" is not a simple concept, or the opposite of "war". It means social inclusiveness and harmony. It strives for social justice and harmony, focusing on creating a society free from fear and violence that is peaceful, fair and inclusive, respecting different cultures, ethnicities and belief systems, as well as supporting mutual tolerance between individuals and societies.³⁶

"Partnership" emphasizes mutually beneficial cooperation between countries, as well as between countries

36. Pan Jiahua, Chen Zi. A transformational agenda for sustainable development in 2030[M]. Social Sciences Literature Press: Beijing, 2016: 6-7

and non-state actors in the international governance system. It aims to improve and promote cooperation between all stakeholders, increasing the participation of all individuals in efforts to meet the needs of the poorest and most vulnerable.³⁷

Sustainable development based on the 5Ps goes beyond the traditional sustainable development concept based on the 3Es, economy, (social) equity and environment. First, two more dimensions are included: peace (social justice and harmony) and partnerships (implementation). Peace is more of a governance goal for a country or region, providing the foundation for meeting all SDGs, while improving partnerships, addresses international or trans-regional governance, providing critical support to the Goals. Second, the 5Ps have a richer content and stronger policy directive than the 3Es. The "People" concept incorporates more than traditional social equity to include the key pledge of the 2030 Agenda: "leave no one behind". The "Planet" concept refers to more than traditional resources and environmental protection. It highlights the significance of the stability of the ecosystem. The "Prosperity" concept, in addition to the traditional idea of overall prosperity, focuses more on each person's prosperity within natural boundaries.

4.4 The Chinese City SDG Assessment Index: The Methodology

4.4.1 Selection of Indicators

Indicators' selection is critical for progress' assessment. Based on specific research objectives, different indicator selection methods can be adopted. In this study, indicators are selected based on the following three criteria:

(1) Indicators applicable to urban SDG evaluation from the 232 SDG global indicators (2019 list).

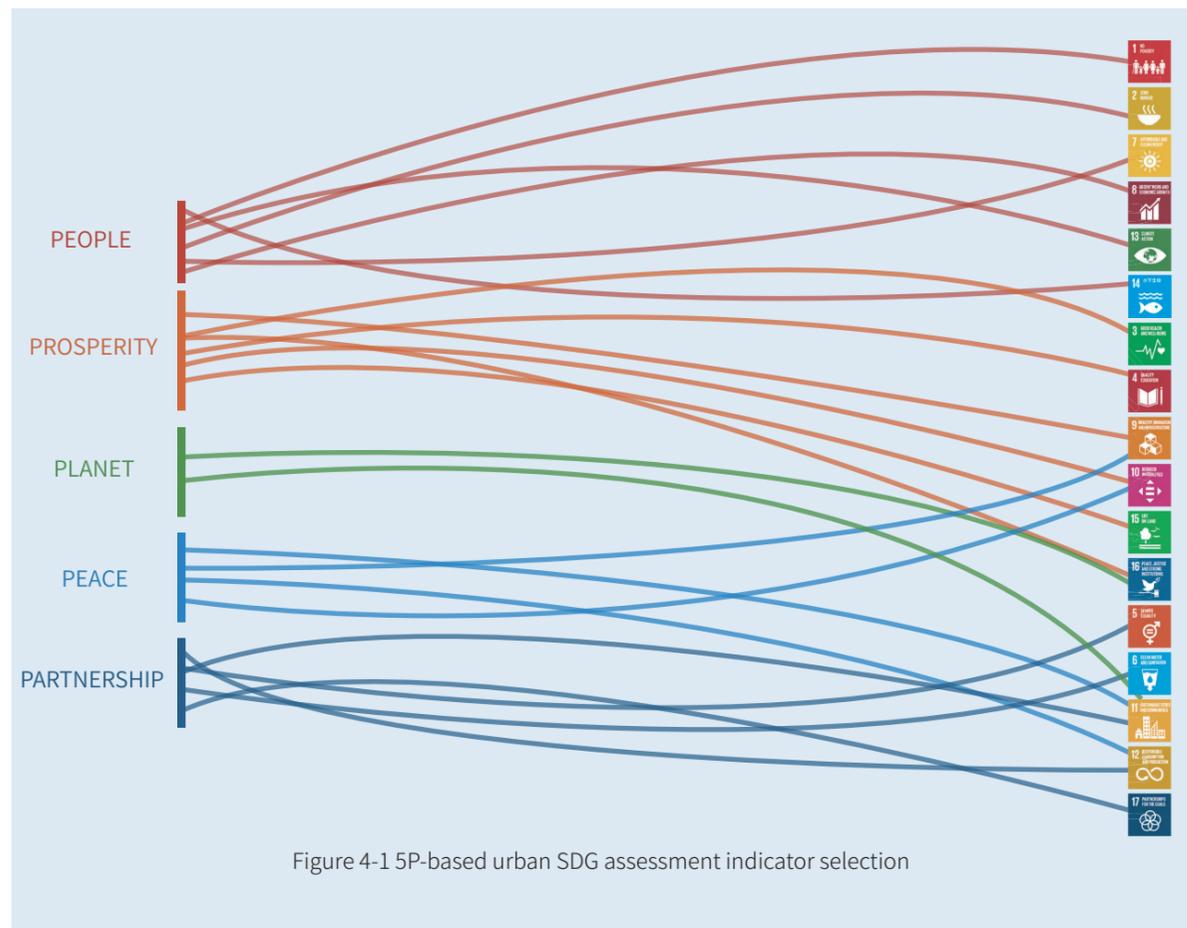
(2) Indicators selected from China's five-year plans or various urban planning processes. Promoting urban development via urban planning is a widely recognized practice. China's consecutive "five-year economic and social development plans" have provided road maps for urban growth and built a foundation for urban development data collection. The continuity of data from the five-year plans enables the evaluation of dynamics and trends in different areas. Besides the five-year plans, departments of local and municipal governments often conduct special planning in various areas, such as spatial structure, economic development, environmental protection, social welfare, etc. These special planning efforts offer another source of data and some of their indicators are included in the CCSAI for a more comprehensive overview of SDG progress.

(3) Other relevant indicators with commonly available data at Chinese municipal level. The CCSAI includes a third category of indicators reflecting the correlation between indicators, with high policy relevance to guide future urban development. Examples of such indicators include decoupling indicators that reflect the elasticity between economic/social development and environmental resource consumption, as well as landscape fragmentation indicators, measuring the level of segmentation of large habitats or smaller land areas following urbanisation, with significant impact on ecosystem conservation. Although the landscape fragmentation indicator has limited historical

37. Ibid.

data for a robust analysis, evaluation data can still be obtained from remote-sensing image data at different stages.

Based on the 5P concept and indicator selection criteria discussed, this study builds a generic CCSAI consisting of five dimensions – the 5Ps – totalling 108 indicators (Figure 4-1). The dimension of “People” contains 42 indicators, “Planet” contains 13 indicators, “Prosperity” 43 indicators, “Peace” and “Partnership” 5 indicators each. For details, see Table 4-2. In the case of Shenzhen, out of the 108 listed indicators, this assessment report selected 52 indicators, based on data availability as listed in the Appendix.



5P	SDGs	Urban indicators	SDGs serial No.
PEOPLE	Goal 1. End poverty in all its forms everywhere	Average age of urban population	PPL-G010001
		Basic pension insurance participation rate	PPL-C010103
		Basic medical insurance participation rate	PPL-C010102
		Share of fixed-asset investment in education, health and social programs	PPL-C010202
		Population below the national poverty line	PPL-C010101
	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Disposable income of residents	PPL-T020101
		Share of fixed-asset investment in agriculture, forestry, stock-raising and fishery	PPL-C020201
		Consumer price index	PPL-C020101
		Share of expenditure for agricultural, forestry and water expenditure in total fiscal expenditure	PPL-T020001
		Share of expenditure for grain and edible oil reserves in total fiscal expenditure	PPL-C020102
	Goal 3. Ensure healthy lives and promote well-being for all at all ages	Number of elderly nursing home beds	PPL-C030108
		Share of urban employees with medical insurance	PPL-C030109
		Life expectancy	PPL-G030001
		Number of doctors per 10,000 population	PPL-C030101
		Number of hospital beds per 10,000 population	PPL-T030801
		Mortality rate of children under five	PPL-C030102
		Infant mortality rate	PPL-C030201
		Early cancer diagnosis	PPL-C030106
		Premature mortality of major chronic diseases	PPL-C030107
		Vaccination rate	PPL-C030105
		Maternal mortality rate	PPL-C030103
		Deaths from traffic accidents per 100,000 people	PPL-C030104
		Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Student-teacher ratio in general primary schools
	Student-teacher ratio in general secondary schools		PPL-C040102
	Degree of citizenization ³⁸		PPL-T040302
	Participation rate of organized learning (pre-school)		PPL-C040201
	Collage teaching staff per 10,000 population		PPL-T040001
	Over-15 illiteracy rate		PPL-C040103
Average years of schooling	PPL-C040104		
Share of education expenditure in GDP	PPL-T040301		

38. Citizenization refers to the change of residents' household registration status in the process of urbanization. Resident's status on the household registration system is changed from "agricultural" to "non-agricultural", granting them full status of urban residents but losing their farmland entitlements.

5P	SDGs	Urban indicators	SDGs serial No.	
PEOPLE	Goal 5. Achieve gender equality and empower all women and girls	Whether a city has formulated legal frameworks to promote, practice and monitor equality and the elimination of gender discrimination	PPL-C050101	
		Share of women in the municipal People Congress representatives	PPL-C050102	
		Share of women in leadership positions (urban)	PPL-C050103	
	Goal 6. Ensure availability and sustainable management of water and sanitation for all	Water consumption per unit of GDP	PPL-C060102	
		Proportion of sewage centrally treated in wastewater treatment plants	PPL-C060101	
		Good quality water ratio (Surface water above category III water quality)	PPL-C060201	
		Severity of water shortages	PPL-C060202	
	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all	Energy consumption per unit of GDP	PPL-T070301	
		Share of renewable energy in energy consumption	PPL-C070102	
		Per capita electricity consumption	PPL-C070103	
		Per capita gas supply	PPL-C070104	
		Share of population with access to electricity	PPL-C070101	
	PROSPERITY	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Urban registered unemployment rate	PST-C080201
			Number of urban employees with unemployment insurance	PST-T080801
			Per capita GDP	PST-C080101
Share of tertiary industry value-added in GDP			PST-T080301	
Share of tourism value-added in GDP			PST-C080102	
Decoupling indicators between energy consumption and economic growth			PST-T080401	
Ecological footprint			PST-C080103	
Share of expenditure for social security and employment in fiscal expenditure			PST-C080501	
Whether a city has developed and operated a youth employment strategy as a separate strategy or as part of an urban employment strategy			PST-T080101	
Overall labour productivity			PST-C080104	
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		Patents per 10,000 population	PST-T090001	
		Carbon emissions per unit of GDP	PST-C090102	
		Share of strategic emerging industries in industrial enterprises above a designated size	PST-C090104	
		Share of hi-tech industry in industrial enterprises above a designated size	PST-C090103	
		Length of drainage pipes	PST-T090101	
		Passenger volume, by mode of transport	PST-C090201	
		Volume of goods transported	PST-C090202	
		Proportion of industrial added value in GDP	PST-T090201	
		Proportion of R&D expenditure in GDP	PST-C090101	
		Contribution rate of advanced technology	PST-T090002	

5P	SDGs	Urban indicators	SDGs serial No.
PLANET	Goal 10. Reduce inequality within and among countries	Theil index	PST-T100201
		Income ratio between urban and rural areas	PST-T100202
		Per capita income of the bottom 40% of the population	PST-T100101
	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	Whether a city has a disaster emergency plan	PST-C110101
		GDP per unit of urban area	PST-T110001
		Annual average concentration of PM2.5	PST-C110201
		Urban road network density	PST-T110201
		Barrier-free facility penetration rate	PST-C110107
		Proportion of public service expenditure	PST-C110108
		Holdings in public libraries per 10,000 population	PST-C110109
		Ratio of average housing prices to average monthly income	PST-C110104
		Green space in built-up areas	PST-T110601
		Bus travel ratio	PST-C110105
		Ratio of bus travel to vehicle travel during peak traffic	PST-C110102
		The ratio of urban land growth rate to population growth rate	PST-C110106
	Goal 12. Ensure sustainable consumption and production patterns	Whether there exists a direct participation structure of civil society in urban planning and management that operates regularly and democratically	PST-C110202
		The number of people who have died, disappeared or are directly affected by disasters per 100,000 people	PST-C110110
		Share of annual average direct loss in GDP caused by disasters	PST-C110203
		Whether population forecasts and resource demand are reflected in the city's urban and regional development plans	PST-C110103
		Ratio of industrial solid waste utilized	PST-C120102
		Non-hazardous domestic waste treatment rate	PST-C120201
		Whether there is already a city-wide action plan, working priority or target for sustainable consumption and production	PST-C120101
	Industrial hazardous waste disposal rate	PST-C120202	
	Goal 13. Take urgent action to combat climate change and its impacts	Whether a city has an organization set up to address climate change	PLN-C130201
		Whether mitigation, as well as adaptation, impact reduction and early warning systems, are already part of the curricula for elementary and middle schools, along with higher education institutions	PLN-C130101
Whether capacity-building training for coping with climate change is comprehensively carried out		PLN-C130102	
Per capita carbon dioxide emissions		PLN-G130001	
Carbon intensity per unit of GDP		PLN-G130002	

5P	SDGs	Urban indicators	SDGs serial No.	
PLANET	Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Share of good quality sea water offshore (category I, II)	PLN-T140201	
		Ocean acidity	PLN-C140102	
		Ocean health index	PLN-T140202	
		Share of reserve maritime area	PLN-C140101	
	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Landscape fragmentation	PLN-T150101	
		Forest coverage	PLN-C150101	
		Per capita green space	PLN-G150001	
		Share of natural reserve in total land area	PLN-C150201	
	PEACE	Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	E-government development index (EGDI)	PEC-C160201
			China's formulated government transparency index	PEC-T160601
Index of Public Integrity			PEC-T160501	
Proportion of basic government expenditure in the initial approved budget			PEC-C160101	
Criminal cases per 100,000 population			PEC-T160101	
PARTNERSHIP	Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	Government debt ratio	PTS-C170201	
		Share of internet users	PTS-C170102	
		Whether a city has a coordination policy mechanism for sustainable development	PTS-C170101	
		Proportion of government revenue to GDP	PTS-C170103	
		Proportion of government tax revenue in fiscal revenue	PTS-C170104	

Table 4-2: Urban SDG Progress Evaluation Indicator System

4.4.2 Assessment Methodology for the Chinese City SDG Assessment Index

(1) Implementation progress and gap assessment methodology

The assessment of urban sustainable development focuses on measuring the implementation progress and gaps to the target. Implementation progress assessment refers to differences between the current implementation status and the benchmark, the development made since the start of the assessment, fixed, in this study, to the year 2000 (Figure 4-2). The target gap assessment refers to the difference between current progress and the target fixed for 2030 (Figure 4-3). The progress assessment, from an historical point of view, highlights areas where development and achievement of SDGs have been realised and to which degrees of success. The gap assessment points to areas with room for improvement, requiring more attention for future development.

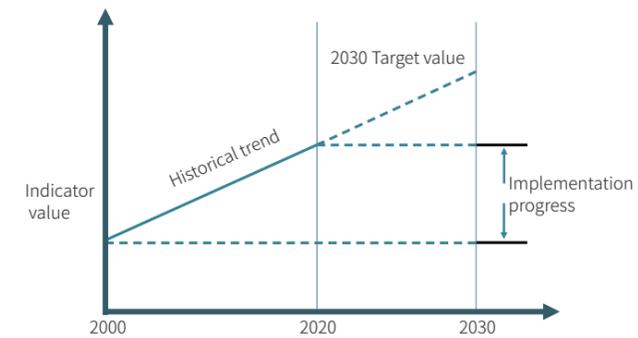


Figure 4-2 Implementation progress assessment

The implementation progress assessment formula is as follows:

$$PAI_i = \frac{IV_i^{2020} - IV_i^{2000}}{TG_i^{2030} - IV_i^{2000}} * 100\% \quad (4.1)$$

Specifically, PAI_i represents the percentage of the implementation progress of indicator; and refer to the value of the indicator i ; IV_i^{2000} and IV_i^{2020} , refer to the value of the indicator i in 2000 and 2020, respectively; and TG_i^{2030} represents the target value of the indicator i in 2030.

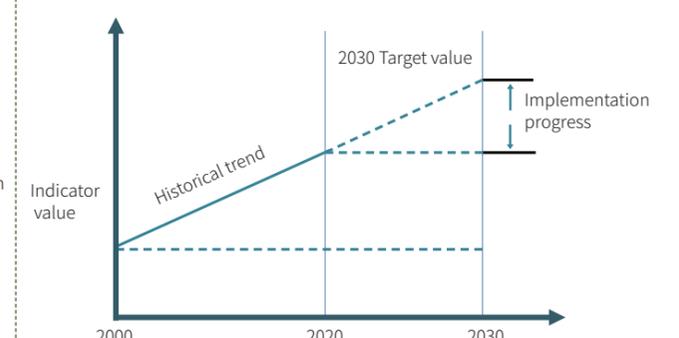


Figure 4-3 The target gap assessment

The target gap assessment formula is as follows:

$$TGA_i = \frac{IV_i^{2030} - IV_i^{2020}}{TG_i^{2030} - IV_i^{2000}} * 100\% \quad (4.2)$$

Specifically, TGA_i , Target Gap Assessment index, represents the percentage of the target gap of indicator i , IV_i^{2000} and IV_i^{2020} refer to the value of the city indicator i in 2000 and 2020, respectively; and TG_i^{2030} represents the target value of indicator in 2030.

(2) Development of the Chinese City SDG Assessment Index

The Chinese City SDG Assessment Index

The next key step once progress assessment indices for each selected indicator have been calculated is to determine the weight to use to calculate the assessment index at the urban level. With the development of information technology, methods for determining the weighting of indicators have diversified, ranging from subjective weighting methods to objective ones.

Subjective weighting assessment methods, which adopt qualitative approaches, obtain weights according to the subjective judgments of experts based on their experience and assessment of the indicators. In this category, commonly used methods include analytic hierarchy process, Delphi method, order correlation analysis method, etc. The analytic hierarchy process and Delphi method are most widely used, as they are able to hierarchically address complex problems and quantify qualitative problems.

Objective weighting methods measure indicators according to the correlation between indicators, or relationship between indicators and assessment results, and are based on historical information of the indicator, enabling researchers to reduce the influence of human factors as much as possible and generate weighting results with stronger objectivity. Examples include entropy weight method, principal component analysis, variable coefficient method, Topsis, etc. The entropy weighting method is most widely used, using the decision matrix as the input.

Finally, there is the subjective-objective method, a combined weighting approach which considers the advantages and disadvantages of the weight determination process under subjective and objective methods.

Having compared advantages and disadvantages of various weighting methods and considered the objectivity and comparability of the assessment results, this paper adopts the equal weighting method, as an objective assessment. This method is used in the global Human Development Index (HDI), and in assessing SDG progress globally.

Once indicators are standardized and weights are determined, the value of the urban sustainable development process can be calculated. The formula to do so is as follows:

$$CCSAI_k = \sum W_{ki} CCSAI_{ki} \quad (4.3)$$

$$CCSAI = \frac{1}{5} \sum PAI_k \quad (4.4)$$

Specifically, W_{ki} is the weight of the i -th indicator in the k -th dimension at the 5P level; $CCSAI_{ki}$ is the percentage of implementation progress of the i -th indicator in the k -th dimension among the 5P; PAI_k is the percentage of implementation progress of the k -th dimension at the 5P level; $CCSAI$ is the comprehensive evaluation value of 2030 sustainable development goals implementation progress, ranging from the minimum 0 to the maximum 1. Higher scores indicate higher implementation level of sustainable development as per the SDGs' indicators.

CCSAI Key Indicators

The Chinese City SDG Assessment Index (CCSAI) consists of multiple indicators. Although each indicator, representing the work done in one aspect, is equally important for a balanced implementation of the 2030 Agenda, some are considered more representative and more important than others given a specific time (development stage) and a specific knowledge background (cognition).

In order to identify these key indicators, this paper adopts the Delphi method, also known as the expert investigation method, to score and screen the key indicators under each P. The paper then assesses the implementation progress and gaps of these key indicators to detect future priorities.

Among all 52 indicators considered for Shenzhen, 19 were selected as key indicators, as follows:

People dimension: basic medical insurance participation rate, disposable income of residents, average years of education, share of women in the municipal People Congress representatives, water consumption per unit of GDP, and proportion of sewage centrally treated in wastewater treatment plants.

Prosperity dimension: proportion of non-hazardous treatment of domestic waste, registered urban unemployment rate, tertiary industry added value as a percentage of GDP, decoupling index between energy consumption and economic growth, Theil index, GDP per unit of urban area, annual average PM2.5 concentration, and

green space coverage in built-up areas.

Planet dimension: direct economic loss caused by disasters as a percentage of GDP, good quality water (Class I and II) as a percentage of total offshore water, and nature reserves as a percentage of land area.

Peace dimension: number of criminal cases per 100,000 people.

Partnership dimension: proportion of the population using the Internet.

4.4.3 Setting the 2030 Target Value for the Indicators

The indicators' 2030 target value refers to the future level which each indicator is expected to achieve in 2030. The target value for each indicator is the basis for assessing implementation progress and gaps. The 2030 target value is determined in the following ways:

Firstly, for some indicators, the target value is clearly defined in the SDGs framework. Of the 232 SDG indicators, a few are assigned with specific target values. For example: one of the indicators in SDG 1 - No Poverty – is a 0 percent extreme poverty rate (indicator 1.1.1), in line with its target to “end poverty in all its forms everywhere” .³⁹The 2030 target values for these types of indicators will be determined based on the SDG indicator description.

Secondly, for indicators whose target value is yet to be defined in the SDG targets, the 2030 target value will be determined by the following methods:

- *Shenzhen Sustainable Development Plan (2017-2030)*. Some cities, such as Shenzhen, have already issued plans related to the 2030 Agenda that include development target values for 2030 for a broader range of indicators. These are used as a reference to determine the 2030 target values of the assessment indicators in our CCSAI.
- Various urban development plans, where some indicators' target values are generally set for the medium- and long-term development of a city. These target values are also measured in line with local development levels and trends, which can be used as 2030 target values, or as a starting point to derive values for the assessment indicators of the CCSAI calculated here.
- The average value of the performance of the five top-performing cities worldwide: for some indicators without a scientific basis to calculate and estimate the 2030 target value, the paper sets the 2030 target value of the indicator as the average of the top five cities globally in the selected development area.
- The average value of the performance of the top five OECD countries, when data of some indicators is difficult to obtain, as members of the Organization for Economic Cooperation and Development (OECD) have relatively comprehensive data collection. Also, their overall development is relatively high, and as such can represent the “advanced” level in many areas.

39. Ritchie, Roser, Mispy, Ortiz-Ospina, "Measuring progress towards the Sustainable Development Goals." SDG-Tracker.org, website,2018. Available at [https://sdg-tracker.org/no-poverty#:~:text=Definition%3A%20Indicator%201.1.,location%20\(urban%20Frural\)%2.&text=Goal%3A%20By%202030%20eradicate%20extreme,less%20than%20%241.90%20a%20day%20](https://sdg-tracker.org/no-poverty#:~:text=Definition%3A%20Indicator%201.1.,location%20(urban%20Frural)%2.&text=Goal%3A%20By%202030%20eradicate%20extreme,less%20than%20%241.90%20a%20day%20)

CHAPTER FIVE

SDG Implementation Progress Assessment in Shenzhen

- 5.1 Overall Assessment
- 5.2 Assessment of 5Ps indicators

Abstract:

Based on the systematic data processing and assessment methodology described in Chapter 4, this chapter applies such methodology to assess the overall progress of SDG implementation in Shenzhen and the progress of indicators in the five dimensions of “People”, “Prosperity”, “Planet”, “Peace”, and “Partnership”. It concludes that Shenzhen has generally made excellent progress in implementing the SDGs. All “Planet” indicators met their 2030 targets. The progress on social and economic indicators has been less satisfactory, but compared to the 2000 benchmark, significant progress has been made and achievements have been higher than expected.⁴⁰

40. The expected implementation target is defined as 60% achievement rate by 2018.

Overall and separate assessments were carried out to measure implementation progress of sustainable development in Shenzhen as well as the gaps to the 2030 SDGs. The report reaches the following conclusions.

5.1 Overall Assessment

(1) Progress evaluation of the 2030 SDGs: the 5Ps

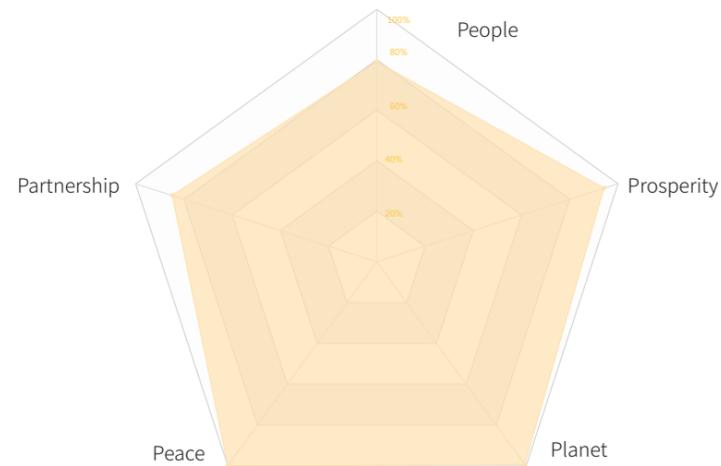


Figure 5-1 Assessment of the 5P dimensions in Shenzhen

Based on the CCSAI, Shenzhen has had good results in overall implementation of the 2030 SDGs between 2000 and 2020, with an overall achievement rate of all targets at 91.5 percent. Targets in the Planet dimension have been achieved. The other sub-indices, People, Prosperity, Peace and Partnership, scored achievement rates of 79.1 percent, 84.7 percent, 99.4 percent and 94.3 percent, respectively.

(2) Progress evaluation of the 2030 SDG: the key indicators

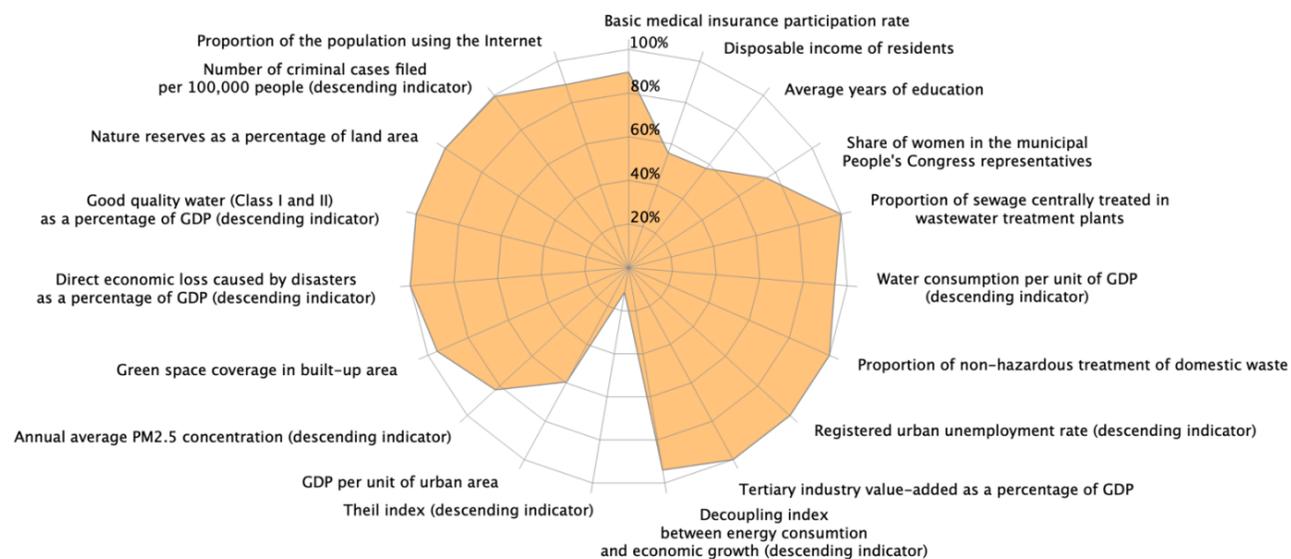


Figure 5-2 Implementation progress assessment of key indicators

Good progress was made for the key indicators, with an overall realization rate of 89.9 percent. Specifically:

For one key indicator the target was already met in 2000: registered urban unemployment rate.

- Key indicators that met their global targets by 2020: direct economic loss caused by disasters as a percentage of GDP, proportion of sewage centrally treated in wastewater treatment plants, proportion of non-hazardous treatment of domestic waste, good quality water (Class I and II) as a percentage of total offshore waters, nature reserves as a percentage of land area, and tertiary industry value-added as a percentage of GDP.
- Key indicators that have met 90 percent of their targets: water consumption per unit of GDP, decoupling index between energy consumption and economic growth, green space coverage in built-up areas and the number of criminal cases filed per 100,000 people.
- Key indicators with relatively slow progress: GDP per unit of urban area, disposable income of residents, average years of education and the Theil index, all of which have achieved less than 67 percent of their targets.

5.2 Assessment of 5Ps Indicators

5.2.1 Assessment of the People Indicators

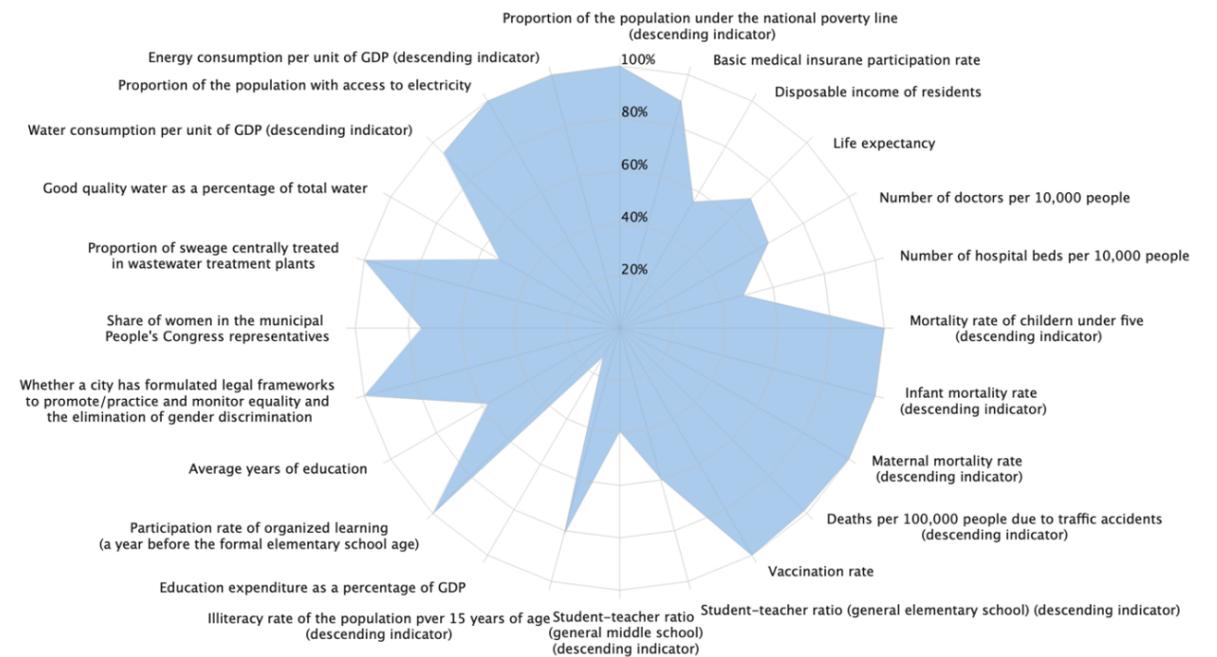


Figure 5-3 Implementation progress assessment of the People indicators

Good progress was made towards the People indicators, despite the overall realization rate of 79.1 percent being the lowest among the 5Ps. Specifically:

- Indicators that had already met their global targets in 2000: the proportion of the population under the national poverty line, the proportion of the population with access to electricity and whether a city has formulated legal frameworks to promote, practice and monitor equality, along with the elimination of gender discrimination.
- Indicators that met their global targets by 2020: the mortality rate of children under five, the infant mortality rate, maternal mortality rate, vaccination rate, participation rate of organized learning (a year before the formal elementary school age), the proportion of sewage centrally treated in wastewater treatment plants and energy consumption per unit of GDP.
- Indicators that have met 90 percent of their targets: water consumption per unit of GDP and deaths per 100,000 people due to traffic accidents.
- Indicators with relatively slow progress: education expenditure as a percentage of GDP, number of hospital beds per 10,000 people, disposable income of residents, student-teacher ratio (middle school), student-teacher ratio (primary school), average years of education and good quality water as a percentage of total water, all of which record a completion rate of less than 67 percent.

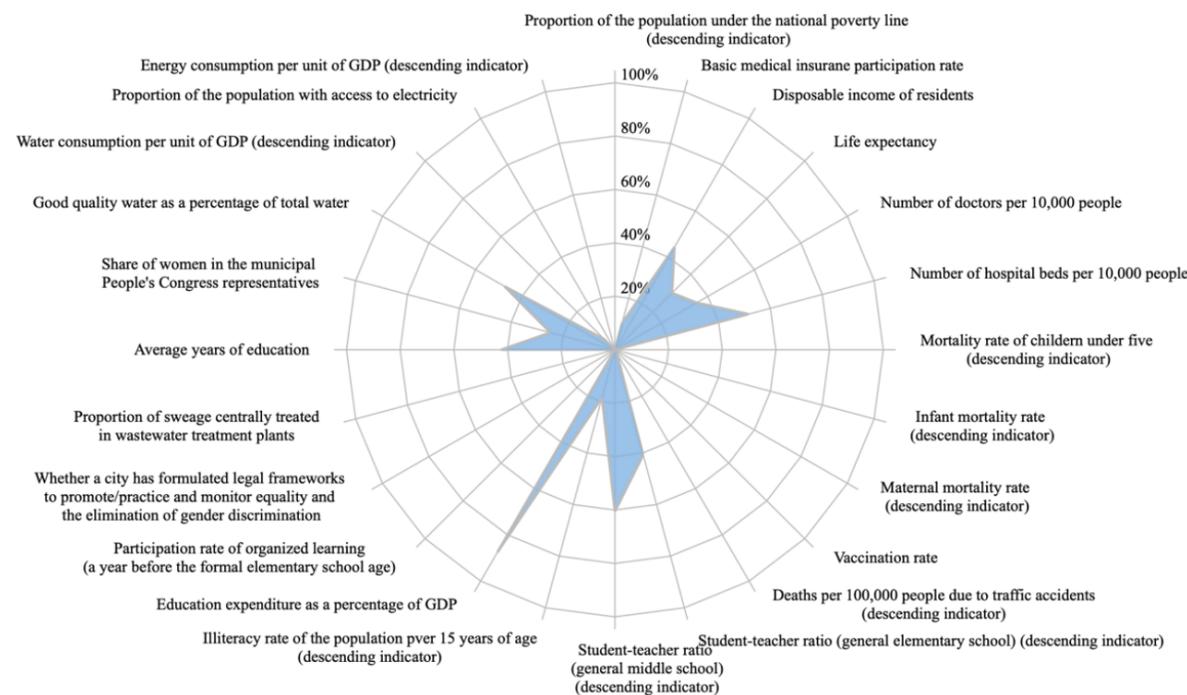


Figure 5-4 Implementation gap assessment of the People indicators

5.2.2 Assessment of the Prosperity Indicators

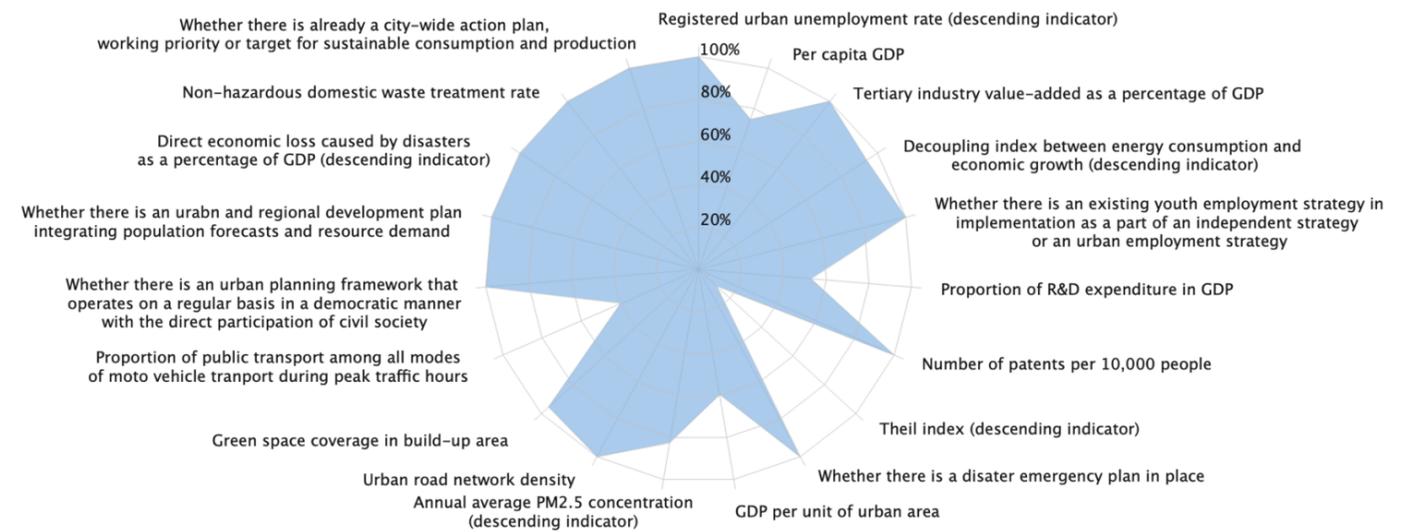


Figure 5-5 Implementation progress assessment of the Prosperity indicators

Shenzhen has made relatively rapid and balanced progress towards the Prosperity indicator targets with an overall realization rate of 84.784.7 percent. Specifically:

- Indicators that had already met their global targets in 2000: the registered urban unemployment rate, whether a youth employment strategy is being implemented, whether there is a disaster emergency plan in place, whether there is an urban planning framework operating on a regular basis in a democratic manner, with the direct participation of civil society, whether there is an urban and regional development plan integrating population forecasts and resource demand and whether there is already a city-wide action plan, working priority or target for sustainable consumption and production.
- Indicators that met their global targets by 2020: urban road network density, proportion of non-hazardous treatment of domestic waste, direct economic loss caused by disasters as a percentage of GDP, tertiary industry value-added as a percentage of GDP and the number of patents per 10,000 people.
- Indicators that have met 90% of their targets: decoupling indicator of energy consumption and economic growth, as well as green space coverage in built-up areas.
- Indicators with relatively slow progress: proportion of public transport to all modes of motor vehicle transport during peak traffic hours, GDP per unit of urban area, proportion of R&D expenditure in GDP and the Theil index, all of which have been realized at a rate of less than 67%.

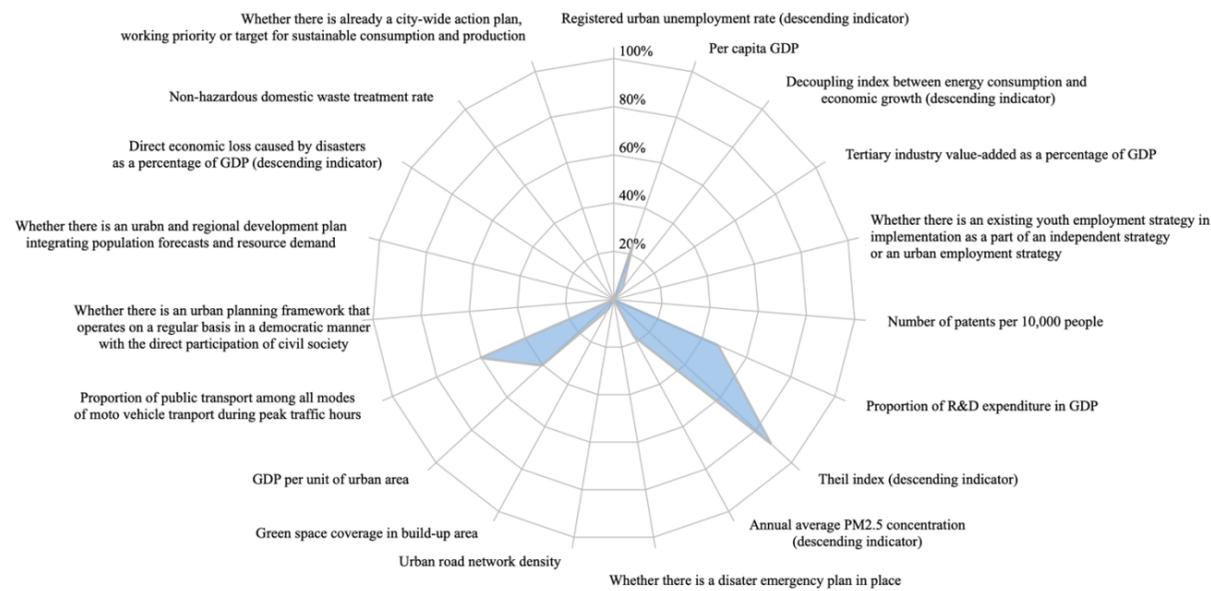


Figure 5-6 Implementation gap assessment of the Prosperity indicators

5.2.3 Assessment of the Planet Indicators

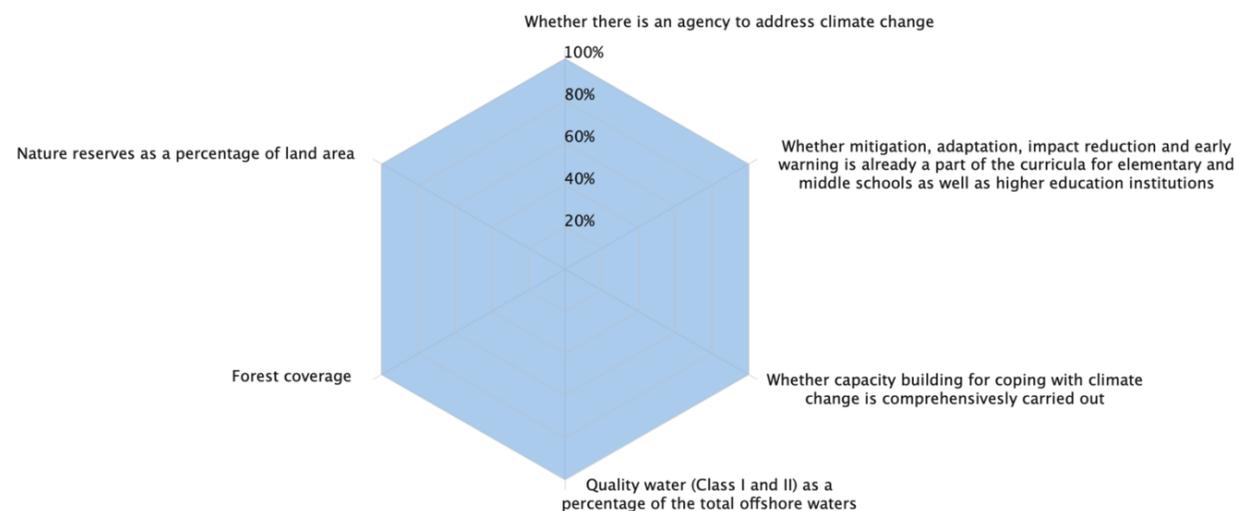


Figure 5-7 Implementation progress assessment of the Planet indicators

For the Planet indicators the overall realization rate was 100%, with one of the six indicators – forest coverage - having reached the 2030 target already in 2000.

5.2.4 Assessment of the Peace Indicator



Figure 5-8 Implementation progress and gap assessment of the Peace indicator

Overall implementation of the Peace indicator has been good. The number of criminal cases filed per 100,000 people dropped from 982 in 2000 to 523 in 2020, realizing 99.4% of the 2030 goal, with a gap of only 0.6%.

5.2.5 Assessment of the Partnership Indicators

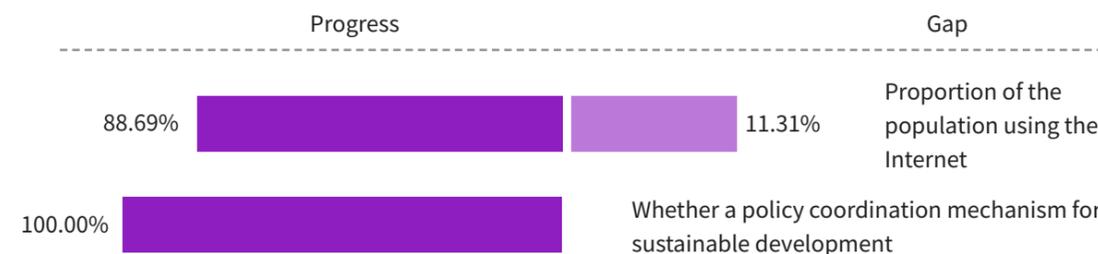


Figure 5-9 Implementation progress and gap assessment of the Partnership indicators

Sound progress was made on the Partnership indicators, with an overall realization rate of 94.3 percent. Specifically, one of the two indicators – whether a policy coordination mechanism for sustainable development is developed – already achieved its 2030 target. The second one achieved 88.7 percent of its 2030 target: the proportion of the population using the Internet rose from 33 percent in 2000, to 87.1 percent in 2020.

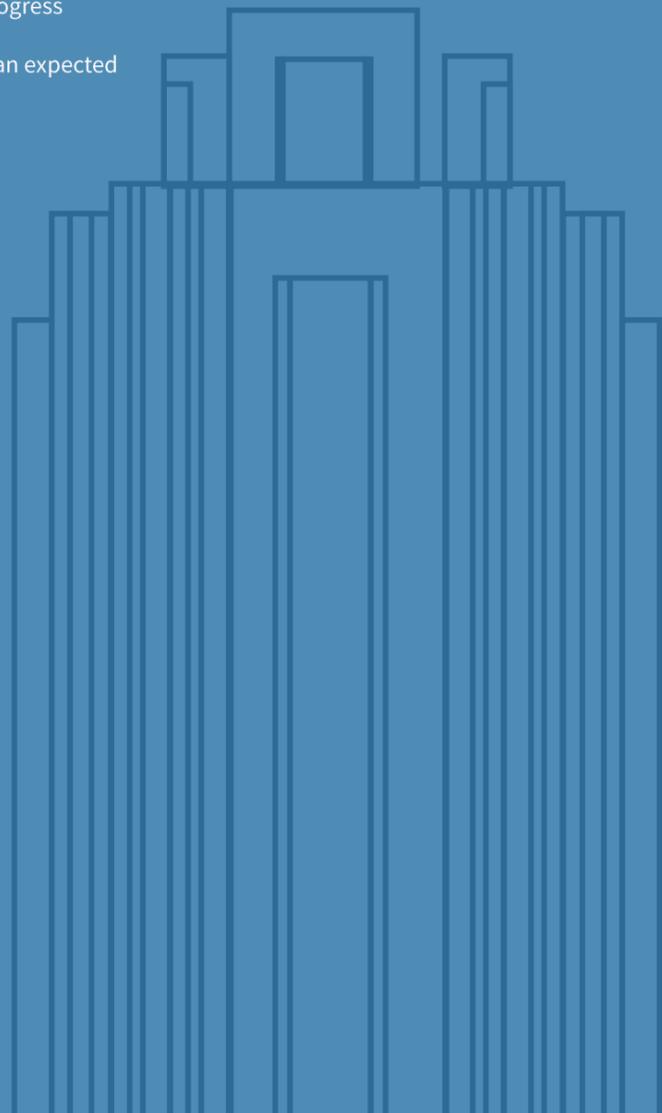
CHAPTER SIX

Conclusions and Implications

- 6.1 Overall progress for the CCSAI Indicators higher than expected
- 6.2 54 percent of the Indicators Reached their 2030 Targets; 77 percent have Higher than the Expected Implementation Progress
- 6.3 Key Indicators' implementation higher than expected

Abstract:

Shenzhen has made excellent overall progress as measured by the CCSAI, with 91.5 percent of the SDG targets realized. 28 of the 52 assessment indicators have already reached their 2030 target. Overall, progress for 77 percent of the indicators is 67 percent higher than expected. Key indicators achieved 89.9 percent of implementation progress, with 79 percent of them higher than expected. These achievements have laid a solid foundation for Shenzhen to be on track to fully realize the SDGs by 2030.



6.1 Overall progress for the CCSAI indicators higher than expected

As described in Chapter 5, the overall realization of the 5P dimensions is as high as 91.5 percent, higher than the expected 67 percent completion rate set as an intermediary target to be reached by 2020. Indicators in the Planet category already achieved their 2030 targets. As for the other dimensions, the best performers were Peace, Partnership, Prosperity and People, whose indicators recorded fulfilment rates of 99.4.

People					
1	Population below the national poverty line	Basic medical insurance participation rate			Goal 1
2	Disposable income of residents				Goal 2
3	Life expectancy	Vaccination rate	Number of doctors per 10,000 population	Number of hospital beds per 10,000 population	Goal 4
	Mortality rate of children under five	Infant mortality rate	Maternal mortality rate		
4	Student-teacher ratio in general primary schools	Student-teacher ratio in general secondary schools	Over-15 illiteracy rate	Share of education expenditure in GDP	Goal 4
	Participation rate of organized learning (pre-school)	Average years of schooling			
5	Whether a city has formulated legal frameworks to promote, practice and monitor equality and the elimination of gender discrimination		Share of women in the municipal People Congress representatives		Goal 5
6	Water consumption per unit of GDP	Proportion of sewage centrally treated in wastewater treatment plants	Good quality water ratio (Surface water above category III water quality)		Goal 6
7	Energy consumption per unit of GDP	Share of population with access to electricity			Goal 7
Prosperity					
8	Urban registered unemployment rate	Per capita GDP	Share of tertiary industry value-added in GDP	Decoupling indicators between energy consumption and economic growth	Goal 8
	Whether a city has developed and operated a youth employment strategy as a separate strategy, or as part of an urban employment strategy				
9	Proportion of R&D expenditure in GDP	Patents per 10,000 population			Goal 9
10	Theil index				Goal 10
11	Whether a city has a disaster emergency plan	GDP per unit of urban area	Annual average concentration of PM2.5	Urban road network density	Goal 11
	Green space in built-up areas	Ratio of bus travel to vehicle travel during peak traffic	Whether there exists a direct participation structure of civil society in urban planning and management that operates regularly and democratically		
	Whether population forecasts and resource demand are reflected in the city's urban and regional development plans		Share of annual average direct loss in GDP caused by disasters		
12	Whether there is already a city-wide action plan, working priority or target for sustainable consumption and production	Non-hazardous domestic waste treatment rate			Goal 12

Planet						
13	Whether a city has an organization set up to address climate change	Whether mitigation, as well as adaptation, impact reduction and early warning systems, are already part of the curricula for elementary and middle schools, along with higher education institutions		Whether capacity-building training for coping with climate change is comprehensively carried out	Goal 13	
14	Share of good quality sea water offshore (category I, II)				Goal 14	
15	Forest coverage	Share of natural reserves in total land area			Goal 15	
Peace						
16	Criminal cases per 100,000 population				Goal 16	
Partnership						
17	Whether a city has a coordination policy mechanism for sustainable development	Share of internet users			Goal 17	
		100%	67%-100%	33%-67%	0-33%	<0

Figure 6-1 Shenzhen's SDGs indicator dashboard

6.2 54 percent of the Indicators Reached their 2030 Targets; 77 percent have Higher than Expected Implementation Progress

Among all assessment indicators (Figure 6-2), Shenzhen has met the 2030 targets for 54 percent. Additionally, 23 percent of the remainder have achieved more than 67 percent of their targets. As such, around three quarters of the 52 indicators have progressed more than 67 percent towards their goals, while 23 percent of them have lagged behind, with achievement rates of less than 67 percent.

Despite comparisons among different progress reports being difficult, the positive performance towards the SDGs shows how Shenzhen is leading the way in China and the Asia Pacific. The UN ESCAP Asia-Pacific assessment report, for instance, shows that current progress is slow in the region, and that not a single SDG will be achieved by 2030 based on current trends.⁴¹

Shenzhen is a fast-growing megacity, with a large influx of inland migrants. The demand for social resources such as housing, roads, transportation and other infrastructure, as well as education and health, has grown rapidly. Amid these pressures and challenges due to rapid economic and social expansion, Shenzhen has still been able to achieve 91.5 percent of its SDGs targets. This demonstrates Shenzhen's focus on sustainable development, along with the efficiency of its sustainable development management and implementation mechanisms.

41. Asia and the Pacific SSG Progress Report 2019 (United Nations Publication, Sales No. E.19.II.F.9). Available at: https://www.unescap.org/sites/default/files/publications/ESCAP_Asia_and_the_Pacific_SDG_Progress_Report_2019.pdf

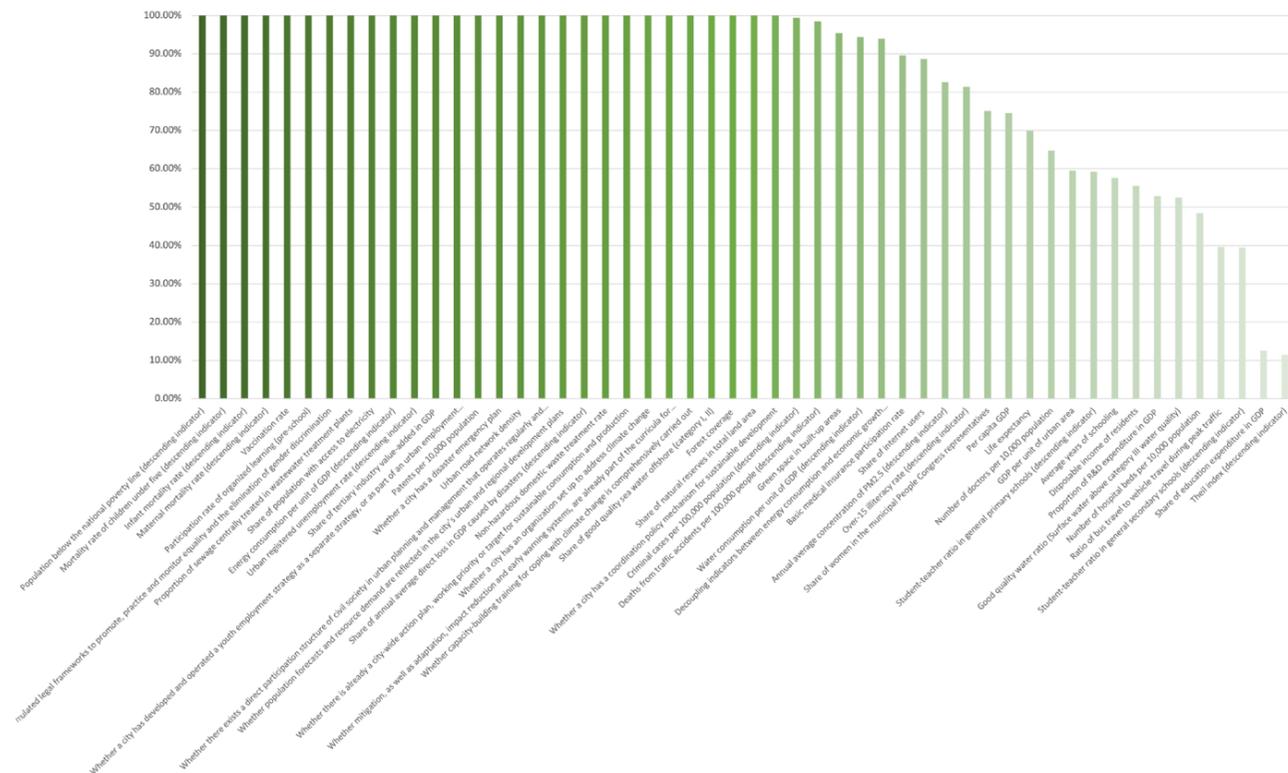


Figure 6-2 Results of implementation progress assessment of all indicators

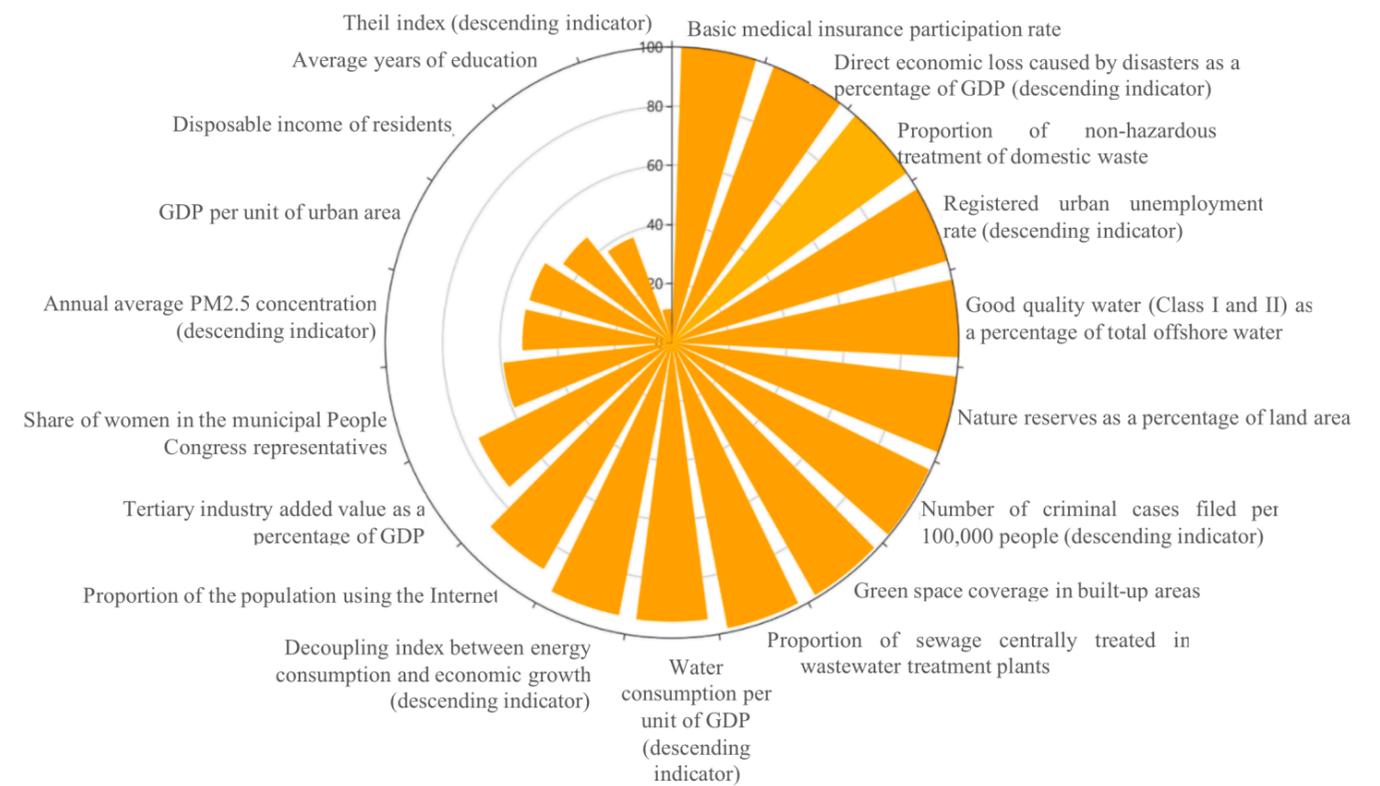


Figure 6-3 Implementation progress of the CCSAI key indicators

Among the 19 key indicators (Figure 6-3), 37 percent have already met the 2030 SDG targets, 42 percent of the rest have met more than 67 percent of targets, while 21 percent met fewer than 67 percent. Together, 79 percent of key indicators have met more than 67 percent of the target. Slow progress was seen in indicators such as GDP per unit of urban area, disposable income of residents and average years of education.

Given the importance of those areas, these key indicators reflect the fact that more effort is needed in the future to achieve these SDG targets. Special plans for different goals must be formulated to effectively work towards the 2030 targets. Actions should also be taken to establish an efficient implementation mechanism, as well as a monitoring and supporting system to execute special plans to achieve the goals. Such efforts are conducive to the comprehensive and high-quality realization of the 2030 SDGs targets.

6.3 Key indicators' implementation was higher than expected

Among all indicators, 19 were selected as key indicators. In general, good progress was made in the CCSAI key indicators, with an overall realization rate of 89.9 percent. Specifically, beyond the Planet dimension that has met all of the 2030 SDG targets considered in this CCSAI, Peace, Partnership, Prosperity and People had realization rates of 99.4 percent, 88.7 percent, 82.6 percent, and 78.7 percent, respectively.

Annex

Shenzhen Sustainable Development Case Studies

- 1 Effective use of resources: The “Shenzhen Model” for domestic waste classification
- 2 Environmental management: Restoration of the Futian Fengtang Estuary River Mangrove Reserve
- 3 Environmental management: The Port of Shenzhen Shore Power
- 4 Environmental management: Development of an Urban GEP Accounting System in Yantian District
- 5 Environmental management: New energy vehicle promotion in Shenzhen
- 6 Life and health: A high quality and efficient medical and health service system
- 7 Modernization of social governance: Smart Futian
- 8 Inclusive and open international cooperation: BGI “Laos-China Modern Agricultural Science and Technology Demonstration Park”
- 9 Innovative development case: Shenzhen as a global innovation capital

Abstract:

This chapter introduces a series of case studies that illustrate Shenzhen’s successful experience in implementing the 2030 Agenda for Sustainable Development and working to meet the SDGs in efficient use of resources, environmental governance, health, modernization of social governance, inclusive and open international cooperation, innovation and development, etc. Shenzhen experience is valuable for other Chinese cities as well as foreign cities to promote the implementation of the SDGs.



1 Effective use of resources: The “Shenzhen Model” for domestic waste classification

1.1 Background

By 2030, the global urban population is projected to rise to 5.17 billion, which increasingly calls for efficient urban planning and management practices to combat the complications with urbanization.⁴² Congestion, lack of adequate housing, deteriorating infrastructure, air pollution and lack of funds to provide basic services, such as the safe removal and management of solid waste within cities, already burden cities today. This is a challenge that, as the case study here shows, can be overcome in ways that allow city and urban settlements to be inclusive, safe, resilient and sustainable, as outlined by SDG 11.

In Shenzhen, a city less than 2,000 square meters, over 20,000 tons of domestic waste is produced every day, endangering the city’s development. The Municipal Party Committee and the Municipal Government of Shenzhen attached great importance to the disposal of domestic waste. Centred around the “Three Modernization and Four Classification” approach⁴³, Shenzhen actively implemented practical, replicable and promotable garbage classification (sorting garbage so that waste streams can be captured for recycling, composting and minimizing landfill).

In 2000, as one of the first eight pilot cities in China, Shenzhen started to implement the classification and recycling of used batteries, waste-paper and waste plastics, forming a preliminary system for garbage classification. Since 2011, Shenzhen began to explore waste classification and recycling, focusing on separating collection of domestic kitchen garbage and decentralizing disposal in small facilities. However, due to problems including high impurities, high energy consumption, difficulty in controlling odour, the 46 small facilities that were created, were successively shut down. Since the release and implementation of the Measures of Shenzhen Municipality on the Classification and Reduction of Domestic Garbage and the comprehensive application of domestic garbage classification on August 1, 2015, Shenzhen established a “Shenzhen Model” for garbage classification integrating it with waste diversion, promotion measures, effective monitoring and shared responsibility. The process includes several stages, from significantly reducing waste at source, to diverting and classifying upstream, as well as sorting dry and wet garbage during the middle stage and comprehensive realising the SDGs at the end of the cycle.

42. World Urbanization Prospects 2018 Highlights (United Nations publication, Sales No. E19.XIII.6). Available at: <https://population.un.org/wup/Publications/Files/WUP2018-Highlights.pdf>

43. “Three Modernization and Four Classification” refers to the reduction, recycling and treatment of domestic waste, and the separate placement, collection, transportation, utilization and disposal of such waste.

1.2 Actions

Actions involve establishing the “Three Systems” (transfer and classification system, promotion and monitoring system, as well as responsibility implementation system), and realizing the “Two Goals” (improve the level of domestic garbage reduction and the level of participation by residents in classification).

1. Establishing a classification system. Under the “Shenzhen model,” catering garbage, green garbage, along with fruit and vegetable waste, of which there are large and increasing amounts, are disposed of by diversion and collection. Domestic hazardous waste, waste glass, metal, plastics and paper, kitchen garbage, old furniture, holiday flowers and fruits, as well as old fabrics, are disposed by classification, and a city-wide system of collection, diversion and disposal covering domestic garbage.

2. Promotion and monitoring. Shenzhen implemented the “Dandelion Project” to raise awareness among the public about garbage classification; promoted the educational practice of garbage classification in schools creating 741 domestic garbage classification model schools; worked with over a thousand restaurants to create a “Clean Plate Pioneer Alliance” and widely cultivated the new “Clean Plate Campaign” trend to reduce food waste. It also cooperated with 17 NGOs to establish a public service alliance to focus on building a new model of shared governance between the government and society. Shenzhen compiled the Guidelines for Classification and Delivery of Domestic Garbage, giving out over 5 million copies, with over 140,000 recycling events. The municipal government organized and encouraged public servants, volunteers, residents and property management practitioners to monitor on a regular basis and effectively improve the participation rate of residents to enhance implementation. It also carried out site monitoring, as well as dynamically integrated garbage classification into community governance, to support and strengthen the interdependency of state governance, social regulation and residents’ self-governance.

3. Shenzhen included garbage classification as an item of its annual performance evaluation of people’s livelihoods, pollution control, and ecological civilization of all district governments. In addition, the requirement to have the garbage classification method in place was included in the property management contract template, the evaluation standard for green property management and the system of creating and evaluating “low-carbon and economical units.” Shenzhen took effective measures to engage with and increase the responsibility of real estate service enterprises to carry out garbage classification in residential areas. It also worked to enable marketplaces to carry out fruit and vegetable waste classification. Additionally, it encouraged catering companies to carry out food and kitchen waste classification; as well as government agencies and public institutions to shoulder the primary responsibility in garbage classification. Further, it sought waste collection, transportation and treatment enterprises to sort before handling; and of districts, sub-districts and communities to carry out garbage classification in areas under their administration. Such actions aimed to effectively enforce responsibilities of all parties involved.



Figure 7-1 Domestic garbage classification of Shenzhen

1.3 Performance

1. There have been considerable achievements in the classification and the reduction of domestic garbage. At present, the amount of garbage diverted and classified and renewable resources recycling around the city per day is about 6,600 tons, with a 27 percent domestic garbage recycling rate, effectively reducing the amount of garbage entering incineration and landfill disposal facilities. The classification system effectively enhances the efficiency of waste incineration, and ensures that the emission standards for Shenzhen are stricter than the European Union's 2010/75/EU standards. In the assessment of domestic garbage classification for 46 key cities by the Ministry of Housing and Urban-Rural Development of China in 2018, Shenzhen ranked second in aggregate score for three consecutive quarters.

2. The system of classification standards has been gradually improved and the participation level of households has increased considerably. Over 140 communities have established domestic garbage compulsory classification model communities, 805 residential areas without waste containers have taken the lead in delivering classified garbage on fixed dates and locations, garbage diversion disposal has covered 256 agricultural products markets and 720 parks, and 407 waste transfer stations have been upgraded. Among them, Yantian District officially launched the establishment of a garbage reduction and classification pilot in 2012. Using innovative methods in garbage reduction and classification, it built a model for the integrated disposal of kitchen waste from residents and public catering waste, and successively won the "Guangdong Award for Best Practices to Create a Liveable Environment" and "China Award for Best Practices to Improve the Living Environment".



Figure 7-1 Domestic garbage classification of Shenzhen

1.4 Outlook

With the continuous improvement of the diversion and classification system and the full recycling and disposal of classified garbage, the recycling rate of domestic waste in Shenzhen should exceed 35 percent by 2020. With regards to the participation of residents in classification, the classification and recycling of kitchen waste at a fixed time and location has been piloted and is now being rapidly replicated and promoted among residential areas around the city. The participation rate of residents in classification should reach over 80 percent by 2020.

2 Environmental management: Restoration of the Futian Fengtang River Estuary Mangrove Reserve

2.1 Background

Forests cover 30.7 percent of the earth's surface and are a major source of food, as well as vital in tackling climate change and protecting biodiversity. Despite this, 13 million hectares of forest currently disappear each year, while desertification affects around 3.6 million hectares of land. Both deforestation and desertification pose serious challenges to sustainable development and affect the livelihoods of millions. As such, SDG 15 calls on all countries to protect, restore and promote sustainable utilization of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and curb biodiversity losses. In combating deforestation, Shenzhen's Futian Mangrove Reserve is an excellent example of reversing deforestation through active management.

The Shenzhen Futian Mangrove Reserve was established in 1984 and promoted to a National Nature Reserve in 1988, covering 367.6 hectares. It is the smallest forest and wildlife National Nature Reserve in China, as well as the only national nature reserve located in the centre of a city, known as the "Green Treasure" by ecologists. The area is rich in animal and plant resources, including 16 species of mangrove plants and 194 species of birds, 23 of which are rare and endangered. For example, according to global survey results on black-faced spoonbills (listed in China's Red Data Book of Endangered Animals) there were 383 black-faced spoonbills in the Shenzhen Futian mangrove forest in 2019, accounting for 8.6 percent of the world's total.

However, during urbanization, the primeval ecological environment of Futian mangrove forest was destroyed. As the Fengtang River passes through the centre of the reserve area, its rigid riverbanks and water pollution problems had adverse effects on the environment. The current moved slowly and there was tidal backwater in the estuary; wild mangroves and artificial fish-ponds coexisted in a disorderly way in the area. The border patrol roads ran through the reserve area, blocking tidal access and benthic organisms, resulting in serious ecological barriers. Human activities greatly reduced the area of wild mangrove forests, resulting in decreased diversity in the reserve area, frequent occurrence of mangrove insect pests and invasion of alien species. In order to address the impact of urban construction on the mangrove reserve, Shenzhen launched the Futian Mangrove Ecological Restoration Project in 2006.

2.2 Actions

The main theme of the Project is "Ecological Restoration of the Land-Sea Interface". This mainly involves runoff's pollution control, wetland habitat improvement and vegetation restoration, to build a large mangrove-water body (aquatic vegetation) structure and mangrove and vegetation belts, to restore the mangrove wetland ecosystem. The Project consists of four parts: patrol road reconstruction, mangrove restoration, estuary water purification, river channel regulation and ancillary structures, with an investment of CNY 250 million (USD 31 million).

1. Runoff pollution control for the Fengtang river water purification project, with a daily treatment of 50,000 tons of sewage, aims to eliminate water environmental pollution in the reserve area. Through sewage interception and treatment, the pollution sources discharged into the reserve area are intercepted and the facilities for the treatment of the polluted river water in this part have been constructed. Sewage treatment simulates the process of natural purification. Ecological and biochemical treatment technology using oyster shells as the filling material are also adopted. Through the final purification of artificial plant ponds, tailwater returns to the natural mangrove wetlands and rivers to improve and protect the water environment.

2. Estuary habitat improvement. There are many types of barriers that impact a healthy ecology in the original area, such as “concrete revetments”, vehicle patrol roads wire fences across the wetlands and a defective land-based enclosure system, etc. Therefore, certain engineering measures are needed to transform habitats, such as constructing wooden trestle bridges to replace the concrete pavement of patrol roads, with biological passages under the trestle bridges. Culverts and gates are set up between the land-based enclosure and seawalls outside to leave biological passages. Through physical model testing, the location, function and operation schemes are determined. Sluice gates are set at the estuary, with the function of taking water from the sewage treatment system and scouring river channels. The debris (rubbish and alien species) is cleaned from the soil and sea mud on the revetment between the original land-based enclosures. Sluice gates are set between the original land-based enclosures to control the water level of each land-based enclosure daily to meet the needs of different habitats and birds in the reserve area.

3. Vegetation restoration. The mangrove wetland vegetation, including terrestrial shrub and grass communities, aquatic plants and mangroves, as well as semi-mangroves, have been restored. 140 hectares of mangrove, semi-mangrove and native vegetation in the original reserve area, including 272,838 square meters of afforested areas; 207,001 mangrove trees; 43,233 semi-mangrove trees; 15,414 arbours; 47,125 shrubs; 54,735 clusters of aquatic plants; 51,151 square meters of other vegetation have all been planted. The scope of vegetation restoration is limited to the experimental area and buffer of the reserve.

2.3 Performance

The ecological environment in Fengtang River Estuary improved after the mangrove restoration project was implemented. In the Restoration Project, the fish farming and wharf operation activities have not been included; 150 hectares of land has been reclaimed to the reserve area; the patrol roads have moved north; the original patrol roads have been transformed into ecological pavement. The concrete revetments of the Fengtang River (including the Xiasha tributaries) have been turned into ecological revetments full of mangroves; 2.5 kilometres of ecological barriers have been removed, greatly reducing the impact on birds and organisms. In addition, 30 water culverts and connecting pipes have been constructed to connect fish ponds, create high and low water surfaces, providing a variety of habitats for birds. The Restoration Project has also significantly improved the air quality around the mangroves and increased the number of birds. After the project was completed, the number of black-faced spoonbills, the rarest species in the reserve area, increased by 153 in four years, according to the Shenzhen Bird Watching Society.

The water quality of the Fengtang estuary improved by implementing pollution interception and pollution control. Based on the overall planning of the reserve area, the estuarine wetlands have been ecologically restored, and a

complete wetland biological community has been established, supporting the region’s ecological sustainability. The Futian Mangrove Wetland has become a “ecological calling card” in Shenzhen, leaving a valuable ecological resource for future generations.

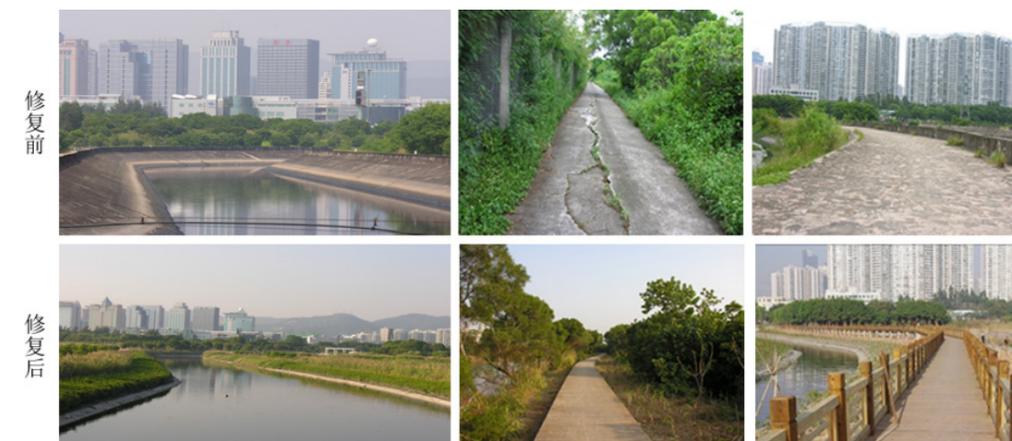


Figure 7-3 The Futian Mangrove Reserve before and after restoration

3 Environmental management: The Port of Shenzhen Shore Power

3.1 Background

Under China’s commitment to reduce greenhouse gas emission via the Paris Agreement, Shenzhen has proposed policies to push for carbon emission peaking and outlined corresponding emission reduction paths at the city level. Shore power, supplying electricity to docked ships from ashore to replace using fuel onboard for power, could significantly reduce carbon and pollutant emissions. By actively promoting the construction of shore power, Shenzhen is on track to further implementing SDG 13, taking urgent action to combat climate change and its impacts.

After more than 30 years of development, the Port of Shenzhen has become the largest container hub port in South China. In 2018, there were more than 12,500 ocean-going container ships berthing in the harbour. The port had a container throughput of 25.73 million TEUs, ranked fourth in all container ports in the world. Since ocean-going container ships are large ships which use heavy oil and emit massively, they have a serious impact on urban air quality.

When ships use shore power during berth time, the emissions are basically zero. Therefore, ports hope to promote

the use of shore power by ships. However, due to the low proportion of ships with shore power devices, and the low enthusiasm of ship companies in using shore power, the use of shore power has always been limited in all ports. Only the ports of California, after more than ten years of hard work, have successfully promoted shore power through legislation. In China, the Ministry of Transport has advocated the construction and use of shore power since 2012 and the Port of Shenzhen actively responded to the call and vigorously promoted shore power.

3.2 Actions

1. Overall planning and well-defined goals. In 2016, *The Five-Year Action Plan of Shenzhen to Construct a Green Low-Carbon Port (2016-2020)* issued by the Shenzhen Municipal Government clearly stated the goal for shore power development to methodically promote it.

2. Effective policy and enterprise response. Since 2014, Shenzhen has successively issued three policies on subsidies for shore power, including the *Interim Provisions for Administration of Subsidies for Shore Power Facilities and Low-sulphur Oil*, which stipulated subsidies for shore power development, shore power prices and shore power maintenance fees. After the three policies were released, port and shipping companies actively responded and accelerated the construction and use of shore power.

3. Publicity and policy communication. Shenzhen has held many symposiums, policy publicity meetings, on-site promotion meetings and international seminars, compiled Chinese and English shore power publicity manuals, and conducted targeted promotion, addressing the doubts and problems of the shipping companies in using shore power. Many shipping companies have signed letters of commitment to use shore power during berth time, increasing its utilization rate.

3.3 Performance

At present, the development and use of shore power in the Port of Shenzhen ranks first domestically and is second only to California's ports globally, making it an international leader in this area. The Port has built 14 sets of shore power facilities covering 28 large deep-water berths. Shore power services are available at the four major container terminals and the Prince Bay Cruise Homeport, and shore power facilities covering nine berths are under construction. At the end of 2019, 80 percent of container berths could provide shore power services. At the port, 415 ships from nine shipping companies connected to shore power for 1,340,301 hours, using 9,145,800 kWh of shore power. The cumulative emissions reduction of sulphur oxides was 91.2 tons, of nitrogen oxides 116.9 tons, of particulate matter 35.2 tons, of carbon monoxide 10 tons, and of hydrocarbons was 3.6 tons. A total emission reduction of about 257 tons has been achieved. Furthermore, implementation of shore power construction and projects has reduced ship pollutant emissions, improved the atmospheric environment of Shenzhen, protected public health, contributed to the coordinated development of the city and the port, while promoting the sustainable economic and social development of Shenzhen.



Figure 7-4 Shore power ship connection at the Prince Bay Cruise Homeport



Figure 7-5 Ceremony for shore power connection of an international ship at Yantian

4 Environmental management: Development of an Urban GEP Accounting System in Yantian District

4.1 Background

Sustainable consumption and production (SDG 12) refer to efficient use of energy and resources, promoting sustainable infrastructure, and increased access to basic public services, green and decent jobs, as well as improved living standards. In the spirit of promoting efforts towards SDG 12, Shenzhen developed the Gross Ecological Product (GEP) accounting system, a broader and more comprehensive accounting system than the widely used gross domestic product (GDP).

In 2008, Yantian District was designated the first national ecological zone in South China. In 2013, The Decision on Building a National Ecological Civilization Demonstration Zone (Shenzhen Yantian District Committee, 2013, No. 1) issued by Yantian District clarified the shift from excessive pursuit of GDP growth to the pursuit of public ecological dividends. In order to improve the evaluation system for development achievements, the Yantian District Committee and District Government issued the Medium and Long-term Plan for the Construction of Ecological Civilization in Yantian District, clarifying establishment of the Gross Ecosystem Product (GEP) accounting mechanism and inclusion of the mechanism in the indicators and evaluation of ecological civilization construction. The Plan's release has contributed to managers' and the public's understanding of GEP, so that they can use GEP accounting and management, as well as correct the bias of assessing achievements simply by economic growth rates.

4.2 Actions

1. Innovatively carry out research on the GEP accounting system of Yantian District. Yantian took the lead in establishing an urban GEP accounting system that corresponds to GDP, reflecting the function of natural ecosystem services and the contribution of humans to improving the environment. Three levels of indicators were designed, including two first-level indicators, 11 second-level indicators, and 28 third-level indicators. On January 21, 2015, Yantian District held a press conference at the Shenzhen Civic Center to officially announce the results of their "GEP" study, which generated a large social response throughout the country.

2. Establish a system that pays equal attention to GEP and GDP. GDP relates to the operation of the economic system, while GEP relates to the operation of the ecosystem. As far as the development of a city is concerned, both are indispensable. It is necessary to move away from the excessive pursuit of GDP growth and pay equal attention to GEP and GDP. By measuring changes of GEP in economic and social development, the ecosystem development can be understood and evaluated in a timely way, through a "double-track promotion" demonstration process for ecological civilization development.

3. Include urban GEP in planning, projects, decision-making and evaluation. Firstly, Yantian District government included urban GEP-related content in the Thirteenth Five-Year Plan for National Economic and Social Development in Yantian District, in the Medium and Long-Term Planning for Ecological Civilization Construction in Yantian District (2013-2020), and implemented sustainable social and economic development strategies. Secondly, the District uses urban GEP as a precondition for the environmental impact assessment of a project. It has established a GDP and GEP dual upgrade project library and strengthened requirements for GEP improvement in construction and project management. Thirdly, by understanding changes in the functional value of urban ecosystems and scientifically evaluating regional economic and social development, as well as sustainable development of the ecological environment, GEP provides a theoretical basis for comprehensive decision-making in economic and social development. Fourthly, Yantai incorporates the specific indicators and work content of the urban GEP into its ecological civilization construction assessment and government performance assessment. The number of assessed units has increased from 20 in 2013, to the current 45, covering all party and government organs, district units and street offices, furthering the goal of a society and economy in harmony with nature.

4. Develop and establish a computerized model of the urban GEP accounting system. Yantian District has developed and designed an urban GEP accounting management platform and established an urban GEP accounting database, along with a GEP module computerized model. It used these to implement "urban GEP" accounting from 2013 to 2017, as well as realizing the automated processing of accounting data indicators and weighting parameters. These simplified processes guaranteed the operability and accuracy of calculations, while improving the digitalization and visualization of regional GEP accounting and management.

5. Complete the first local standard for urban GEP accounting in the country. The Standard for Accounting of Gross Ecosystem Production (GEP) in Yantian District clarified the accounting indicators, accounting methods, accounting factors, pricing methods and data acquisition methods for urban GEP. The standard was launched in 2016, with procedures for soliciting opinions, revision, reporting and review completed in 2017. The entire system was officially released and implemented at the end of 2018, providing a demonstration for the calculation of urban GEP in other regions.

6. Organize a high-level urban GEP forum. On April 27, 2015, the Yantian District Committee, the District Government, the Municipal Committee for Comprehensive and Deepening Reform, the Municipal Development and Reform Commission, the Municipal Human Settlement Environment Committee and the Municipal Statistics Bureau jointly held a high-level forum, called "Discussion on the Development of Yantian-Urban GEP Innovation, Integration, and Development". Dozens of leaders, experts and scholars from the National Development and Reform Commission, the Ministry of Environmental Protection, the Research Office of the State Council, the Development Research Center of the State Council and the Chinese Research Academy of Environmental Sciences attended, discussing the application of urban GEP in Yantian.

4.3 Performance

1. Systems were innovated to support ecological civilization for sustainable development. Yantian District took the lead in exploring a GEP accounting system that can reflect the value of nature and ecological benefits. The system is designed for double accounting, double operations, along with double promotion of GDP and GEP in Yantian District. The technical specification for urban GEP accounting was compiled and completed, an urban GEP accounting and management platform was constructed, and standardization, normalization, modularization and computerization of urban GEP accounting work realized to ensure that "urban GEP" was applied to "planning, project, decision and assessment," to turn research results into practical applications.

2. New ideas were explored for green development. As a unit of the first and second batches of national demonstration zones for ecological civilization, Yantian District responded to national requirements for ecological civilization development through the "GEP+" green development mode with a theme of "urban innovation-driven development strategy under the new normal". It strengthened the balancing function of the ecological civilization system by coordinating the interests and demands of all stakeholders in society, forming a green development action plan with the principle of "priority protection, strict management and sustainable development", along with effectively promoting the development of ecological civilization.

3. Public awareness of ecological civilization has significantly grown. Various functions of urban GEP were "valued" and "price tags" for "blue sky, green space, beautiful mountains and clear waters" were made to promote the transformation and upgrading of economic and social development in a green direction, helping to raise awareness among the public of the value of urban ecosystems. By building livelihood projects related to urban GEP, such as providing energy saving and emissions reduction public bicycles, public participation was enhanced. The more people ride, for example, the higher the value of GEP. Yantian District has taken the lead in realizing full coverage of waste classification for the whole city. Nineteen communities have been recognized by the Guangdong provincial government as the most liveable in the province. Residents' awareness of ecological civilization and their rate of satisfaction over environmental improvement in Yantian ranked first in the city for six consecutive years.

4. The Yantian experience was publicized and is replicable. Research results of urban GEP in Yantian District have been recognized by experts and scholars from the National Development and Reform Commission, the Ministry of Ecology and Environment, the Development Research Center of the State Council, the Chinese Academy of Sciences and other institutions. It was also widely reported by media such as the People's Daily, Economic Daily, China Environment News and China National Radio. The State Statistical Bureau, Yuexiu District of Guangzhou City, Caidian

District of Wuhan City and other units have visited Yantian to investigate the accounting, management and application of urban GEP. In December 2015, the project "Urban GEP Accounting System and Application" won the honorary title of "Best Practice of Innovation of the Chinese Government in 2015".

Urban GEP accounting index system

Urban GEP accounting is based on three levels of indicators, with 2 level 1 indicators, 11 level 2 indicators, and 28 level 3 indicators.



Figure 7-6 Urban GEP accounting indicator system of Yantian

5 Environmental management: New energy vehicle promotion in Shenzhen

5.1 Background

Promoting new energy vehicles is an important measure taken by Shenzhen to curb air pollution and support sustainable development. In 2011, Shenzhen promoted new energy vehicles by adopting the model of "vehicle-electricity separation, lease financing, and integrated charging and maintenance". In the same year, the city also constructed 81 supporting fast-charging stations and installed nearly 3,000 slow-charging stations for private cars, helping to form a charging network covering the entire city. Shenzhen also sped up formulating technical standards, promulgating guidelines such as the Shenzhen Electric Vehicle Charging System Technical Specifications. It also took the lead in the country to promulgate local technical specifications for charging facilities. From 2013 to 2015, Shenzhen set up a new energy vehicle promotion and application leading group headed by the mayor, which is responsible for coordinating and guiding the work related to new energy vehicle promotion. The city also issued a number of policies, such as Measures for Promotion and Application of New Energy Vehicles in Shenzhen, and the Shenzhen New Energy Vehicle Development Work Plan. Furthermore, it introduced 18 local technical standards, such as Electric Vehicle Charging System Technical Specifications Part 2: Design Specifications of Charging Stations and Charging Stations. Since 2016, Shenzhen has continuously improved its supporting policies, explored, promoted and applied new technologies and models. It also successively issued the Shenzhen Financial Support Policy on New Energy Vehicle Promotion and Application (2016), Financial Support Policy on New Energy Vehicle Promotion and Application (2017) and the Shenzhen New Energy Vehicle Promotion and Application Work Plan (2016-2020).

5.2 Actions

1. Electrification of public transportation. In urban public transport, Shenzhen chose to promote new energy buses and taxis. The decision was made after comprehensively considering factors such as advantages in energy-saving and environmental protection, existing technology levels, and difficulties in adopting new energy vehicles. In order to enhance the effectiveness of promotion activity, the Shenzhen Municipal People's Government explicitly required all renovated and newly-purchased buses must be pure electric vehicles from 2012 onwards. Since 2015, Shenzhen has spared no effort in promoting electric buses and taxis. The government has developed a special operations subsidy policy for pure electric buses, so as to accelerate their promotion and use. In 2015, a total of 3,616 pure electric buses hit the road, followed by 9,638 in 2016 and 1,756 in 2017, with buses for mass public transport fully electric. Shenzhen Bus Group became the first of its kind in the world to realize the operation of pure electric buses on June 8, 2017. According to Shenzhen Bus Group estimates, its electric buses have run about 321.1 million kilometres, saved about 116,000 tons of fuel, and cut carbon dioxide emissions by about 360,000 tons in cumulative terms, indicating significant effects in

energy savings and emission reduction. By the end of 2018, Shenzhen's cruising taxis have all been purely electric, with a total of 22,082 taxis and 6,264 new quick-charging stations for electric taxis installed.

2. Increase in the construction of charging facilities. In order to meet the growing demand for new energy vehicles, Shenzhen has strongly promoted construction of supporting charging facilities. By the end of July 2019, it had cumulatively installed 81,634 charging stations, with a total power of 2,229,043 kW, of which 27,598 are fast-charging and 54,036 are slow-charging. Shenzhen's financial support policy for new energy vehicles focuses on the construction of charging facilities and has increased subsidies for them. In view of the serious shortage of parking spaces and low utilization of slow-charging stations, Shenzhen has begun to pilot intensive flexible charging stack technology, gradually replacing the originally designated fast-charging and slow-charging facilities with integrated fast/slow-charging facilities. It aims to improve the proportion and utilization efficiency of fast-charging facilities and reduce the land use for construction. At the same time, Shenzhen will further bring forward the development and use of wireless charging facilities. The city will introduce mobile electric vehicles during emergencies or in areas short of stations and provide diversified charging methods for electric buses. The construction of charging facilities has gradually shifted from focusing on quantity expansion to utilization efficiency.

3. The policy guarantee system. Since 2015, Shenzhen has adjusted and improved the policy guarantee system for local promotion and application in a timely manner, in accordance with the guiding principles of policies issued by the central government. Firstly, the municipal government has allocated more purchase subsidies for new energy vehicles. One-time charging subsidies have been issued for passenger car users since 2013; charging subsidies have also been given to new energy logistics vehicles based on mileage since 2016; new energy buses have been given operation subsidies based on operating mileage and service quality among other indicators; and pure electric taxis have been awarded subsidies for excess emissions reduction based on emissions reduction effects and operating mileage. Secondly, Shenzhen adjusted the method for subsidizing construction of charging facilities from 2016 and began to subsidize according to the amount of investment in charging equipment to power. Thirdly, it has adjusted the allocation method of the incremental quota of cars. Each year, 20,000 of the incremental quota of 100,000 cars are allocated for new energy vehicles, with a policy of exemption from traffic and purchase restrictions. Fourthly, Shenzhen has innovatively set up green logistics zones in each of the ten administrative areas. While banning light diesel trucks, the city allows light electric trucks to run in the city except for Shennan Avenue. Greater road rights are given to demonstrate and guide the use of new energy logistics vehicles. Finally, since 2016, Shenzhen has invested a total of more than CNY 3 billion (USD 424 million) to phase out 200,000 old vehicles, and guided owners to update to new energy vehicles in accordance with the new energy vehicle promotion policy. At the same time, a preferential policy is given to new energy vehicles for parking in public parking lots for the first two hours free of charge, to encourage citizens to purchase more new energy vehicles.

4. Innovation, promotion and application models. Since 2016, Shenzhen has changed the original "vehicle-electricity separation, financing lease, integrating charging and maintenance promotion" model of the three major bus companies. Each is given the authority to select a suitable business model for the promotion of new energy buses in accordance with its own needs. Specifically, Shenzhen Bus Group has adopted the business model of "complete vehicle purchase and service outsourcing" and concludes vehicle purchase contracts with original equipment manufacturers (OEMs) and charging service providers separately, with maintenance service agreements and charging infrastructure

service agreements during the vehicle operation period attached. Shenzhen Eastern Bus and Shenzhen Western Bus have adopted a "mixed lease (financing lease of bare buses + 'four electric power' operation lease)" business model (four electric power refers to pure electric power battery, driver, electronic control system and charging facilities). The OEM sells the vehicles and supporting charging facilities (with a station-to-vehicle ratio of 1:2) as a package to third-party financial institutions. The OEM will also be responsible for maintaining the vehicles, except the vulnerable and consumable parts during the operation period, as well as constructing and operating charging facilities. The bus operation company signs a lease contract with a third-party financial institution to lease the vehicles and charging facilities. During the lease period, the ownership of the vehicles and charging facilities belongs to the financial institution. After the lease period (8 years) expires, ownership of the vehicles and charging facilities will belong to the bus company.

5.3 Performance

1. The promotion of new energy vehicles has achieved remarkable results.

As of the end of July 2019, there were nearly 3.4 million registered motor vehicles in Shenzhen, of which 9 percent, or 299,620, were new energy vehicles. Shenzhen is also the first city in the world to have a public transport system made up entirely of electric buses: 100 percent of Shenzhen's bus fleet (16,359 buses) and taxi fleet (22,082 taxis) are now purely electric. In freight logistics, Shenzhen's new energy trucks exceed both its electric taxis and buses, with 56,166 registered – the world's largest number of new energy electric logistics vehicles for four consecutive years. At the same time, 3,279 pure electric commuter cars and 125,006 new energy private cars began operating. Supporting facilities were being constructed simultaneously and rapidly for new energy vehicles, with more than 73,000 charging stations installed to form a charging service network covering the entire city. Shenzhen has also established a standard system for electric vehicle maintenance, charging facility construction and operation, as well as battery management, creating a sound policy and standards environment.

2. Significant benefits have been achieved in environmental protection.

Vehicle exhaust emissions are the main source of air pollution in Shenzhen, making up 41 percent of local PM2.5 emissions. Promoting new energy vehicles is an important measure to tackle air pollutant emissions from motor vehicles. The switch to new energy public transport vehicles has significantly reduced atmospheric pollutants. It is estimated that on an annual basis, emissions of approximately 11,400 tons of nitrogen oxide, 18,900 tons of carbon monoxide, 345 tons of PM2.5, 380 tons of PM10, and 2,000 tons of volatile organic compounds are reduced. This contributes to decreasing the average annual PM2.5 concentration by 0.95 µg/m³, compared to 2017 levels. It should also help to stabilise noise from traffic, although evidence is mixed as road traffic noise has basically remained stable at 68 to 70 dB.

5.4 Outlook

It is expected that by the end of 2020, more than 50 percent of light logistics vehicles will be powered by electricity in Shenzhen; a total of approximately 120,000 various fast and slow charging stations will be installed, and the service radius of public charging stations will be shrunk to less than 0.9 kilometres in urban centres. By 2025, light vehicles for intercity logistics will basically be powered purely by electricity, and green logistics will be expanded to major urban areas.

At the same time, in order to address challenges to promoting new energy vehicles, Shenzhen will research the benefits of building charging stations, incorporate charging station construction into supporting projects of road infrastructure and research key electric highway technologies. Actions will be taken to establish a unified public service platform for data collection and monitoring new energy vehicles across the city, advance technologies applied in new energy vehicles, lay out charging facilities and provide relevant data to address traffic congestion. Efforts will be made to investigate the basics of the actual life cycle status of new energy vehicle power batteries and study their utilization, storage, transportation and recycling. In particular, Shenzhen will gradually establish a recycling mechanism for waste and used power batteries, with vehicle manufacturers the main responsible entity.

6 Health: A high quality and efficient medical and health service system

6.1 Background

Ensuring a healthy lifestyle and promoting the well-being of all people of all ages are crucial to sustainable development. Although countries have made great progress in increasing life expectancy, continuous efforts are needed to tackle persistent and emerging health problems. By providing funding for the health care system and enhancing medical accessibility, Shenzhen is pushing to make significant progress in implementing SDG3, ensuring a healthy lifestyle and promoting the well-being of people of all ages.

Shenzhen has thoroughly implemented the Healthy China strategy, followed the reform proposal of "Building a People Centred Integrated Care (PCIC) System" put forward by the World Health Organization, the World Bank, the National Health Committee, the Ministry of Finance and the Ministry of Human Resources and Social Security, and has continuously improved the new integrated medical service system based on "regional medical centres + primary medical groups". In 1996, Shenzhen set up the first community health service agencies to provide citizens with basic medical care and basic public health services, including medical care, prevention, health care, rehabilitation and health education. The community health service agencies were funded by the government and organized by hospitals to promote the integrated development of hospitals and community health service agencies. Since 2015, with Luohu

District as a pilot area and administrative districts or several streets as service grids, Shenzhen has set up 12 primary medical groups. These are led by tertiary hospitals and composed of several other hospitals, public health agencies, community health service agencies, nursing homes and professional rehabilitation agencies, providing citizens with comprehensive, continuous and systematic medical and health services. With municipal hospitals in the lead, 11 regional medical centres, 10 specialized prevention and treatment centres and one regional medical centre of traditional Chinese medicine were set up to undertake emergency and critical treatment, consultation of difficult and complex cases, prevention and treatment of major specialized diseases, training of talents and crucial medical science and technology. Through specialized medical alliance and hierarchical diagnosis, primary medical groups have been driven to improve their capabilities and levels. The construction of an integrated medical and health service system has effectively made medical resources available at lower levels.. This improved the overall capability and operating efficiency of Shenzhen's medical service system.

6.2 Actions

1. Adjust and optimize the allocation of medical and health resources, as well as promote the integrated and collectivized operation of the medical health service system.

Firstly, Shenzhen established an integrated system framework centred on "primary medical groups + regional medical centres". Regional medical centres are mainly composed of municipal hospitals, aiming at improving the diagnosis and treatment of severe acute diseases and complex diseases, promoting the coordinated development of medical research and prevention, and promoting the overall medical level of the region by radiation. Primary medical groups have administrative districts or several streets as their service grid. They promote the integration of hospitals, primary medical and health agencies and rehabilitation care agencies, provide citizens with comprehensive, continuous and systematic basic medical and health services, acting as "gatekeepers" of health for residents in their region. Regional medical centres and primary medical groups are connected and clustered, so as to strengthen medical cooperation, establish discipline alliance, strengthen personnel and technical assistance, develop scientific research resources and encourage the impact and driving effect of regional medical centres on primary medical groups.

Secondly, the resource integration and optimization of primary medical groups is promoted, and collectivize management strengthened. Each primary medical group is expected to improve the efficiency of allocation and utilization of public resources by formulating articles of association of the group, improving its organizational management structure, clarifying responsibilities, rights and obligations of each member unit of the group, while improving the circulation and operation mechanisms of HR, financial and material resources. They set up a centralized and unified sharing platform for examinations, medical imaging, logistics management and medical equipment procurement. Other actions include implementing an online version of the community health service information system, creating a real-name system of residents from the whole city to establish electronic health records and promoting mutual recognition of examination and test results. They also include supporting open information exchange channels among hospitals, community health service agencies and public health agencies, along with promoting information sharing and communication among members, as well as strengthening their use of beds and equipment.

Thirdly, the division of responsibilities and cooperation among different agencies in the system to provide

integrated services is being encouraged. This is done by implementing “priority appointment referral, priority diagnosis and treatment, priority examination and priority hospitalization”, allocating all the appointments with public hospitals’ senior doctors in the city one day in advance for use by community health service agencies, unblocking the two-way referral channels for hospitals and community health service agencies and the billing process, while promoting hierarchical diagnosis. Other actions being implemented include strengthening the guidance of specialized public health agencies to hospitals and community health service agencies, promoting public health resources for care at the grassroots level in disease control, maternity and child care, as well as preventing and treating chronic diseases. They also include integrating prevention, treatment, rehabilitation and health promotion services. Special documents are also being issued to strengthen the role of hospitals hosting community health service agencies, promote two-way referrals, integrate the distribution of drugs in both and realize “examination by community health service agencies and diagnosis by hospitals”.

2. Promote four incentive mechanisms for “strengthening the primary units and promoting health” to form the internal capacity to promote medical and health resources and services at grassroots levels.

Firstly, medical insurance is promoting medical recourses at grassroots levels. Shenzhen medical insurance participants who are willing to sign a family doctor service agreement with the basic medical groups are the objects of service (the Contracted Insured). The medical insurance organization and basic medical group enter into an agreement to define the health management, tiered diagnosis and treatment for the Contracted Insured, with awards for saving medical insurance fees. Upon executing the agreement, the basic medical group works to improve the service capacity, strengthen social health institutions, provide home doctor services and improve the two-way system of transfer treatment. Thus, the Contracted Insured will first receive a diagnosis from the home doctor, at social health institutions or the hospital, based on principles of a healthy life, less hospitalization, better recovery and being less burdened. After settling the total annual medical expenses of the Contracted Insured with the designated medical insurance institutions, the municipal medical insurance department controls the total annual medical expenses of all the Contracted Insured, as agreed with the basic medical group. If there is any surplus, all the surplus funds will be given to the basic medical group.

Secondly, financial subsidies are allowing medical resources to permeate to the grassroots level. The basic allowance for medical services provided by the basic medical group is managed in a tiered and classified manner, with the minimum outpatient service subsidy of social health institutions increased to CNY 40/patient and the outpatient service subsidy for tertiary hospitals gradually reduced or cancelled. The public hospitals are encouraged to share general outpatient services with the social health institutions, with special funds established as financial aid to deputy senior doctors of the tertiary hospitals who provide outpatient services at the social health institutions. The office of such experts of a deputy senior title or above may charge for examination, as per the rate of their original hospitals. For the home doctor services provided by the home doctor team to the local insured, a standard subsidy equal to CNY 120/ Contracted Insured is available. The basic subsidy for public health as provided by the social health institutions are increased to CNY 70/permanent resident. The fees for a home sickbed are increased to CNY 100/bed and the visit fees of a home sickbed are increased to CNY 77/time, both of which are covered by medical insurance. The basic medical group is encouraged to develop home sick-bed services.

The third action for strengthening healthcare is to channel resources to social health institutions through pricing

differentials. The rate of a social health institution is 20 percent lower than that of a tertiary hospital. The local Class 1 contracted insured is entitled to favourable policies when first receiving diagnosis services at a social health institution or buying any medicine at a medical insurance services’ designated agency with the prescription issued by a social health institution, in which case, 70 percent of the cost will be paid from the patient’s personal account, with the residual 30 percent paid by the consolidated funds. The local contracted insured of Class 2 or 3 is required to seek a diagnosis firstly at a social health institution and will be entitled to the tiered service of transfer treatment. Otherwise, the medical insurance will not work.

Fourth, the salary incentive system for medical workers supports greater grassroots medical and health care. This is because state-approved resident doctors or graduates with a training certificate as a general practitioner are encouraged to work at the social health institutions. The ones choosing to do so are awarded a maximum CNY 350,000 (USD 50,000) as a lump-sum living subsidy and a salary system equivalent to or superior to that for a specialist at a public hospital of the basic medical group. The salary standards for the medical personnel of the social health institutions are enhanced. Further, posts for the deputy seniors willing to work on the front lines are not limited by the official quantity for senior technical posts, in order to expand the career development of general practitioners working at social health institutions.

3. Guarantee public health through the development of basic medical institutions.

Firstly, social health institutions must be optimized continuously. Standards were released to establish the community organization of health services, to stimulate the classification management of social health institutions, standardize facilities and personnel management, along with lowering the threshold for room configuration and applications for social health businesses. Social organizations are now encouraged to set up social health stations in large-scale comprehensive buildings, industrial parks, agencies and institutions for the purpose of providing convenient medical services and health management to all.

Secondly, the availability of family doctor services must be increased. The Regulations on the Administration of the Family Doctor Service in Shenzhen (Trial), the Specifications of Family Doctor Services, and the Guidance on the Competence Assessment for the Senior Family Doctors in Shenzhen (Trial) have been released to standardize the provision of family doctor services and continuously improve the competence of the family doctor teams. The 24h hotline for family doctor services has been set up, with the “QR Code of Health” promoted for the purpose of archiving, contracting, attendance and transfer treatment, to develop networked, digital and smart health management services.

Thirdly, basic public health projects need to be further implemented. The Regulations on the Management of the Basic Public Health Services in Shenzhen has been developed to manage the contracted agencies providing basic public health services as basic medical institutions, establishing a system where the government assumes the costs for basic public health services, promotes the performance assessment by a work point system, and encourages society to build more basic medical institutions to expand the coverage of basic public health services. Family doctor services should increasingly serve as a channel for promoting basic public health services. The family doctors should be required to preserve the health records of the contracted residents and inform them about basic public health services.

6.3 Performance

1. The allocation of medical resources have been optimized. There are currently 138 built-in hospitals in Shenzhen, including 80 public hospitals (42 tertiary ones and 18 Grade A tertiary ones) and 668 community health service centres. This means at least one regional medical centre and one basic medical group are available in each district, at least one hospital or regional social health institution is available at the sub-district level and one social health institution is available for each community. There are on average of 2.7 doctors serving every 10,000 people and one social health institution serving every 19,900 people (average). There are also 543 offices for specialists in 404 social health institutions.

2. Preliminary development of tiered diagnosis and treatment has been realized. At present, an integrated medical service system based on 22 comprehensive regional medical centres (special centre of prevention and control), while 12 basic medical groups have been developed. In 2018, the basic medical service system mainly consisting of basic medical groups undertook 74.9 percent of total outpatient services of Shenzhen. There were 1,150,000 patients accessing to the two-way transfer treatment through the social health information system. More than 3,300,000 residents entered into an agreement with family doctors. The load of diagnosis and treatment assumed by social health institutions increased by 7.6 percent year-on-year.

3. Continuous improvement of public health. The basic medical groups have positively enhanced chronic disease management, gerontology, women's and children's health, along with disease screening for community residents, with prevention and control integrated against critical diseases, in order to prevent any major diseases and guarantee healthy conditions to the best extent possible. In 2018, the number of public health emergencies fell by 62.1 percent, the caseloads reduced by 74.5 percent. In 2020, the average life expectancy extended to 81.45 years old (3.1 years more than in 2012); and the death rates of pregnant and lying-in women and infants reduced to 4.79/100,000 and 1.14 percent respectively. The Specialized Committee of Healthy Cities of the Chinese Society for Urban Studies released an indicator system of healthy cities in July 2018, in which Shenzhen ranked first.

4. Low resident medical costs has been achieved through high fiscal subsidies. In 2018, state funding accounted for 32.5 percent of total spending of the public hospitals in Shenzhen, more than three times the national average of about 9.5 percent. Since 2015, personal spending on healthcare has been lower than 20 percent of total health expenses. In 2018, the proportion of spending on drugs for all medical institutions in Shenzhen was cut to 24.5 percent, which was low compared to the national average. The average outpatient service fee per time was CNY 248.9 and the average hospitalization expenses per time were CNY 11,353, lower than the average level of the sub-provincial cities of China.



Figure 7-8 Charity clinical services at the Health Service Centre in Cuiling Community

7 Modernization of social governance: Smart Futian

7.1 Background

With the development and application of new technologies, such as the Internet of Things, artificial intelligence and big data, profound changes are taking place in society. People's demands for social governance and public services are constantly increasing. Traditional urban management and service methods can no longer meet people's new needs and expectations. Countries all over the world have explored new development paths. The 19th National Congress of the Communist Party of China proposed the goal of building a digital China and a smart society. In the 8th (2018) Evaluation Report on the Development Level of Smart Cities in China released by the Information Research Center of the Chinese Academy of Social Sciences, Shenzhen's smart city development level reached 76.3³⁹, ranking first in China. A key example is Futian District, which implements the decisions of the central, provincial and municipal government. Focusing on improving the vitality of the city and the well-being of its population, Futian has made great efforts towards SDG 11, Sustainable Cities, by integrating modern science and technology within governance and public services, through promoting scientific decision-making, increasing the efficiency of public services and creating a new pattern of social governance jointly built and shared. In 2018, Futian District won the State Council's commendation for speeding up and improving the quality and efficiency of its work to "streamline administration, delegate powers, and improve regulation while providing better services."

7.2 Actions

1. Multi-stakeholder participation has created a new pattern of social governance. This is demonstrated through the Futian District Smart City Command Center, led by the government to optimize the business and information flow of operations, reshaping the administrative system. The centre is positioned as the centralized control unit, integrating an emergency command centre, operations monitoring centre, distribution and disposal centre, as well as a big data centre. It integrates four levels of management, namely: district, street, community and grid, with a "centre-sub-centre" command system. Futian pioneered the "Taobao" model in the field of social services in China. Through crowdsourcing and subcontracting, it undertakes government services and function transfers, intelligently matches high-quality projects, enterprises and funds, as well as realizes in-depth information integration and accurate matching of resources between the government, enterprises and social organizations. The public actively participates in creating a better life through multiple channels. Futian has relied on the Smart City Command Center to build five platforms covering early warning and monitoring, comprehensive management, decision support, public services and basic support. These operate through 102 systems covering education, health, civil affairs, the economy, public safety, environmental

39. Centre for Informatization Study, Govmade Smart City Research Center. Peking. 2018.

protection, etc. Residents participate in social co-construction by reporting hazards, reflecting demands and putting forward suggestions through the Smart Futian Mobile Portal. Using the Smart Civil Administration System, the elderly in the community can receive home services, visits from family doctors and others without leaving home. Residents also participate in the “people’s livelihood micro-facts” project through mobile platforms, prior proposals, in-process monitoring and post-event evaluation. The whole process interacts with the community to solve urgent problems in a timely manner, including small matters.

2. Multi-platform innovation is creating a new model of “co-governance”. Firstly, the District is promoting smart “hidden danger” warnings in innovative ways. It is essential to integrate data from cameras, sensors, alarms and other relevant sources from various government departments. This can build a comprehensive database on economic activities, public safety, communities’ services, transportation, and environmental protection, so as to detect hidden dangers in a timely manner and issue early warnings. Secondly, the District is building an innovative integrated governance platform. Relying on the comprehensive management platform, the District is building smart street management system, smart emergency response system, smart fire protection system, smart violation detection system. Through comprehensive event integration, full-cycle governance, the District is building a transparent governance system integrating all four administrative levels from city, district, street, to community. The smart street management system has been integrated with data on security monitoring, environmental protection, urban management and of other departments. The status of each indicator can be displayed in a single window, so that the situation of the jurisdiction is readily available. The smart emergency disposal system links with the daily distribution and disposal system, efficiently handling all kinds of emergencies. For example, when the Internet of Things (IoT) monitoring equipment verifies there is a fire, it will sound the alarm and notify the property management team. It will also automatically notify the fire brigade and relevant leaders. The command centre will send the police fire truck along the fastest traffic route, to the best parking position, provide the building map and resident personnel contact information, besides monitoring the situation in real time. The integrated system allows users to gain valuable time. The third contribution is to innovate decision-making through evidence-based research. Through big data research and analysis of macroeconomics, public safety, livelihood services, IoT perception and environmental protection, the system effectively supports scientific decision-making and promotes accurate management. The IoT sensing system extends sensors to different locations, such as industrial zones, business zones and residential quarters, highlighting weak spots and providing “first-hand information” for urban governance and decision-making. In case of heavy rain, it will evaluate the precipitation forecast, analyse the historical flood data and real-time monitoring of the IoT device. It can then issue an early warning for areas at risk of waterlogging and notify emergency personnel.

3. Multi-data integration is creating a new pattern of “sharing” of social governance, through “share” innovation and “service supply”. Futian District integrates the work of the government service hall and re-creates the processes, so residents can complete their procedures through various online channels, such as the online service window, WeChat Official Account, self-service terminal and service hotline. Futian District has come up with a new mode of “processing at fingertips, all-day working, official account management and processing at the nearest office”, to build a “zero distance” government service supply system. The second step is to break information silos through sharing. The District has introduced a performance appraisal system for government information sharing, conducted performance appraisal for information sharing for 54 assessed units, examined more than 1,000 data items incorporating them into appraisal and evaluation, and lowered performance appraisal scores for non-sharing departments, to effectively address the problem

of incomplete and late information sharing in all departments. The third is to promote “responsibility implementation” by sharing. City’s locations are accurately associated with basic data on people, legal entities, and urban areas, as well as various service management business data. The data is localised to the level of buildings and apartments, offering multi-dimensional visual displays, data collection of building and house information, security officers, building managers and the responsible policeman, as well as defining management boundaries, service targets and management responsibilities. An integrated mobile work APP is applied to record and share the work of public officials, increasing government transparency.

7.3 Performance

The financial big data monitoring system launched at the end of December 2017, combined with Futian’s aim to be the financial centre of Shenzhen, conducts financial big data monitoring for more than 580,000 key enterprises in the jurisdiction. It has screened out 23 high-risk enterprises and 67 medium-risk enterprises, and 4,690 low-risk enterprises, effectively promoting the healthy and stable development of Futian’s economy. Futian’s stability maintenance early warning and prediction system conducts data analysis and model deduction on disruptive incidents, such as riots and mass violent conflicts, in the region. A total of 53 potentially disruptive incidents were investigated and two mass incidents involving over 1,000 people were resolved. The number of mass incidents and people involved decreased by 32.4 percent and 43.4 percent respectively year-on-year.

The Smart Futian APP mobile portal connects the online service hall, the city’s basic-level comprehensive public service platform and the electronic license library. It also introduces facial recognition technology, self-service terminals, postal express delivery, etc. It can provide 212 services in 15 categories for citizens and enterprises. Futian Court pioneered the “Great Whale Intelligent Platform”, the first fully-online financial dispute case handling system in China, realizing that parties involved in litigation cases do not want to have to take time to be present in person. It has been included in the Blue Book series of Annual Report on the Rule of Law in Local China of the Chinese Academy of Science, and is the only legal innovation project selected for the court system of Guangdong Province. The “cloud notarization” system, via online notarization, has solved the problem of difficulty in obtaining evidence from phishing websites and online sales of fake rights protection. Remote video mediation of disputes and online judicial confirmation of agreements have enabled the public to protect their rights without having to do so in person. So far 416 cases have been processed, a result that has been commended by the public.

A coordinated data-sharing and dynamic updating mechanism has been set up within the district and in urban areas. All departments of the district have shared more than 45 million pieces of data, while district data centres have accumulated more than 430 million pieces of various types of data. The framework for the Smart Futian platform will be reconstructed, with basic tools jointly built and shared. Department business systems will be collected on the government cloud, and new businesses will be built on the government cloud to ensure resource sharing among departments. The “Qian Fan” campaign for big data application was launched to deepen the innovative application of “data sharing”. 47 informatization projects were submitted by 39 units in the whole region in 2017, involving many fields

such as industry, public safety, people's livelihood services, environmental protection, etc. Solutions were provided with a brand-new perspective and innovative methods. More than 10 projects, such as "eCaibao" developed by the Futian Public Security Bureau and District Digital Cultural Center, are in leading positions in the country.



Figure 7-9 Smart City Command Center Hall, Futian District, Shenzhen



Figure 7-10 Smart City Command Center System, Futian District

8 Inclusive and open international cooperation: BGI "Laos-China Modern Agricultural Science and Technology Demonstration Park"

8.1 Background

Productive partnerships between the governments at all levels, the private sector and civil society are at the heart of implementing the SDGs. As an example of efforts towards SDG 17, we present the Shenzhen-based Beijing Genomics Institute (BGI)'s work to support Laos' agriculture development.

In 2007, in response to the China's "Going-out" strategy, BGI – relying on Laos' rich natural resources and its own advanced genetic scientific and technological achievements – launched projects in Laos to collect, identify and breed various important grain crops and tropical crops for agribusiness. The "Laos-China Modern Agricultural Science and Technology Demonstration Park" is a science and technology assistance project to developing countries, jointly built by the science and technology departments of the two countries and by BGI. At the "10th China-ASEAN Expo" held in September 2013, the Minister of Science and Technology, Wan Gang, along with the science and technology ministers of Laos, Thailand, Indonesia and other countries, witnessed the project's signing. The "Laos-China Modern Agricultural Science and Technology Demonstration Park" project, jointly organized by BGI and the Lao Ministry of

Science and Technology, was supported by the national Ministry of Science and Technology. In December 2014, the demonstration park was recognized as the "BGI-Laos New Agricultural Technology Demonstration Park" by the Yunnan Provincial Government and Yunnan Science and Technology Department. On August 4th, 2017, the "Laos-China Modern Agricultural Science and Technology Demonstration Park" was successfully selected as one of the first batches of Overseas Agricultural Cooperation Demonstration Zone" construction pilots by the Ministry of Agriculture.

8.2 Actions

Relying on BGI's global leading biotechnology, it has built a molecular breeding joint laboratory, a tropical breeding base and related supporting facilities to carry out projects such as animal and plant breeding, non-food bioenergy and genetic health, helping Laos' bio-economic development. Projects include experiments for improving and breeding local glutinous rice to improve the yield based, while maintaining the original flavour and taste. They also include seedling cultivation experiments of tropical cash crops, such as Inca fruit and balsa wood, along with cultivation methods suitable for Laos. A series of products using Inca fruit has been developed, as well as a water and fertilizer integrated irrigation greenhouse demonstration project using soilless cultivation, with the park built for it the first smart agricultural system in Laos. It has also established a display module of a crop-planting production site control system that addresses the actual needs of Laos. In addition, a talent exchange system has been established, encouraging scientific and technological exchanges between scientists in China and ASEAN countries.

8.3 Performance

BGI has introduced seed granules from South America and Peru, bred new strains of Inca fruit with full seed particles, high seed setting rates and plant growth, as well as explored a new model suitable for germplasm in Laos. It also successfully developed a series of products such as essential oils, handmade soaps, masks, creams, etc. with Inca fruit as the main raw material. BGI has collected more than 300 tropical rare plant resources along the Mekong River Basin. The park breeds Mekong giant catfish, tilapia and other characteristically Laotian fish, and is listed as an important demonstration base for aquaculture by the Lao Ministry of National Defence.



Figure 7-11 Rice planting experiment in the demonstration park

8.4 Outlook

After years of practice in Laos, BGI has formed an innovative development mode of "Scientific Research, Technology, Industrial Promotion and Resource Integration". It is expected to establish a new agricultural breeding centre, collect and develop new germplasm resources, and carry out research on new varieties and technologies, as well as demonstrate and promote their application. BGI will also promote talent development, cooperation and exchange, along with gradually improving the demonstration areas and cooperation mode, sharing results with ASEAN countries, contributing to the agricultural modernization of partner countries.

9 Innovative development case: Shenzhen as a global innovation capital

9.1 Background

Technological advancement is a catalyst for development and the implementing the SDGs. Increasing investment in innovation could help provide the tools for addressing urban sustainability challenges and promote inclusive, sustainable industrialization, further implementing SDG9.

On March 7th, 2018, General Secretary Xi Jinping attended the deliberation of the 13th National People's Congress of Guangdong Province and delivered a key speech at the first session, giving Guangdong a new mission and responsibility of being at the "forefront of development in four areas in the country." This clearly pointed to the development of the high-tech industry in Shenzhen, which has become an example for the entire country in playing a demonstration role. On December 26, 2018, General Secretary Xi Jinping gave important instructions to Shenzhen, demanding that it move toward the construction of a pioneering demonstration zone of socialism with Chinese characteristics and strive to become a model city to build a strong modern socialist country.

Shenzhen, as a national innovative city, a national independent innovation demonstration zone and a national sustainable development agenda innovation demonstration zone, has thoroughly implemented the innovation-driven development strategy set by the Government. It has made fresh progress and achieved new results in promoting innovation-driven development through reforms on the supply side of scientific and technological innovation such as policies, carriers, technologies and talents, focusing on key issues, addressing deficits and weaknesses.

9.2 Actions

1. Strengthen policy guarantees and improve the innovative governance system. Shenzhen has formulated a series of planning policies, including the overall plan to be the first innovation-oriented city in China, the plan for the national independent innovation demonstration zone and the 33 measures to promote independent innovation. Since 2016, according to the central government's deployment requirements on promoting supply-side structural reform, Shenzhen has formulated a "package" policy of 235 measures to support enterprises' competitiveness, promote scientific and technological innovation, give priority to the development of talents and promote the development of higher education. In 2018, in order to further strengthen the innovation-driven legal system guarantee, Shenzhen promoted the Regulations on the Independent Innovation Demonstration Zone of the Shenzhen Special Economic Zone focusing on scientific and technological innovation, industrial innovation, financial innovation, management service innovation, space resource allocation and development of the social environment.

After being approved to build the first batch of innovation demonstration zones for the Sustainable Development Agenda in China, Shenzhen formulated and issued the outline and implementation plan for sustainable development based on the theme of "Innovation-led Megacity Sustainable Development." For the reform of scientific research fund management for colleges, universities, research institutions, enterprises and other research subjects, it identifies trigger points and problems in managing the funding of scientific research projects. Then, the Implementation Opinions on Strengthening and Improving the Fund Management of Municipal Financial Scientific Research Projects was issued, providing innovations on 20 specific measures around fund management for scientific research. This includes fund allocation, budget preparation, use management, supervision and inspection. After a series of science and technology policy and regulations was put forward, a relatively comprehensive top-level frame was created to promote innovation-driven development in Shenzhen.

2. Strengthen the carrier of innovation and carry out technological breakthroughs. Shenzhen aims to improve weak links and focus on large installations, high platforms and pioneering areas. In addition, it is implementing major basic scientific research projects, and establishing a target for the scientific research project management system. Shenzhen is also promoting the National Key Laboratory of Tumour Genomics to ministerial and provincial departments to achieve breakthroughs in the national key laboratory of chemical oncogenomics, dissecting the biology of cancer-associated genes. Further, it is strengthening the construction of a makerspace, supporting optimization and upgrading of unique creation spaces. Additionally, Shenzhen is supporting makerspace organizations, such as Chaihuo and Techspace, to provide a comprehensive range of powerful modular development tools, small batch production, fund matching and other comprehensive incubation services to makers focused on hardware.

Focusing on key technologies in high-end medical equipment, industrial motherboards, core chips, key components and other key areas, Shenzhen has carried out core technology research and invested a total of CNY 738 million (USD 104 million) in special funds for the project. It will formulate implementation measures for strengthening basic research and tackle key technologies in 10 key components, including for chips and medical devices.

3. Strengthen government guidance and optimize the innovation environment. Government support is being given a guiding role and Shenzhen has set up a CNY 100 billion (USD 14 billion) government investment guidance fund, to build social capital in innovation and entrepreneurship, as well as support the development of emerging industries. An angel investment guiding fund with an initial investment of CNY 5 billion (USD 700 million) will be set up, entrusted

to Shenzhen Investment Holdings and Shenzhen Capital, two municipal state-owned enterprises, that will jointly manage it. The establishment of a technology and finance special project will enlarge the leverage of government funds on financial resources and guide financial support for enterprises to innovate and start businesses through such projects as bank-government-enterprise cooperation discount, equity investment and risk compensation. According to the law, stricter intellectual property protection will be implemented and the China (Shenzhen) Intellectual Property Protection Center and the South Center will be officially listed. Programs, such as the Peng Cheng Talent Program, will be introduced and a national human resources service industrial park will be established.



Figure 7-12 Intellectual property subsidy projects, Nanshan Intellectual Property Protection Center

9.3 Performance

1. The supply capacity of technological innovation has been strengthened. Two provincial laboratories in Guangdong, the Peng Cheng Laboratory and the Life Information and Biomedical Laboratory, were approved in 2018 and 2019 respectively. There are seven provincial laboratories in the province, two of which are located in Shenzhen. Five national key laboratories for enterprises, including the State Key Laboratory of Wireless Communication Access Technology (Huawei) and State Key Laboratory of Metamaterial Electromagnetic Modulation Technology (Kuangchi), have been established. A number of new research and development institutions have been set up, including the Research Institute of Tsinghua University, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences and the Kuangchi Institute of Higher Studies, which integrate scientific discovery, technological invention and industrial development. 11 institutions, including the Shenzhen Academy of Aerospace Technology and Shenzhen Academy of Robotics, have been recognized as provincial-level new research and development institutions, and a total of 41 provincial-level new research and development institutions have been established. Ten Nobel Prize Scientists Laboratories are planned, and five Nobel Prize Laboratories, including the Grubbs Research Institute and the Shuji Nakamura Laser Lighting Laboratory, have been established. The first batch of seven Shenzhen overseas innovation centres, including the San Francisco Overseas Innovation Center in the United States and London Overseas Innovation Centre in the United Kingdom, was officially awarded licenses. Based on the field of genomics, metamaterials, big data, graphene and other frontier fields, 10 new basic research institutions have been established. In 2018, 189 new innovative platforms were built, with 1,877 platforms in total, of which 114 were the national level.

2. Shenzhen hosts firms with increasing innovation capability for key technologies and their application. In 2018, Shenzhen won 16 national science and technology awards, including the first prize for Scientific and

Technological Progress, and four gold medals for Chinese patents. The number of patents granted increased by 48.8 percent. The contribution rate of scientific and technological progress to economic growth was further increased by Shenzhen-based companies. Hisilicon, an electronic manufacturer, produces the “Kirin” Application Processor Chip (APU) with performance on par with the globally leading “Snapdragon” APU by Qualcomm. Intellifusion, a technology firm, was first in the world to propose the “cloud + end” dynamic portrait intelligent solution, taking the lead to achieve immediate mass facial recognition. The Shenzhen-based Goodix Technology’s fingerprint identification chip is in the leading position globally in terms of capability, and they have also produced a fingerprint identification chip which provides security for mobile payments. Pango Micro, an electronic manufacturer, has launched the first domestic high-performance FPGA chip at the 10 million level with independent property rights. BGI Gene has contributed 40 percent of the Global Gene Sequencing Data; Chidamide, a new drug developed by Chipscreen over 12 years, has been used as an oral anti-tumour drug to fill the gap in the treatment of T-cell lymphoma in China; Li-ion battery negative electrode material of BTR has the largest market share in the world; Jinzhou is the first and second largest supplier of hard alloy precision ultra-fine drills and milling cutters for Printed Circuit Board (PCB) in China and the world.

3. Innovation and entrepreneurship is being upgraded as well. In 2018 more than 500 enterprises obtained loans from cooperative banks, with a total amount of nearly CNY 10 billion (USD 1.4 billion) in loans. A total of 195 makerspaces, 111 incubators and 75 makerspace service platforms have been funded, with a total funding of over CNY 500 million (USD 71 million). China (Shenzhen) Innovation & Entrepreneurship International Competition has become an important platform to stimulate innovation, attracting a total of 23,000 entries and 570 winning projects, obtaining social investment of CNY 1.27 billion (USD 180 million), and cultivating a large number of innovative enterprises such as DJ-Innovations, Maxphonics and Malong Technologies. In 2018, 285,000 new talents with high professional and academic achievements settled in Shenzhen, an increase of 8.4 percent year on year; 12 full-time academicians were attracted to work in the city, with an increase of 41 percent, and 2,678 high-level talents were added, with an increase of 59 percent.

9.4 Outlook

Shenzhen will persist in using innovation as the leading strategy for urban development and accelerate construction of an international innovation centre for science and technology industries. It will also carry out major projects for the high-quality development of high-tech industries, participate in the construction of the Guangzhou-Shenzhen-Hong Kong-Macao Science and Technology Innovation Corridor, strive to build a comprehensive national science centre, develop and expand new momentum and play a leading role in the new round of global science and technology industry reform.

The Shenzhen CCSAI indicators listed according to the 5Ps

People

Proportion of the people under the national poverty line	Basic medical insurance participation rate
<p>Indicator No.: PPL-C010201</p> <p>Description: The proportion of people within the total population living under the national poverty line</p> <p>2000: 0%</p> <p>2020: 0%</p> <p>2030: 0%</p> <p>Data sources: Shenzhen Civil Affairs Bureau</p> <p>Formula: $PPBNPL = PBNP / PP * 100\%$ PPBNPL refers to the proportion of people under the national poverty line; PBNP refers to the number of people living under the national poverty line; PP refers to the number of the total population</p>	<p>Indicator No.: PPL-C010201</p> <p>Description: The proportion of people within the total population insured by basic medical insurance</p> <p>2000: 19.13%</p> <p>2020: 91.6%</p> <p>2030: 100%</p> <p>Data sources: Statistical Communique of Shenzhen on the National Economic and Social Development</p> <p>Formula: $BMIPR = PBMI / PP * 100\%$ BMIPR refers to basic medical insurance participation rate; PBMI refers to the number of people covered by basic medical insurance PP refers to the number of the total population</p>
Disposable income of residents	Life expectancy
<p>Indicator No.: PPL-T0101</p> <p>Description: Disposable income of residents refers to the income available to residents, including wage income, net operating income, net property income, and net transfer income</p> <p>2000: CNY 20,906</p> <p>2020: CNY 64,878</p> <p>2030: CNY 100,000</p> <p>Data sources: Survey Office of the National Bureau of Statistics in Shenzhen; Statistical Communique of Shenzhen on the National Economic and Social Development; Shenzhen Sustainable Development Plan</p> <p>Formula: $DIR = WI + NOI + NPI + NTI$ DIR: disposable income of residents WI: wage income NOI: net operation income NPI: net property income NTI: net transfer income</p>	<p>Indicator No.: PPL-G03</p> <p>Description: The expected average years of life for the people born in the same period, based on the assumption that the current mortality rate by age remains unchanged</p> <p>2000: 75.5 years old</p> <p>2020: 81.3 years old</p> <p>2030: 83.7 years old</p> <p>Data sources: Eleventh Five-Year Development Plan for Health Undertakings in Shenzhen; Shenzhen Health Statistical Yearbook and Health Service Planning; Shenzhen Sustainable Development Plan</p>

Number of doctors per 10,000 people	Number of hospital beds per 10,000 people
<p>Indicator No.: PPL-C030c01</p> <p>Description: The number of doctors per 10,000 people</p> <p>2000: 11</p> <p>2020: 25.1</p> <p>2030: 32.8</p> <p>Data sources: Shenzhen Health Statistical Yearbook; Shenzhen Municipal Health Commission</p> <p>Formula: $NDP = DP / (PP / 10000)$ NDP refers to the number of doctors per 10,000 people; DP refers to the number of doctors; PP refers to the number of the total population</p>	<p>Indicator No.: PPL-T0308</p> <p>Description: The number of hospital beds equipped per 10,000 people</p> <p>2000: 15.0</p> <p>2020: 35.8</p> <p>2030: 58.0</p> <p>Data sources: Shenzhen Health Statistical Yearbook; Shenzhen Municipal Health Commission</p> <p>Formula: $NHB = HB / (PP / 10000)$ NHB refers to the number of hospital beds per 10,000 people HB refers to the number of hospital beds PP refers to the number of total population.</p>
Mortality rate of children under five	Infant mortality rate
<p>Indicator No.: PPL - C030201</p> <p>Description: The mortality rate of live-birth children before the age of five during the designated years</p> <p>2000: 7.5‰</p> <p>2020: 1.9‰</p> <p>2030: 3‰</p> <p>Data sources: Manually submitted by: Shenzhen Health Statistical Yearbook; Municipal Health Commission</p>	<p>Indicator No.: PPL - C030203</p> <p>Description: The ratio of infants who die before one year of age to total births</p> <p>2000: 6.0‰</p> <p>2020: 1.1‰</p> <p>2030: 2.8‰</p> <p>Data sources: Eleventh Five-Year Development Plan for Health Undertakings in Shenzhen; Shenzhen Health Statistical Yearbook; forecast based on current trends in Shenzhen</p>
Maternal mortality rate	Deaths from traffic accidents per 100,000 people
<p>Indicator No.: PPL-C030101</p> <p>Description: The number of pregnant women in childbirth who die per 100,000 cases of live births</p> <p>2000: 28.4/100,000</p> <p>2020: 4.8/100,000</p> <p>2030: 6/100,000</p> <p>Data sources: Eleventh Five-Year Development Plan for Health Undertakings in Shenzhen; Shenzhen Health Statistical Yearbook; Municipal Health Commission</p>	<p>Indicator No.: PPL - C030104</p> <p>Description: Deaths due to traffic accidents per 100,000 population in a given period of time</p> <p>2000: 8.7/100,000</p> <p>2020: 2.2/100,000</p> <p>2030: 2.1/100,000</p> <p>Data sources: Shenzhen Municipal Public Security Bureau</p> <p>Formula: $RMRT = (NDRT / TP) * 100000$ RMRT refers to Deaths from traffic accidents per 100,000 people; NDRT refers to Number of deaths due to traffic accidents; TP refers to Total population</p>

Vaccination rate
Indicator No.: PPL-C030105
Description: The number of people actually vaccinated as a percentage of people who should have been vaccinated
2000: 96.5‰
2020: 99.7‰
2030: 98.0‰
Data sources: China National Immunization Program Chinese Center for Disease Control and Prevention; Municipal Health Commission
Formula: $VCR = AVP / NVSA \times 100\%$ VCR refers to vaccination rate; AVP refers to actual number of vaccinations; NVSA refers to number of people who should be vaccinated

Student-teacher ratio in general primary schools
Indicator No.: PPL-C040101
Description: Ratio of pupils to teachers in general primary schools
2000: 30.3
2020: 17.9
2030: 9.4
Data sources: Shenzhen Statistical Yearbook; Average of top 5 states in World Bank Database
Formula: $TSRP = NTP / NSP$ TSRP refers to student-teacher ratio in general primary schools; NTP refers to number of students in general primary schools; NSP refers to number of teachers in general primary schools

Expenditure on education as a percentage of GDP
Indicator No.: PPL-C040301
Description: Percentage of GDP spent on education
2000: 1.8%
2020: 2.7%
2030: 8.5%
Data sources: Shenzhen Bureau of Statistics; World Bank
Formula: $PEE = EE / GDP \times 100\%$ PEE refers to the consumption expenditure as a percentage of GDP EE refers to education expenditure GDP refers to gross regional product

Participation rate in organized learning (before the first year of formal age for primary school entry)
Indicator No.: PPL - C040201
Description: Proportion of children aged 3-5 years enrolled in kindergarten
2000: 66.1%
2020: 100%
2030: 100%
Data sources: Shenzhen Education Bureau
Formula: $RFNPCP = FNPCP / NPCP \times 100\%$ RFNPCP refers to percentage of female representatives in municipal people's congress; FNPCP refers to the number of female representatives in municipal people's congress; NPCP refers to the total number of representatives of municipal people's congress

Student-teacher ratio in general secondary schools
Indicator No.: PPL - C040102
Description: Ratio of students to teachers in general secondary schools
2000: 16.1
2020: 12.8
2030: 6.8
Data sources: Shenzhen Statistical Yearbook; Average of top 5 states in World Bank Database
Formula: $TSRJ = NTJ / NSJ$ TSRJ refers to student-teacher ratio in general secondary schools; NTJ refers to number of students in general secondary schools; NSJ refers to number of teachers in general secondary schools

Illiteracy rate of the population over 15 years of age
Indicator No.: PPL-C040103
Description: Ratio of illiterate population aged over fifteen years old to total population aged over fifteen years old.
2000: 1.2%
2020: 0.5%
2030: 0.5%
Data sources: Shenzhen Bureau of Statistics; Census data; National Bureau of Statistics, International Statistical Yearbook 2018, global Top 5 mean values
Formula: $IR = NI / FTP \times 100\%$ IR refers to illiteracy rate of the population over fifteen years of age; NI refers to number of illiterate persons over fifteen years of age; FTP refers to the total population aged fifteen and over

Average years of schooling
Indicator No.: PPL-C040104
Description: Average of the total number of academic education years in a given period of time
2000: 9.8
2020: 11.9
2030: 13.4
Data sources: Evolution and impact of Shenzhen's industrial development and population structure (article); Shenzhen Municipal Bureau of Statistics; UNDP global top 5 values
Formula: $ALE = () / TP$ ALE refers to average of the total number of academic education years; DEPI refers to years of education of the population with different qualifications; EPI refers to population by educational level; TP refers to total population

Percentage of Female representatives in municipal people's congress
Indicator No.: PPL-C050102
Description: The Percentage of female representatives in urban people's congress
2000: 17.1%
2020: 24.9%
2030: 30.9%
Data sources: Shenzhen People's Congress Standing Committee Website; Municipal People's Congress Election Union Appointment Work Committee
Formula: $RFNPCP = FNPCP / NPCP \times 100\%$ RFNPCP refers to percentage of female representatives in municipal people's congress; FNPCP refers to the number of female representatives in municipal people's congress; NPCP refers to the total number of representatives of municipal people's congress

Proportion of sewage treated in a centralized manner in waste-water treatment plants

Indicator No.: PPL-C060301

Description: The proportion of treated domestic and industrial sewage to total discharged sewage

2000: 20.2%

2020: 96.1%

2030: 98%

Data sources: Shenzhen Municipal Statistical Yearbook; Shenzhen Sustainable Development Plan (2017-2030)

Formula: $CTRSTP = \frac{STC}{TDS} * 100\%$
 CTRSTP refers to the proportion of sewage treated in a centralized manner in a waste-water treatment plant
 STC refers to the volume of treated sewage
 TDS refers to the total volume of discharged sewage

Good quality water as a percentage of total environmental water

Indicator No.: PPL-C060302

Description: The proportion of provincial section environmental water at or better than Class III

2000: 28.6%

2020: 28.6%

2030: 54.5%

Data sources: Shenzhen Bureau of Ecology and Environment

Formula: $WBRGEWQ = \frac{NAWB}{TSW} * 100\%$
 WBRGEWQ refers to good quality water as a percentage of total environmental water
 NAWB refers to the proportion of surface water at or better than Class III
 TSW refers to surface water

Water consumption per unit of GDP

Indicator No.: PPL-C060401

Description: Water resources consumed for every unit of gross domestic product

2000: CNY 56.1 m3/10,000

2020: CNY 8.4 m3/10,000

2030: CNY 5.6 m3/10,000

Data sources: Shenzhen Water Resources Communique; Municipal Water Affairs Bureau; Shenzhen Sustainable Development Plan (2017-2030)

Formula: $CTRSTP = \frac{STC}{TDS} * 100\%$
 CTRSTP refers to the proportion of sewage treated in a centralized manner in a waste-water treatment plant
 STC refers to the volume of treated sewage
 TDS refers to the total volume of discharged sewage

Proportion of the population with access to electricity

Indicator No.: PPL-C070101

Description: The proportion of the population with access to electricity in the total population

2000: 100%

2020: 100%

2030: 100%

Data sources: Forecast according to “Guangdong solved the problem of electricity consumption for 21,000 rural households without access to electricity in 2007” ; “China solves the problem of electricity consumption for population without access to electricity in an all-round way” ; Asia-Pacific Sustainability Report in 2019

Formula: $PPAE = \frac{NP AE}{PP} * 100\%$
 PPAE refers to the proportion of the population with access to electricity;
 NP AE refers to the number of people with access to electricity;
 PP refers to the number of the total population

Energy consumption per unit of GDP

Indicator No.: PPL-T0703

Description: The energy consumed for each unit of gross domestic product

2000: 0.593 tons of standard coal/ CNY 10,000

2020: 0.191 tons of standard coal/ CNY 10,000

2030: 0.23 tons of standard coal/ CNY 10,000

Data sources: Shenzhen Bureau of Statistics; World Bank Database

Formula: $ECP = \frac{NEC}{GDP}$
 ECP refers to the energy consumption per unit of GDP
 NEC refers to the total energy consumed
 GDP refers to the gross domestic product

Legal frameworks for equality and the elimination of gender discrimination

Indicator No.: PPL-C050101

Description: Whether a city has formulated legal frameworks to promote, practice and monitor equality and the elimination of gender discrimination (1 for “Yes” and 0 for “No”)

2000: 1

2020: 1

2030: 1

Data sources: Articles 33 and 48 of the Constitution of the People’s Republic of China; Law on the Protection of the Rights and Interests of Women of the People’s Republic of China; Shenzhen Women’s Development Plan (2001-2010); Shenzhen Children’s Development Plan (2001-2010); Regulations on Promoting Gender Equality in Shenzhen Special Economic Zone

Prosperity

Registered urban unemployment rate

Indicator No.: PST-C080502

Description: The ratio of the unemployed to the employed population meeting all the conditions for employment in a given period of time

2000: 2.5%

2020: 2.5%

2030: 3%

Data sources: Statistical Communique of Shenzhen on the National Economic and Social Development; Shenzhen Bureau of Human Resources and Social Security

Formula: $UER = \frac{UEP}{(UEP + EP)} * 100\%$
 UER refers to the registered urban unemployment rate
 UEP refers to the number of unemployed people
 EP refers to the number of employed people

Per capita GDP

Indicator No.: PST-C080101

Description: The ratio of GDP to the resident population

2000: CNY 33,276

2020: CNY 157,575

2030: CNY 200,000

Data sources: Shenzhen Bureau of Statistics; Shenzhen Municipal Economic and Social Development Statistical Bulletin; Shenzhen Sustainable Development Plan (2017-2030)

Formula: $PCGDP = \frac{GDP}{PP}$
 PCGDP refers to per capita GDP
 GDP refers to gross domestic product
 PP refers to the number of the resident population

Added value of tertiary industry as a share of GDP

Indicator No.: PST-T0803

Description: The proportion of tertiary industry added value to GDP

2000: 49.3%

2020: 62.1%

2030: 62%

Data sources: Shenzhen Bureau of Statistics; Shenzhen Sustainable Development Plan (2017-2030)

Formula: $PAVTI=AVTI/GDP*100\%$
PAVTI refers to tertiary industry added value as a share of GDP
AVTI refers to tertiary industry added value
GDP refers to the gross domestic product

Energy consumption and economic growth decoupling index

Indicator No.: PST-T0804

Description: The relationship between energy consumption change and economic change

2000: 0.83

2020: 0.05

2030: 0

Data sources: Shenzhen Municipal Industrial Energy Consumption Guide; Tapio paper

Formula: $DIECEG=(\% \Delta EC)/(\% \Delta GDP)$
DIECEG refers to the index of energy consumption decoupling from economic growth
% Δ EC refers to the rate of energy consumption change
% Δ GDP refers to the rate of GDP change

Proportion of R&D expenditure

Indicator No.: PST-C090501

Description: R&D expenditure as a share of GDP

2000: 2.9%

2020: 3.9%

2030: 4.8%

Data sources: Shenzhen Municipal Statistical Bulletin on Major R&D Data; Shenzhen Municipal Statistical Yearbook; Shenzhen Sustainable Development Plan (2017-2030)

Formula: $PRD=ERD/GDP*100\%$
PRD refers to the proportion of R&D expenditure;
ERD refers to R&D expenditure;
GDP refers to the gross domestic product.

Number of patents per 10,000 people

Indicator No.: PST-T090

Description: Number of patents per 10,000 people

2000: 0

2020: 117.3

2030: 99.5

Data sources: Shenzhen Municipal Statistical Yearbook; Shenzhen Municipal Market Regulation Bureau

Formula: $RNPO=NPO/(TP/10,000)$
RNPO refers to the number of patents per 10,000 people
NPO refers to the number of patents authorized
TP refers to the total population

Theil Index

Indicator No.: PST-T1002

Description: An indicator that measures the income gap between individuals or between regions

2000: 0.078

2020: 0.07

2030: 0.008

Data sources: Calculated by a research group using the indicator and the formula; average of the top 5 countries in the world

Formula: $T=1^n \cdot nGDP_j / GDP * LN [(GDP_j/GDP) / (POP_j/POP)]$
GDP and GDP_j refer to the GDP of Shenzhen and its districts, respectively
POP and POP_j refer to the population of Shenzhen and its districts, respectively n refers to the number of districts in Shenzhen

GDP per unit of built-up area

Indicator No.: PST-T110a

Description: GDP produced per unit of built-up area

2000: CNY 671 million/square kilometres

2020: CNY 2.90 billion/square kilometres

2030: CNY 4.419 billion/square kilometres

Data sources: Shenzhen Bureau of Statistics; Shenzhen Municipal Economic and Social Development Statistical Bulletin; depending on the average value of the top 5 cities in the world

Formula: $UBAO=GDP/BA$
UBAO refers to the GDP per unit of built-up area
GDP refers to the gross domestic product
BA refers to the built-up area

Annual average concentration of PM2.5

Indicator No.: PST-C110602

Description: Atmospheric particulate matter (PM) with aerodynamic diameters less than or equal to 2.5 microns

2000: 38 µg/m³

2020: 19 µg/m³

2030: 15 µg/m³

Data sources: Shenzhen Bureau of Ecology and Environment; Shenzhen Municipal Environment Status Bulletin; Shenzhen Sustainable Development Plan (2017-2030)

Density of urban road networks

Indicator No.: PST-T1102

Description: Total mileage of road networks as a share of the total area

2000: 1.84km/square kilometres

2020: 8.56km/square kilometres

2030: 8.0km/square kilometres

Data sources: Shenzhen Municipal Artery Network Report; Shenzhen Municipal Transport Bureau; Shenzhen Municipal Bureau of Planning and Natural Resources

Formula: $URND=TMRN/RA$
URND refers to the density of urban road networks;
TMRN refers to the total mileage of road networks;
RA refers to the total area

Green space in built-up areas
Indicator No.: PST-T1106
Description: The ratio of green coverage in the built-up area to the area built-up area. Green coverage refers to the vertical projection area of all vegetation in the city, such as trees, shrubs and lawns, etc
2000: 49.3%
2020: 62.1%
2030: 62%
Data sources: Shenzhen Municipal Bureau of City Administration and Law Enforcement.
Formula: $GRBUA = GSA / BA$ GRBUA refers to the green rate of built-up areas; GSA refers to the green area of built-up areas; BA refers to the built-up area

Proportion of people using public transport in motorized trips during peak hours
Indicator No.: PST-C110201
Description: The ratio of public transport trips to total trips of urban residents
2000: 51%
2020: 60.5%
2030: 75%
Data sources: Shenzhen Municipal Transport Bureau
Formula: $BTSR = TNTPT / TNT * 100\%$ BTSR refers to the proportion of people using public transport TNTPT refers to the number of people using public transport TNT refers to the number of people using various modes of transport

Direct economic loss caused by disasters as a percentage of GDP
Indicator No.: PST-C010502
Description: Annual average direct economic loss caused by disasters as a percentage of GDP
2000: 0.034%
2020: 0.0125%
2030: 0.0152%
Data sources: Meteorological disasters and risk assessment of Shenzhen since 2000; Statistical Analysis Report of Shenzhen on Meteorological Disasters (2005-2014); Statistical Analysis Report on Shenzhen's Meteorological Disasters (2005-2014).
Formula: $PDEL = DEL / GDP * 100\%$ PDEL refers to the annual average direct economic loss caused by disasters as a percentage of GDP DEL refers to the annual average direct economic loss caused by disasters GDP refers to the gross domestic product

Proportion of non-hazardous treatment of domestic waste
Indicator No.: PST-C120402
Description: The amount of non-hazardous treatment of domestic waste as a share of the total amount of domestic waste produced
2000: 90%
2020: 100%
2030: 100%
Data sources: Shenzhen Municipal Environment Status Bulletin; Shenzhen Municipal Bureau of City Administration and Law Enforcement.
Formula: $HTRDW = NMWTH / TDWP * 100\%$ HTRDW refers to the proportion of non-hazardous treatment of domestic waste NMWTH refers to the amount of waste that has been treated TDWP refers to the total amount of domestic waste produced

Youth employment strategy in implementation as an independent strategy or as part of the urban employment strategy
Indicator No.: PST-T080b01
Description: Is there is an existing youth employment strategy in implementation as an independent strategy or as part of the urban employment strategy (1 for "Yes" and 0 for "No")
2000: 1
2020: 1
2030: 1
Data sources: Opinions on Further Deepening the Reform of Employment System for Graduates of General Institutes of Higher Education; Several Measures for Further Promoting Employment in Shenzhen; Thirteenth Five-year Plan for the Development of Human Resources and Social Security in Shenzhen, etc.

Urban planning framework that operates on a regular basis, in a democratic manner, with the direct participation of civil society
Indicator No.: PST-C110302
Description: Is there an urban planning framework that operates on a regular basis, in a democratic manner, with the direct participation of civil society (1 for "Yes" and 0 for "No")
2000: 1
2020: 1
2030: 1
Data sources: Regulations of Shenzhen on Urban Planning; Public Participation Workshop for the Preparation of Shenzhen Urban Master Plan (2016-2035); literature (public participation in Shenzhen Urban Planning), etc.

Urban and regional development plan integrating population forecasts and resource demand
Indicator No.: PST-C110a01
Description: Is there an urban and regional development plan integrating population forecasts and resource demand (1 for "Yes" and 0 for "No")
2000: 1
2020: 1
2030: 1
Data sources: Shenzhen Urban Master Plan (1996-2000); Outline of the Thirteenth Five-year Plan for Shenzhen; Shenzhen Sustainable Development Plan (2017-2030), etc.

Is there a disaster emergency plan
Indicator No.: PST-C110b01
Description: Is there a disaster emergency plan (1 for "Yes" and 0 for "No")
2000: 1
2020: 1
2030: 1
Data sources: Emergency Plan for Meteorological Disasters in Shenzhen; Emergency Plan at Municipal Level in Shenzhen; Thirteenth Five-year Plan for Emergency System Construction in Shenzhen, etc.

Urban action plan, working priority or target for sustainable consumption and production
Indicator No.: PST-C120101
Description: Is there is already a city-wide action plan, working priority or target for sustainable consumption and production (1 for “Yes” and 0 for “No”)
2000: 1
2020: 1
2030: 1
Data sources: Introduction to the Basic Information on Economic and Social Development of Shenzhen; Shenzhen Sustainable Development Plan (2017-2030), etc.

Planet

Proportion of offshore areas with good water quality (Category I and Category II)	Forest coverage
Indicator No.: PLN-T1402	Indicator No.: PLN-C150101
Description: Proportion of offshore areas with Category I or Category II water quality	Description: Forest area as a share of land area
2000: 50%	2000: 47.4%
2020: 72.7%	2020: 39.4%
2030: 72.7%	2030: 37.4%
Data sources: Shenzhen Bureau of Ecology and Environment.	Data sources: Shenzhen Municipal Environment Status Bulletin; Shenzhen Municipal Bureau of Planning and Natural Resources.
Formula: PPAMA=PA/MA*100% PPAMA refers to the reserve area as a proportion of the ocean; PA refers to the reserve area; MA refers to the ocean area	Formula: FCR=FA/LA+100% FCR refers to forest area as a share of land area; FA refers to forest area; LA refers to land area

Nature reserve as a share of land area	Agency to address climate change
Indicator No.: PLN-C150402	Indicator No.: PLN-C130302
Description: Nature reserve as a share of land area	Description: Is there an existing agency to address climate change? (1 for “Yes” and 0 for “No”)
2000: 0.5%	2000: 0.5%
2020: 11.4%	2020: 11.4%
2030: 9.8%	2030: 9.8%
Data sources: Shenzhen Municipal Bureau of Planning and Natural Resources.	Data sources: Establishment of the Office of the Leading Group for Climate Change and Energy Conservation and Emission Reduction in Shenzhen.
Formula: PNRLA=NR/LA*100% PNRLA refers to nature reserve as a share of land area; NR refers to the nature reserve area; LA refers to land area	

Mitigation, adaptation, effect reduction, and early warning incorporated into elementary and secondary school, colleges and universities curricula	Comprehensive capacity-building for climate change in cities
Indicator No.: PLN-C130301	Indicator No.: PLN-C130102
Description: Have mitigation, adaptation, effect reduction, and early warning been incorporated into the curricula of elementary and secondary schools as well as colleges and universities or not? (1 for “Yes” and 0 for “No”)	Description: Comprehensive capacity-building for climate change in cities (1 for “Yes” and 0 for “No”)
2000: 0	2000: 0
2020: 1	2020: 1
2030: 1	2030: 1
Data sources: Medium and Long-term Plan of Low-carbon Development in Shenzhen (2011-2020); Cooperation between Shenzhen Development and Reform Commission and Harbin Institute of Technology (Shenzhen) to Establish Shenzhen Research Center on Climate Change, etc.	Data sources: Shenzhen Eco-environmental System Capacity Building Training on Climate Change, Carbon Market Emissions Exchange, etc.

Bibliography

[1]High Level Political Forum on Sustainable Development, Monitoring and Progress, Available at: <https://www.un.org/sustainabledevelopment/zh/monitoring-and-progress-hlpf/2019>.

[2]UN Sustainable Development Group, A Million Voices: The World We Want.2013. Available at: <https://unsdg.un.org/resources/million-voices-world-we-want>

[3]United Nations Department of Economic and Social Affairs, Division for Sustainable Development Goals, Partnership Exchange Report 2018, Available at: https://sustainabledevelopment.un.org/content/documents/2569Partnership_Exchange_2018_Report.pdf

[4]United Nations Department of Economic and Social Affairs, Division for Sustainable Development Goals. Available at: <https://sustainabledevelopment.un.org/partnerships/>

[5]UN Department of Economic and Social Affairs Statistics Division, Inter-agency and Expert Group on SDG Indicators. Available at: <https://unstats.un.org/sdgs/iaeg-sdgs/2020>.

[6]United Nations, The Sustainable Development Goals Report 2018 (New York, United Nations, 2018).

[7]United Nations, The Sustainable Development Goals Report 2019 (New York, United Nations, 2019)

[8]United Nations Economic and Social Commission for Asia and the Pacific, Regional Road Map for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific SDGS Progress Report 2019. Available at: https://www.unescap.org/sites/default/files/Regional_Road_Map_SDG_in_A-P_Progress_Report_2019.pdf

[9]United Nations General Assembly. Transforming our world: the 2030 Agenda for Sustainable Development. Available at: https://www.un.org/zh/documents/view_doc.asp?symbol=A/RES/70/1&Lang=E,2015.

[10]The State Council of The People’s Republic of China, China’s National Plan on Implementation of the 2030 Agenda for Sustainable Development Available at: [http://www.gov.cn/xinwen/2016-10/13/5118514/files/4e6d1fe6be1942c5b7c116e317d5b6a9.pdf,2016-10.\(in Chinese\)](http://www.gov.cn/xinwen/2016-10/13/5118514/files/4e6d1fe6be1942c5b7c116e317d5b6a9.pdf,2016-10.(in Chinese))

[11]Prakash, M. Teksoz, et al., The U.S. Cities Sustainable Development Goals Index 2017: Achieving a Sustainable Urban America (New York, Sustainable Development Solutions Network (SDSN),2017).

Peace

Number of criminal cases filed per 100,000 people

Indicator No.: PEC-T1601

Description: Number of criminal cases filed per 100,000 people in a given period of time

2000: 982.0

2020: 522.9

2030: 520.3

Data sources: Shenzhen Municipal Public Security Bureau

Formula: $NCCPOHT = (NCCEC/PP) * 10$
 NCCPOHT refers to the number of criminal cases filed per 100,000 people;
 NCCEC refers to the number of criminal cases filed;
 PP refers to the number of the total population per 10,000 people

Partnership

System for coordinating sustainable development policies

Indicator No.: PTS-C171401

Description: Is there is a system for coordinating sustainable development policies (1 for “Yes” and 0 for “No”)

2000: 0

2020: 1

2030: 1

Data sources: Notice of the General Office of the People’s Government of Guangdong Province on the Establishment of the Leading Group for Promoting the Construction of the Innovation Demonstration Zone of Shenzhen National Sustainable Development Agenda; Leading Group for the Construction of the Innovation Demonstration Zone of Shenzhen National Sustainable Development Agenda, etc.

Proportion of people using the Internet

Indicator No.: PTS-C171401

Description: Internet users as a share of the resident population

2000: 33%

2020: 87.1%

2030: 94%

Data sources: Shenzhen Internet Market Development Report; Shenzhen Internet Development Report 2017; We Are Social & Hootsuite: Global Digital Report 2018.

Formula: $PPUI = NPU/PP * 100\%$
 PPUI refers to the proportion of people using the Internet;
 NPU refers to the number of people using the Internet;
 PP refers to the number of the permanent population

[12]UN ESCAP, Asia And The Pacific SDG Progress Report 2019. Available at: https://www.unescap.org/sites/default/files/publications/ESCAP_Asia_and_the_Pacific_SDG_Progress_Report_2019.pdf

[13]United Nations General Assembly, "The Future We Want". Available at: <https://undocs.org/A/RES/66/288,2012-9>.

[14]United Nations, "UN adopts new Global Goals, charting sustainable development for people and planet by 2030". Available at: <https://www.un.org/development/desa/en/news/sustainable/un-adopts-new-global-goals.html,2015-9>.

[15]United Nations, "Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development" Available at: https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202019%20refinement_Eng.pdf,2019-2.

[16]UN Development Group (2013). "A Million Voices: The World We Want" Available at: <http://www.worldwant2015.org/millionvoices>.

[17]Inter-agency and Expert Group on SDG Indicators. Available at: <https://unstats.un.org/sdgs/iaeg-sdgs/>

[18]UN General Assembly (2018). Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development A/RES/71/313. Available at: <https://undocs.org/A/RES/71/313>

[19]United Nations General Assembly (2015). Transforming our World: The 2030 Agenda for Sustainable Development A/RES/70/1. Available at: <https://www.un.org/zh/documents/treaty/files/A-RES-70-1.shtml>

[20]United Nations. "The Global Sustainable Development Report provides a scientific basis for countries to formulate sustainable development policies", June 30, 2015. Available at: <https://www.un.org/development/desa/zh/news/sustainable/gedr2015.html>

[21]The United Nations (2019). The Sustainable Development Goals Report 2019, New York, pg. 6. Available at: https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019_Chinese.pdf

[22]United Nations. "The UN launched the Decade of Action for the Sustainable Development Goals, and the Secretary General warned about the great four threats in the 21st century", January 22, 2020. Available at: <https://news.un.org/zh/story/2020/01/1049671>

[23]UN ESCAP (2019). Regional Road Map for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific SDGs Progress Report 2019. Available at: https://www.unescap.org/sites/default/files/Regional_Road_Map_SDG_in_A-P_Progress_Report_2019.pdf

[24]Government of Sweden (June 2017). Sweden and the 2030 Agenda: Report to the UN High Level Political Forum 2017 on Sustainable Development. Available at: <https://sustainabledevelopment.un.org/content/documents/16033Sweden.pdf>

[25]Government of Iceland (2019). Iceland's Implementation of the 2030 Agenda for Sustainable Development Voluntary National Review, 2019. Available at: https://sustainabledevelopment.un.org/content/documents/23408VNR_Iceland_2019_web_final.pdf

[26]European Commission (2019), Sustainable Development in the European Union – Overview of Progress towards the SDGs in an EU context -2019 edition. Available at: <https://ec.europa.eu/eurostat/web/products-catalogues/-/KS-02-19-166>

[27]Government of China (2016). China's National Plan on Implementing the 2030 Agenda for Sustainable Development. Available at: <http://www.gov.cn/xinwen/2016-10/13/5118514/files/4e6d1fe6be1942c5b7c116e317d5b6a9.pdf>

[28]Prakash, M., Teksoz, K., Espey, J., Sachs, J., Shank, M., and Schmidt-Traub, G. (2017), The U.S. Cities Sustainable Development Goals Index 2017: Achieving a Sustainable Urban America. New York: Sustainable Development Solutions Network (SDSN).

[29]Lynch, A., LoPresti, A., Fox, C. (2019), The 2019 US Cities Sustainable Development Report. New York: Sustainable Development Solutions Network (SDSN).

[30]UN Department of Economic and Social Affairs (2018). World Urbanization Prospects 2018 Highlights. Available at: <https://population.un.org/wup/Publications/Files/WUP2018-Highlights.pdf>



Shenzhen Sustainable Development Report (2021)