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Roundtable discussion: rethinking and exploring smart city development

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Abstract

Since the concept of the "Smart City" was proposed in 2008, the construction of smart cities has developed rapidly. While embracing smart cities, we are also gradually realizing that creating good cities cannot rely solely on new technologies. The wisdom of cities is profound and should be noted that the essence of a smart city is the intelligentization of urban entities, including the government, enterprises, and citizens. The construction of a smart city must be combined with the needs of the government, enterprises, and citizens. Especially for the iteration of smart city construction, government guidance is the key to the development of smart city construction. Enterprises are active responders and promoters of smart city construction, and users are evaluators of the achievements of smart city construction. Against this backdrop, this salon, based on more than a decade of exploration, has launched discussions around "Smart City: Reflecting on the Gains and Losses of Exploration", inviting experts from different industries such as universities, research institutes, and enterprises to exchange and speculate, discussing the difficulties and challenges faced by smart cities, as well as the development trends of new smart cities in the future. The construction focus of smart cities and how to achieve the vision of "cities make life better" are also discussed, in order to provide ideas for the future development of smart cities.

Keywords Smart city, Data technology, Practical scenarios, AI city technology15分钟前

Wu Zhiqiang: What I am going to share is Exploring and Rethinking Smart City Development and Emerging Intelligent Infrastructure, which will be described from five aspects as follows.

(1) Concept of the emerging intelligent infrastructure

What humankind established in the initial stage of civilization was a physical world which was mainly comprised of cities. With the development of cities, humankind began to create support for the world of social civilization. Today, in addition to these two worlds, there is a third world—the digital world that lies in our living, production and ecology.

In the development of modern cities, different technologies have been applied in every aspect of modern cities. In 1785, the advent of the Age of Mechanization enabled the wide application of water power and mechanical power. After 1845, with the emergence of the steel and iron industry, railways and railway stations appeared in cities, and steam engines and locomotives became the symbol of a modern city. The power sector, chemical industry, etc. emerged around 1900, and internal

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combustion engines made cities present a different appearance so that transportation planning became an important part of urban planning. After 1990, the 4th wave of city technologies was applied, and TV sets, computers, etc. were introduced. At this moment, the height control in space, airport layout, and links to town groups and other cities were taken into consideration in planning. In about 1990, the 5th wave of the technological revolution happened, and a lot of biological technologies were used in cities. Around 2000, as sustainable development technologies began to develop, concepts such as renewable energy sources, green design innovation and ecological low-carbon appeared in cities. Nowadays, we are undergoing the 7th wave of technical development, artificial intelligence, big data and mobile internet technologies are involved in cities. Every wave of technological application cities underwent has left an important influence on production, living and ecology and we can expect more from AI.

In this context, the concept of intelligent infrastructure is not proposed as an occasional result, it lies in the social life in cities. It can be described from five key aspects: 1. smart construction; 2. smart space; 3. smart life; 4. smart cities; and 5. smart society. Its core is to provide support for space, development and living in cities. In developing the intelligent infrastructure, we need to enable it to act effectively as intelligent support for a better life while bearing the mission of bettering urban life in mind.

(2) Directly addressing the pain spots against a better life

The pain spots against a better life exist in production, living, the environment, etc. For example, we may see the pain spots against an ideal home in smart times in nature, governance, trips, business, medical services, education, industries, infrastructure, innovation, housing, etc. The intelligent infrastructure is aimed at identifying them. The pain spots may dissatisfy us to some extent, but the intelligent infrastructure is proposed to help us deal with them.

(3) The intelligent infrastructure provides support for a better life

Today intelligent infrastructure development is under systematic progress on a large scale, which can be described in three parts: 1. the intellectualization of existing infrastructure, which can be seen in the energy engineering system, water conservation system, environmental protection engineering system, transport logistics system, communication engineering system and urban disaster prevention system; 2. application of future intelligent technologies in infrastructure development: an example is the application of the technology of Big Data, Intelligentization, Mobile Internet and Cloud Computing, a principal foundation for intelligent technologies, in the production and living in smart cities; 3. creation of nodal space in cities with the intelligent infrastructure. The optimization of overall urban space and local parts and the space for the intellectualization of sub-systems in future can be expected. When it comes to households, smart households met individual demands and enhance individuals' ability to control the living environment by providing an intelligent environment. In terms of communities, the intelligent infrastructure makes living more convenient. In terms of urban transport, the 'intelligent vehicle brain' helps us improve our lives. In addition, the intelligent infrastructure facilitates the interaction between people and green space.

(4) Top-down based planning framework of the emerging intelligent infrastructure

How should we plan intelligent urban infrastructure? We must have a complete top-down design orientation and analyze the aspiration of individuals for a better life. Based on experience, the authors classified smart cities into two groups: those that were constructed without the introduction of people and those that were intellectualized in an established environment to address the pain spots against urban life. The development of the latter ones often receives a good outcome because it is directed at people's needs, with each demand directly and well addressed. But social, economic and ecological benefits can be obtained by focusing on people's basic needs after their introduction, helping us find the right path for intellectualization. That is the most profound lesson we have drawn in the practical exploration of smart cities over the past 12 years.

In the planning of the emerging intelligent infrastructure, we need to follow six basic principles: open and cooperative, local areas-specific, safe and stable, self-evolved, entire population-friendly and green and sustainable. To be specific, they are reflected in six areas: intelligent urban management, intelligent urban transport, intelligent urban social services, intelligent municipal infrastructure, intelligent urban ecological environment, and intelligent urban economy and industries.

(5) Academic organizations for the emerging intelligent infrastructure

Now we are building an academic framework for the study of smart cities. In 2017, we established the World Alliance for Artificial Intelligence Urban Planning and

released the World AI Declaration for City Planning, in a bid to encourage more scholars, enterprises and industrial parks to jointly explore intelligent infrastructure planning. In 2014, we formed the China Intelligent Urbanization Co-creation Center, with more than 30 member cities in the region involving themselves in special cooperation on regional urbanization. Over the past years, we have accumulated state-of-the-art technologies and established the world's largest urban database by applying artificial intelligence in the research on cities and towns. In future, we will attract more academicians, professionals, government officials, researchers and enterprise representatives to jointly explore new spaces in cities. Now we are also building a visit and experience space for the intelligent infrastructure, which integrates information into the space where we live and presents it to the public to achieve an all-round perception, enabling the public to more directly understand how smart cities operate.

Zhen Feng: I will share the re-pondering on intelligent city theories from the following three aspects:

(1) Focus on and reflect on smart city study and practice

By reviewing the literature of smart cities over the past 20-plus years, we found that many groups are interested in smart cities, and much relevant research focuses, such as development goals and strategies, management and application, technical supports etc. The study on smart cities runs from the exploration period in early 2000, through the preliminary growth period around 2010, to the deep development period today. During the process, the research groups expand from IT researchers in the early stage to scholars in the field of management, economy, sociology, geography, and planning. Changes in literature keywords show that the research scope of smart cities is wide. In addition, many emerging technologies, such as the Internet of Things and cloud computing, have been used in the research of smart cities, and relatively state-of-the-art edge computing and blockchains are gaining more attention.

In terms of practice on smart cities, the process from the first attention of the Ministry of Housing and Urban–Rural Development paid to smart cities in 2010 to the discussion of gains and losses of smart city exploration we made today means a good trend. Although China stays ahead of other countries in terms of some fields of smart city development, on the whole, it still has a long way to go.

Problems exposed during the development of smart cities can be summarized as follows:

First, the position of planning is not clear. Smart city planning can be explained as the smart planning of cities or the planning of smart cities. When it comes to the smart planning of cities, many scholars in the field of city planning are exploring how to formulate city planning methods more intelligently. But for the planning of smart cities, the trace of information-enabled planning is prominent, and we have no understanding of what relationship such planning has with national economic and social development planning and with national land and spatial planning.

Second, we lack sufficient understanding of city development law, with few sufficient analyses on the current background of the times, problems and demands, for scholars studying smart cities from the perspective of urban science, emerging technologies are absent. Given this, I think it is very important to make coordinated considerations of the strengths and weaknesses of different disciplines.

Third, the application of information technology is over-emphasized, and integrated application and innovation of technologies are not accommodated during the development of smart cities. In the past years, we focused much on ICT without taking into consideration technological innovation in other sectors. At the same time, we attached more importance to technologies than to society and culture and didn't notice the renewal of the knowledge system brought by knowledge progress, leading to dealing with current problems with traditional thought.

Fourth, to build a "city brain", what we need to do first is to free our minds. Many city managers and citizens haven't adjusted their minds to the establishment of smart cities. How to deal with such problems and establish a new mind and open new ideas, flow, shared and integrated requires our attention.

Fifth, how should we improve institutional mechanisms to respond? For the government, a body that takes the main responsibility for spatial planning, do urban planning and establishment goals coordinate with and match that of smart cities? Will new investment opportunities be created? Do residents adapt to the emerging technologies that we introduced to improve their quality of life? Emerging technologies are of course important for enterprises. But which emerging technologies they should choose, the relations between emerging technologies and existing ones, and whether the introduction of emerging technologies increases the operation cost of enterprises should be taken into consideration.

(2) Need for more theoretical exploration of smart cities

Given the problems exposed during the development of smart cities, we must enhance theoretical exploration. Today our understanding of smart cities has begun to focus on people and the demands of social groups. As the International Telecommunication Union stated in 2016, smart cities meet future generations' economic, social, environmental and cultural demands while improving the quality of life, urban operation and competitiveness using information technology. As a result, we need to consider how to integrate people, technologies, space and society and ensure coordinated development during the development of smart cities, and gain more insight into the connotation of such development.

Smart cities exist in a regional system with complex people-land relations. A city itself is a complex system. In a new technical environment, relations between people and land, between buildings and geographical environment will be rebuilt. We need to explore the element of interaction between people and between lands in the context of new people-land relations, to facilitate the development of smart cities, including "digital twins". In studying people-land relations, we explored the application of intelligent technologies in urban infrastructure, industries, urban management and service for the public, as well as the change in residents' lifestyles. We also performed some research on the virtual space and the real space, which are indeed not sufficient for building a complex smart city system.

Smart cities are living organisms. We facilitate its operation through smart management and element flow, with the help of the smart management centre, integrated data platform and smart function zones. For a specific project, we are allowed to conduct construction in several stages. But when performing its function setting, we need to make comprehensive and unified consideration of intelligent space units.

(3) Pushing forward the development of smart cities with reliable methods

The development of smart cities is a continuous process which should be promoted reliably from the following aspects:

First, demand orientation: to meet the activity demands of individuals. For space units at different levels and of different types in smart cities, such as the varying demand of smart communities and smart industrial parks. We need to analyze the demands of individuals from different space dimensions—from buildings to communities, functional areas, cities and even to metropolitan regions.

Second, guidance by goals: how to facilitate sustainable development. The introduction of smart cities aims to promote sustainable urban development. As a result, we need to consider how to create smart spaces by integrating virtual elements with real elements to achieve the coordinated development of spaces.

Third, data sharing: information resource integration and intelligent brain platform. It is a process from the recognition of the data environment to the establishment and integration of database and data analysis, and in the end to the application in industries. It is important to build a smart city information model after having a full understanding of city operation law, instead of building the "digital twins" by simply integrating the current real city into a virtual city. Based on the smart brain platform, we can carry out various data analyses, risk evaluations and warnings, to ensure safe urban operations.

Fourth: coordinated space: space intellectualization in the context of the application of future technologies. In the smart planning of national land and space based on technology application and institutional innovation. In this process, we need to take the dynamic coupling and time & space coordination of human-facility-space into consideration, including the time & space coordination and dynamic matching of public service supply and demand, emergency intelligent control of traffic, smart diagnosis and treatment and dynamic allocation of medical resources.

Fifth, coordinated governance: the interaction between complex systems and multiple individuals. We need to ensure good interaction between the technical system, space system, activity system and decision-making system, and good interaction inside each system, to coordinate smart applications in all sectors and industries to achieve intelligent development of national land and space.

Sixth, in terms of smart city planning practice, we need to integrate urban science into the establishment of data platforms, technical supports, applications and services, to enable close combination of planning of smart cities and intelligent planning of cities and facilitate their coordinated development.

Wu Xiaoli, Guo Leixian: It is often said in the planning field that Shenzhen is a city that was constructed in full accordance with "planning". Shenzhen can be used as a case of smart city development not only for housing several leading enterprises in smart cities, but also for its inherent urban features which provide an excellent scene for us to discuss smart cities.

Institutionalized planning has a developing period of up to 10 years and cannot respond to changes in cities in real-time, then how does Shenzhen grow in the context of changing economy and technologies? We found a dynamic mechanism that had not been fully evaluated before, which is the power of evolution. The evolution mechanism can be seen as a search and improved algorithm widely used in biology. In terms of logic, the "smart cities" we are talking about also use similar evolution algorithms as a support, and achieve the "algorithm-action" closed loop through technical means and governance mechanisms, enabling cities to better adapt to the demands of humanity. Such recirculation will also speed up cities' change and evolution. But Herbert Simon, Father of Artificial Intelligence, said that what evolution mechanisms provide is just rationality without vision; any opinion on evolution, i.e. opinion that evolution will maximize fitness, refers to just local maximum, and we should not expect that evolution can lead to anything that can be described as global maximum. In other words, in theory, the evolution algorithm may not lead a city to a global optimal state. North Huaqiang Commercial Area, a place driven by the digital economy, develops the makeup industry and may bring short-term profits for microbodies. But we are not sure whether the situation will be beneficial for the Area and Shenzhen.

From the perspective of planners, how should we treat the development of smart cities? Many planning and development activities conducted today using smart city-related technologies can only improve a city's partial areas and partial systems. Even if our cities have many closed-loop routes used to improve partial areas and partial systems, planners' intervention capacity and intervention means are still unclear. We will further explain the opinions with two cases.

The first case is about Shenzhen's urban renewal. We tried to find the technically closed loop that enabled the overall external influence of urban renewal on cities through big data analysis. Urban renewal through massive demolition is blamed today for the long-distance commuting it caused. Last year, our team conducted the implementation evaluation of big data-based urban renewal planning, together with Baidu Map Huiyan. With the help of LBS data, we learn about how many people will be relocated due to the demolition of villages in cities, where they will be relocated, and how their commuting patterns will change. We found that the proportion of the people who were relocated for the demolition of their original place of residence but kept their workplace and performed long-distance commuting in total relocated people is the core parameter that influences the change in commuting size.

From this perspective, it seems that as long as the parameter is improved, the negative external impact that urban renewal left on a city will be reduced significantly. But when we make careful contemplation, we will find it very hard to control the parameter, and we have no practical routes to directly improve key parameters. However, if measures against root causes are taken, such as directly adjusting cities' functional structure layout or improving renewal policies, we will return to the track of planning, which is contrary to the original intention of smart city development. This case shows that today, technologies related to smart cities are directed at cities' partial optimization, and it is hard for them to cause overall and structural influence.

The second case is about how to improve cities' anti-pandemic actions through big data and spatial information platforms. During the outbreak of COVID-19, a sufficient number of community workers, policemen and medical workers and supplies were critical to pandemic prevention and control. From the perspective of technology, if the closed loop of "discovering shortage – matching resources –supplementing supplies" is created, the operation of the prevention and control system can be supported. To this end, we built a community pandemic prevention and control management information platform for Shenzhen together with Baidu Map Huiyan and Geohey Platform, which can give community risk assessment levels according to a community's permanent population density and the places where confirmed cases stayed. At the same time, it can identify the dominant function of each community and provides differentiated prevention and control measures guidance for them. But when conducting the project, we found that it was easy to evaluate resources lacking but hard to match the need, and planners had no relevant data information to fill the closed loop. The problem was not solved until Shenzhen released the "anti-pandemic pioneer" application in mid-March of this year, on which communities uploaded demands for workers and supplies, and party members and volunteers across Shenzhen signed up for offering voluntary services based on demands information. The link is out of the planner's traditional work boundary, and the application did what planning wants to but couldn't have offered.

These two cases lead us to profound contemplation. Today, much core work related to smart cities is executed by IT workers, with planners participating in it, who even are responsible for the top-down design of smart cities. However, their role in the work related to smart cities remains unclear. At the same time, open sharing of data across society still lags behind industrial expectations. Planners have no methods other than continuous procurement to obtain the big data provided continuously

and stably, leading to the absence of sufficient productive elements for smart cities. In addition, basic theories of smart city planning and development are to be explored by the academic community.

In times with society and technologies interacting continuously, planners should take the initiative to consider how to enable smart technologies to better serve cities in future. "Planning" should have made special contributions to the establishment of technology and governance closed loop of smart cities. Positively, in addition to participating in the top-down design of smart cities and the planning and development of new digital infrastructure, planners may involve themselves in technology R&D and service supply by obtaining franchise or incubation technology companies, to make contributions to the development of smart cities.

We believe that planners need to fully leverage their systematic and structural thinking strengths, and especially in the current context with massive data, they should be able to make a structural determination that is more meaningful than ever before. In addition to connecting more data to city brains, we also need to provide these data to planners in a certain way, helping them gain more insight and make a more accurate determination during planning. Our current research shows that the fundamental driver of such determination is our humanity. Although whether smart cities can make cities 'smarter' is a problem to be solved, it can be expected that planners are establishing themselves to be more acute and visionary during the development of smart cities.

Zhou Xingang: Led by Academician Wu Zhiqiang, our team created an evaluation indicator system for intelligent cities. The system is comprised of two levels of indicators. Level 1 indicator mainly focuses on the top-down design of intelligent cities and includes the following 5 dimensions: intelligent development and environment, intelligent management and service, intelligent economy and industry, intelligent hardware and residents' attainment. Level 2 indicator is embodied in all aspects of the development of intelligent cities. With 4 indicators under each dimension in the Level 1 indicator, the system consists of 20 indicators.

Based on the system, we evaluated the "City IQ" of global cities and posted evaluation results on the iCity city intelligence website (http://icity.ikcest.org/, affiliated with the International Knowledge Center for Engineering Sciences and Technology under the Auspices of UNESCO). As we know, cities have an 'intelligence quotient' (CityIQ). Based on the evaluation of CityIQ of global cities we made, the CityIQ of a city can be easily found in CityIQ modules. Taking cities in China as an example, we can view their CityIQ scores on intelligent management and service, intelligent environment and development, intelligent infrastructure, residents' intelligent attainment and intelligent economy and industry, and compare them, thus learning about the aspects in which these intelligent cities have good performance and the aspects that can be further improved.

We tested 27 cities in the Yangtze River Delta region with 5 dimensions and 20 indicators, which can directly show each city's overall intellectualization level and the development in each dimension, allowing us to analyze the development in each field and the public's feedback to intelligent city development. This also embodies the people-centred thought. By comparing the CityIQ of these 27 cities, we found that most of the cities in the Yangtze River Delta region have a high CityIQ value, with Shanghai ranking first; capital cities have a higher value than non-capital cities, with cities' strengths and weaknesses varying. On this basis, we can compare and diagnose cities in the 5 dimensions in the Level 1 indicator. For example, despite having the highest CityIQ score, Shanghai ranks 6th in terms of intelligent management and service. We found that capital cities such as Shanghai, Nanjing and Hangzhou have a higher score in terms of intelligent economy and industry.

By monitoring and diagnosing the intelligent development of different cities and fields using the evaluation system for intelligent cities, we can identify the problems that cannot be easily found with general observation methods, evaluate cities' development and operation management in various aspects, and "prescribe" cities from different dimensions and indicators, thus providing assistance for urban intellectualization.

Theoretical progress and practical innovation in intelligent cities are critical to urban development and planning. Based on the large-sample, dynamic and real-time evaluation of city intellectualization using the evaluation indicator system for intelligent cities, we can have an understanding of cities' ranking in each dimension, thus rolling out matched policies and facilitating cities' intellectualization to provide rational supports for the development of intelligent cities in China.

Zhao Ying: We proposed the "one core, two wings" vision of smart cities, and created smart cities through AI and big data. From traditional digital cities to smart cities, and with the advent of big data and artificial intelligence technologies, we can solve the 'last kilometre' problems of smart cities. On this basis, we introduced the indicator of city entropy which reliably and digitally reflects cities' macro-operation. Early warning and alarm can be issued based on the sudden change of city entropy to inform decision-makers and citizens about city systems' operation, which enables cities too, like people or machines, study, evolve, discover problems, issue early warning and alarm, handle events, draw lessons after

troubleshooting and discover new problems and address them. In this process, city entropy is a measurement of city study maturity.

We need to have the capacity to gather government data, time and space data, video and other non-structured data from all industries and sectors, to enable them to form a big basis which is known as the intelligent city operating system. It is part of intelligent infrastructure development. After data collection, we need a platform to provide AI's enabling capacity, to manage and use such data. Then, how to use and which application-related problems we need to solve today lead us to the city operation system-based "one core, two wings" vision. "One core" refers to city governance modernization; "two wings" are the "AI + industrial development" which serves enterprises and the "life service sector" which serves citizens, which is also known as the digital economy. "City governance modernization" helps the government perform macro-monitoring of city operations, coordinate and direct the response to emergency events. It also helps the government enhance its governance capacity. When city safety is guaranteed, we need to consider economic growth.

AI and big data can help the government optimize the industrial process for local industries, improve enterprises' production efficiency and foster an enabling business environment, and help relevant sectors create new growth drivers. It is imperative to create a sustainable living service platform to help operators attract customers and reduce cost and to improve livelihoods, stimulate consumption and facilitate rapid growth in consumer goods retails. For example, ordinary people enjoy the rights to membership reward points during offline dining, shopping and ticket booking, and points exchange brings more options for them and enables offline and online data to be connected. In doing so, data connectivity is achieved. Enterprises' sustainable development, citizens having access to continuous preferential treatment and improved governance capacity of the government are what we need to strive for at the current development stage of intelligent cities.

An intelligent city operation system serves as the technical core of the intelligent infrastructure. The full data gathering centre, data management centre, AI enabling centre and data service data is applied in Xiong'an New Area. Through the establishment of the block data platform, the database for digital twins in Xiong'an New Area was consolidated, thus providing support for synchronized planning and development of digital twins and physical cities in the area and enhancing the core competitiveness of digital industries in the area.

Why did we mention city governance modernization in digital government? It may be easier to start from city governance modernization, then to the prefecture-level city, county, district and towns, and in the end to grassroots.

When it comes to modern living services, our overall work route is to meet people's ever-growing needs for a better life. We will create a modern living service platform through the living service operation system to integrate food, accommodation, transport, trip, entertainment and shopping resources and adopt both online and offline operation models, in a bid to bring down-to-earth lifestyle transformation for the government, enterprises and the general public.

"AI + industrial development" is to provide an "AI + industrial development" overall solution for full life cycle management based on big data and AI by considering local industrial characteristics and industrial capacity. Its core mission is to enable the development from industry informationization to industry digitalization, then to industrial service, and in the end to industry intellectualization. In a word, to improve our capacity of promoting the sound development of industry chains, we need to identify driving forces based on specific conditions of the agriculture, and food industry in an industrial zone or the development of a new national-level industrial zone.

Mao Weiying: The discussion we are making now is related to the "win–win model" I described in my doctoral dissertation to some extent. Hence, I will share with you the "study on city intellectualization based on a win–win model—new industrial cities in industrial parks".

Through reviewing recent development policies, it can be predicted that urban development in future will be a "city war". Reasons are as follows: 1. demographic dividend and labour dividend are absent; 2. as the urbanization rate has entered the slow growth stage from rapid growth, the focus of urban development changes from quantity to quality, and smart planning stands out at this moment; 3. cities face many acute challenges in their current development, and the best solution to these problems is city intellectualization. In addition, the advent of emerging technologies helps us make city intellectualization possible. Thus, our pursuit of smart cities is a result of the necessity brought by serious problems in city development and the feasibility brought by technological changes.

By early April 2020, the number of pilot smart cities released by the Ministry of Housing and Urban–Rural Development had reached 290, and the number determined by other authorities had reached 749. The number is expected to grow continuously in future, which suggests that smart cities have become a new development trend. Given the current development stage of smart cities, a bottleneck period with challenges and vast room for development, some reflection is needed. During this

process, coordination between traditional planning and the planning of smart cities should be ensured. At the same time, we need to be aware that urban systems have both features of hetero-organization and self-organization. Since the outbreak of the COVID-19 pandemic, we have placed higher requirements on urban industries, and capital and resources flowed to the real estate sector from the real economy are slowly returning. This is the "industry" content in "industry-city integration" that I want to share with you today.

In exploring models, I have always focused on the best matching way for linking a city's inherent growth drivers with the external epidermis. If we see industries as the source of driving forces of urban development, which talents and industries should we attract to make cities more dynamic, thus leading to a better multiplier effect? In this context, we extracted six elements of the win–win model for smart city development from Porter's industrial competitiveness model: technologies, planning, capital, the government, enterprises and citizens. I identified them as six elements of the win–win model. The government, enterprises, citizens, planning, capital and technologies all can combine to form key factors influencing cities' competition and cooperation, which in turn, can enhance and influence cities' competitiveness for development.

When we use these six elements to solve problems in cities in practice, we will get 62 probabilities through permutation and combination. We determined the direction of urban development by integrating these six elements and explaining them in combination with urban development drivers and demand orientation. Its core includes strategies, drivers, structure, governance and culture.

For industry-city integration and the win–win model in practice, I have two cases to share. The first one is the DC·SPACE Fashion Industrial Park in Qingshanhu District, Nanchang, Jiangxi. With 1/3 of total T-shirt exports in China, Qingshanhu District is home to more than 2,000 textile and garment companies which generate about 40 billion in output value. Although these companies are very dynamic, they also face some problems that cannot be conquered on their own. In 2016, the local government of Nanchang decided to remove partial labour-intensive industries because of industrial upgrading. Thus, we planned a reasonable platform development route, and introduced the concept of individual batch customization, with a focus on the upgrading of traditional industries. We launched industry-city integration of old cities based on respecting commercial models by importing the elements of government and technologies, and then the elements of capital and technologies.

Based on investigation and analysis, we introduced the mobile connectivity-based individual batch customization platform and addressed the upstream and downstream demands of a series of industrial chains by creating the "Fashionable Creation" and the "Consumption for Fashionable Life" through the platform. We built a quasi-government platform for the marketization of modern textile industries which is operated by the government and enterprises, thus facilitating communication between the government and enterprises. A data centre management platform and industrial brains were built, and technical supports on design, production, marketing and industrial service were provided, which facilitated targeted and effective investment attraction in industrial parks with the help of big data. The extension of whole industry chains from up to bottom was achieved by importing the elements of government and planning.

The second case is the Yingtan Intelligent town in Yingtan, Jiangxi. In 2017, the town ranked last in Jiangxi in terms of its economy. Its low cohesion led to heavy population migration, which greatly impeded urban economic and industrial development. In carrying out the project, how to attract enterprises and citizens to return back was one of the major factors to consider, in addition to the elements of government and planning.

We positioned it as a complex of intelligent industry, tourism and habitation to integrate industry, city, people, green elements and future. A core place with scenery is selected to create an intelligent town for Yingtan. The government established various platforms which can be used by enterprises for free. We also made a prototype street landscape belt with a width of 80 to 100 m along the roads in the industrial zone to enable the presence of smart industrial prototypes there. Under the guidance of the win–win model with six elements, we effectively promoted the industry-city integrated development of the new urban area.

Hu Jingjing: What I am going share is the establishment of and reflection on the urban safety platform.

First, I would like to introduce the background for platform establishment. The Work Safety Commission of the State Council issued the National Three-Year Action Plan on Improving Workplace Safety in April 2020, which focused on providing unified planning and direction for safety in cities across the country and covered the governance of sources, systematic governance, etc. Among the specific directions provided in the overall objective guidance for each sector, an important item is improving the security in urban development, and many special items are related to it. On this basis, MOHURD issued the Three-Year Action Implementation Plan on Improving Urban Development Safety, which introduced following requirements: (1) to see urban safety resilience as an important part of city evaluation; (2) to integrate urban safe development into each link of urban planning, development and management; (3) to establish national,

provincial and prefecture-level city safety platform systems using information technology to promote safe and sustainable urban development. The task that the Information Center of the China Academy of Urban Planning & Design where I work received is to establish such systems. For cities, safety, habitability and local characteristics are important goals in urban planning and development. And among them, safety is the top priority.

Second, I will share my understanding of urban safety problems and platform establishment. We conducted much investigation which can be mainly divided into three parts: (1) urban safety; (2) work route on urban safety; and (3) application of urban platforms and emerging technologies in ensuring urban safety.

Our project team classified urban safety-related incidents over the last ten years into three groups: natural disasters, man-made safety-related incidents and public health events. Authorities in Beijing have made some delicate efforts in urban safety risk prevention and control systems, but in general, their route is still based on urban emergency management, i.e. addressing disasters after they occur. Besides, in specific work, index requirements are raised on old pipelines, municipal safety, fire safety infrastructure and road traffic security. But we have been considering how to link these indexes to responsibility bodies and how to implement and re-divide them based on responsibility bodies. Thus, both early warning and responsibility bodies are needed for urban safety.

By reviewing relevant academic research on urban safety, we obtained the route which was used to establish a disaster risk evaluation indicator system (risk of factors resulting in disasters, the fragility of carriers, response capacity of carriers and their recovery capacity), which is to vary study depending on the categories of disaster and carrier.

In addition, we also take into consideration the work route from the perspective of media, even though not a traditional urban planning and development management authority or a related company. But we noticed that the media played an important role when a disaster occurred. Thus, the content and indexes that the media considered are also useful for us.

In the investigation of smart city platforms and emerging technologies, we found that the platform involves many fields. Although the computing capacity of computers has been substantially enhanced today, whether wisdom determination capacity matches the computing capacity has been puzzling us. As a result of many items covered by the platform and limited support data, not all functions can play a good role. However, the platform has strong identification and monitoring capacity, which are its strengths. Based on the investigation for a long time, we drew the following conclusions: (1) the risks and safety-related incidents that cities face, the means for their prevention are limited; and it is important to draw prevention lessons during daily work; (2) terms of the current work route on urban safety, we placed a high priority on response capacity, but efforts on monitoring and early warning were insufficient; (3) in terms of its features, the current smart platform has strong observation and identification capacity, and the information captured by it is comprehensive and accumulative and collected promptly.

Based on the discussion mentioned above, I will make a brief introduction of the route and method for platform establishment. It is important to combine incident prevention with incident relief, with a focus on prevention, and to evaluate urban safety in a timely and accurate manner using information means. Secondly, it is important to transition from emergency management to regular comprehensive management, define responsible bodies, combine traditional means with emerging technologies, and take into consideration the safety elements risk evaluation, safety elements monitoring and early warning, emergency rescue and guarantee capability evaluation and information transmission capacity evaluation. In addition, we need to build an urban safety platform integrated based on feasible intelligent technologies, with a focus on safety elements and monitoring and early warning.

Finally, I will share some problems we encountered in practice: data and application. Today data provide substantial assistance for us when we solve complex problems. It seems that we live in an era with massive data. But when it comes to a particular field, the data that can be used is limited. Given the situation, we need to employ the work method of bounded rationality while speeding up the digitalization of the entire society. In addition, another problem we face is the low working timeliness and less application of the platform. While enhancing the capacity of the industry and the academic community to transform technologies into applications, we also need to leverage special strengths to combine application with models. In terms of the route of establishing safety platforms, we can form diverse communities of small-sized intelligent platforms based on timeliness, from small ones to big ones. In the field of smart cities, it is imperative to form good synergy and interaction of planning & development with information technology.

We hope to, based on traditional monitoring means, integrate emerging technologies as support means, to enable them to act effectively within a limited period. At the same time, we will do our best to perform some exploration of new intelligence planning models.

Liu Zhaohui: In my opinion, the most impressive achievements in smart cities over the past 10-plus years

should be in the e-government field. The policy of doing our best to see those requiring a presence in person get done in one place and without the need for a second trip, and the nationwide integrated online government service platform have made significant contributions to opening up isolated data islands, promoting government reform, improving urban governance capacity and making life easier.

However, what we are more familiar with may be diverse new models of smart cities which were introduced in the period. The idea of "New Smart Cities" tries to solve the problems we face in developing smart cities, such as isolated information islands and poor public perception. The "City Brain" initiative tries to build a new type of urban infrastructure to turn computing capacity and artificial intelligence into public goods. The "Digital twins" program aims to establish a virtual world that is in parallel with the real world, thus previewing and changing the running of the real world. The "Artificial intelligence cities" initiative seeks a method to regulate public resources in cities in a more effective manner, to improve the running efficiency of cities. By reviewing the evolution path of the concept of smart cities, we found that every step of progress provides an answer for the problems we encountered in developing smart cities. However, we may also find that smart cities face many conflicts–those between theory and practice, between ideas and responses, and between goals and perspectives, which result in a deviation between dreams and reality.

The causes of these conflicts are some basic assumptions without evidence behind the practice of smart cities.

1. It is assumed that it is the government's responsibility to develop smart cities. Of course, the government's responsibility cannot be denied, but a city is jointly created by every citizen and every enterprise.
2. In constructing smart cities and city brains, we tend to assume that as long as data is sufficient, all incidents can be predicted and all problems can be addressed. If there is any discrepancy between results and expectations, we will attribute it to insufficient data. However, we must be aware that in the real world, data is rarely sufficient, and decisions are always made based on insufficient information.
3. We believe that cities are not lifeless machines, but a set constituted by innumerable individuals, and it needs to pay a price to command these individuals. In many cases, it is difficult for the urban government to bear such a price.
4. We always hope that all resources are available for the development and operation of smart cities, which is unrealistic.

Therefore, we need to have more understanding of smart cities. As there is no perfect linear logic for urban development, we need to recognize the incompleteness of data, the scarcity of resources, the limitation of capacity and the creativity of society. At the same time, we also need to accord great importance to the opportunities and challenges to cities brought by transformative changes in information technology. Smart cities are not a particular state or a goal, but a method. In developing smart cities in future, it is needed to make coordinated planning in traditional physical city space and booming virtual city space, and redefine the operation structure of the economy, society and the environment based on a new technological environment, to convert the creativity of all sectors of society and people's aspiration for a better life into driving forces for the development of smart cities.

It can be expected that smart cities which are not confined to the daily management and service by the government cannot only focus more on the strategic problems of urban development, but also be closer to the life experience of ordinary people. With this pragmatic and open method, smart cities can be allowed to grow spontaneously into an evolving intelligent life body, and we can share the happiness brought during their growth.

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