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The Suggestion for the Sustainable Smart City Development in the Water Area, Dongguan, China

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Abstract this report focused on the 'smart city' strategies and measurements in Water Areas of Dongguan, China. This report analyzed and summarized the excellent experience and shortcoming in the 'smart city' development process in the in Water Areas of Dongguan. For the deficiencies in the 'smart city' development in Water Area, some more advanced and targeted strategies or suggestion were proposed as the reference for future development.

Keywords: Smart City, Smart Mobility, Smart People, Smart Living, Smart Governance, China case study

1 Context

1.1 Background of the Dongguan City

The city of Dongguan, in south-central of Guangdong Province, is in the middle of the triangle, which is consist of Guangzhou, Shenzhen and Huizhou. Dongguan is one of the most important industrial and commercial city in the east coast of the Pearl River. The population of Dongguan is 825.48 million in 2011 and the Gross Domestic Product is 501.0 billion yuan, ranking eighth in Chinese prefecture-level city, and Dongguan owns the reputation of 'World Factory'.

This report is mainly related to the Water Area of Dongguan, which consist of ten towns: Shijie, Shilong, Shatian, Daojiao, Hongmei, Machong, Gaobu, Zhongtang, Wangniudun and Wanjiang (Figure 4.1). The statics of this ten towns' residents and area is showed in Fig 4.2. Despite of the superior location and traffic conditions, low level of Water Area's economy is lack of connection and mutual collaboration, and industry scale is small. Currently, the area of water district is 63.70 km2, accounting for 24% of the total area of Water Area and 18% of the total water area of Dongguan. The river density of Water Area about 1.90 km / km2.

Water area is in abundant of water resources while in low level of the economy, and this is the greatest characteristic.

Fig 1.1: The Location Map of Water Area

Source: Drawn from the Author

Table 1.2 The area and population statics of the Water Area in Dongguan

Number	Name	Population	Area/kilometers	Population Density
1	Gaobu	217,436	30.0	7,247.86
2	Zhongtang	139,563	60.0	2,326.05
3	Machong	118,062	74.0	1,595.43
4	Wangniudun	84,786	31.5	2,685.65
5	Hongmei	58,114	33.0	1,761.03
6	Shijie	246,960	36.0	6,860.00

7	**Daojiao**	**143,107**	**63.0**	**2,271.53**
8	**Wanjiang**	**143,619**	**50.5**	**3,219.00**
9	**Shilong**	**68,184**	**10.38**	**10,062.00**
10	**Shatian**	**59,228**	**107.0**	**912.00**
Total		**1279,059**	**495.38**	

1.2 Precious Achievements

1.3 Smart Economy - Innovation and Competitiveness

The increasing demand for land, water and energy in Dongguan has caused the conflict between limited resources and urbanization expand. The per capita water resources in Dongguan has approached the severe water shortage line. To solve this current dilemma, Dongguan has proposed the alternative economy increasing mode, which is based on Low-carbon Economy and Smart Economy.

Relying on its own comprehensive electronics manufacturing industry, Dongguan proposed the smart economy mode which combine the smart manufacturing, smart logistics and smart trading (Fig. 1.3). The smart manufacturing, which depend on one to two enterprises as a pilot, upgrade the manufacturing process and establish enterprise intelligent management platform. The smart logistics, which depend on the RFID (Radio Frequency Identification) and BDS (BeiDou Navigation Satellite System), integrate with the customs electronic supervision channel technology to form a system of Internet of goods. The smart trading, which aims to promote mobile e-commerce services and transaction security system, combines the Internet of things （IoT）with e-commerce. In this process, the Internet of Things will play a fundamental role. IoT has a rapid growth in Water Area, and has been applied in many aspects of living and producing (Fig. 1.4).

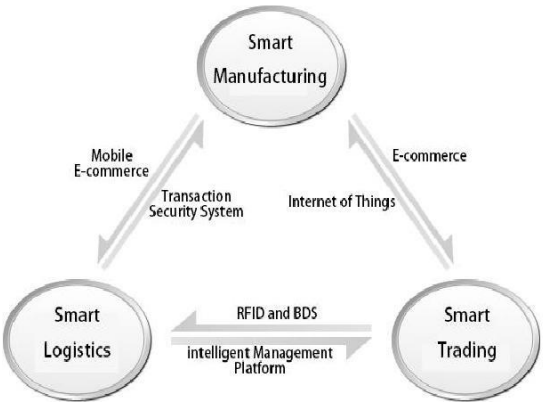

Fig 1.3: The New Mode of Economy in Dongguan: Smart Economy
Source: Drawn from the Author

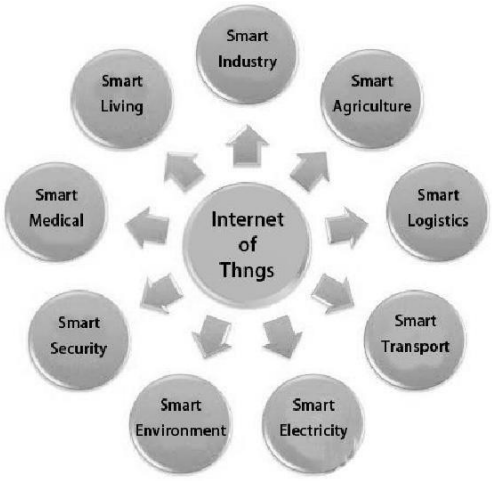

Fig 1.4: The application of Internet of things in Dongguan
Source: Drawn from the Author

1.4 Smart Mobility- Infrastructure and Transport

For the infrastructure construction, there two intensive projects, Digital Dongguan and Wireless City, cooperate with the CMCC (China Mobile Communications Corporation) and CTG (China Telecom Global Limited). By November 2009, the length local optical fiber core in Dongguan is 17,088 kilometers, and the number of mobile base station is 10,990. The fixed-line subscribers in the city is 4.44 million units; mobile phone users reached 14.54 million; Internet users reached 967000; the city's informatization composite index rose from 69.9% in 2003 to 72% in 2008. It has been realized that the WIFI and 3G wireless covered in the main government building, main street, commercial block, municipal square, exhibition center, commercial buildings, colleges and universities and other hot spots. The citizen could log in the website of Digital Dongguan to find the hospital or restaurant and so on (Fig 1.5).

For the smart transport, it mainly promotes the ability of vehicle identification and tracking. Applying the RFID to trace the vehicle localization and create the intelligent management platform (Fig 4.6). Meanwhile, transforming existing traffic video monitoring platform to realize real time surveillance in the main highway, main road, fast road, intersection, large bus station and other important traffic area. Then publish the traffic information dynamically for all the participants in the traffic system, which could improve the road network traffic capacity and safety coefficient at the greatest extent. And in Daojiao and Wanjiang, all the roads have been applied the intelligent street lights, which could provide the WIFI and adjust the lamp switch automatically according to the sunlight (Fig 1.7).

Fig 1.5: The Lo-gin Screen of Digital Dongguan Geographic Information System
Source: Website: http://publicmap.dg.gov.cn/dggz/

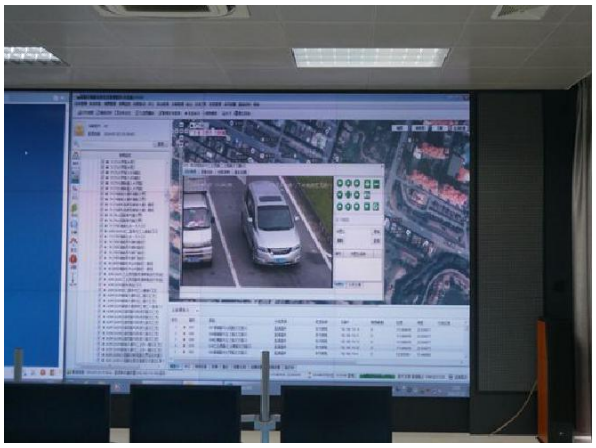

Fig 1.6: The Intelligent Management Platform in Dongguan
Source: Dongguan City of Major Information Infrastructure Twelfth Five-years Plan

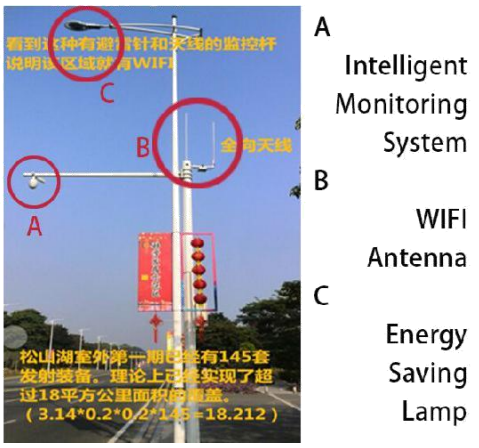

Fig 1.7: The Intelligent Street Lighting Dongguan
Source: Dongguan City of Major Information Infrastructure Twelfth Five-years Plan

1.5 Smart Environment - Resources and Sustainability

The main industry in Water Area is the clothing production, paper industry, food products processing, equipment manufacturing and agricultural production, and this brings dozens of environmental pollution, which mainly are industrial waste water, industrial waste gas and solid waste (Fig 4.8). The water quality in Water Area is between third and fourth class, and that means water environment pollution situation is quite grim.

Tab 1.8: The Main Pollution in Water Area in 2013

Industrial Waste-water (tons)	Industrial Emissions (m3)	SO2 Emissions (ton)	NOX Emissions (ton)	Smoke-Powder Emissions (ton)	Solid Waste (ton)
173710391.1	14274714.82	76848.209	49296.496	9346.703	2986986.025

Facing the increasingly serious environmental pollution, the Dongguan government and some NGOs take a lot of measures to create the balance between economy and environment through the industry guiding, population controlling and environmental regulation. However, for the pollution controlling, waste recycling and resource saving, it did not realize the development of innovation management, which means that there is a large gap between the current measurements and smart environment.

1.6 Smart People - Creativity and Social Capital

The smart people concept is related to kinds of perspectives like social ethnic diversity and inclusiveness, affinity to lifelong learning, innovation ability and participation in public life. After field study in Dongguan, it did not find many achievements about these factors and these were not associated with smart city. Therefore, this report does not do much analysis in smart people.

1.7 Smart Living - Culture and Quality of Life

For smart living, there are three main factors in Water Area: smart security, smart family and smart medical. Smart security refers to improving the management level of the city and construction of 'Happiness Dongguan'. By applying the IoT, it realizes to real-time supervise the all the dangerous situation and food security. The smart family requires to build community based data business data center, and integrated information service platform to realize the intelligent management of community public service. Nearly 22.5% of the families in Water Area have apply the video calls, security monitoring, home appliance control, health management, environmental controls and other integrated services (Fig 1.9). Smart medical aims to integrate medical institutions and medical equipment by creating healthy archives of regional health information platform and using the most advanced Internet technology. By December 2014, Wanjiang, Wangniudun and Shilong have realized to make an appointment to see the doctor on Internet and medical insurance card online register.

Fig 1.9: The Typical Smart Family in Water Area Source: Dongguan City Accelerating the Construction Development of IoT Implementation Plan (2014-2017), edited by author

1.8 Smart Governance - Participation and Empowerment

Based on governance and service informatization, Dongguan government has proposed to build the digital city public service platform (Fig 1.10), which provides the population, geography and economy data. This will integrate the information resource and cooperate with different departments and groups. Furthermore, the Water Area Governance Committee has taken some measurements to improve the efficiency. For example, all of the Water Area government departments have owned the online business website (Fig 1.11) and specific information collection system.

On the other hand, Water Area Governance Committee also rely on the teleconference, e-government cloud system and mobile office system (Fig 1.12) to improve work efficiency. Completing the emergency disposal system and electronic monitoring system to provide the efficient, high quality, honesty and the integration of management and services for citizen (Fig 1.13). This could meet the masses of the citizens' right to know, participate, express and supervise.

Fig 1.10:Digital City Public Service Platform of Dongguan

Source: Government Website

Fig 1.11:The Online Business Website of Dongguan

Source: Government Website

Fig 1.12: The Mobile Office System of Dongguan

Source: Government Website

Fig 1.13: The Service for the Convenience of Customers of Dongguan

Source: Government Website

1.9 Existing problems and Scheme Appraisal

1.10 Improve the Public Participation

For the social management and public services, the general acquaintance of Smart City has become increasing popular among government agencies and different social groups, however, the acquaintance is limited to the surface of understanding the concept. According to our survey in Dongguan, more than half of the citizens and government officials have never heard about the concept of Smart City (Fig 1.14). The cognition of the smart city applications in all of aspect of daily lives is in quite low level compared the maturity smart city case, and this makes the public low-enthusiastic to the relevant policy. For the industry departments, all the producing process, which contains the raw materials procurement, manufacturing production process monitoring, supply chain management, warehousing and logistics management, and marketing, increasingly rely on the informatization and intellectualization. Some enterprises ignore the advanced manufacturing and management applications, which makes hard to form the Smart City for Dongguan.

To improve all of the implementation of the smart city in the Water Area requires to ensure the effectiveness of public participation in policy making. It is essential to provide valid platform for public informed and involved in. The current government usually employ the government website, personal apply, SMS and mail, newspapers and media to public information (Fig 1.15). Second, it is necessary to transform these public participation into the institution, which keep the constancy. This will really make the public participation own the meaning of ‘seat’ rather than just ‘watch’.

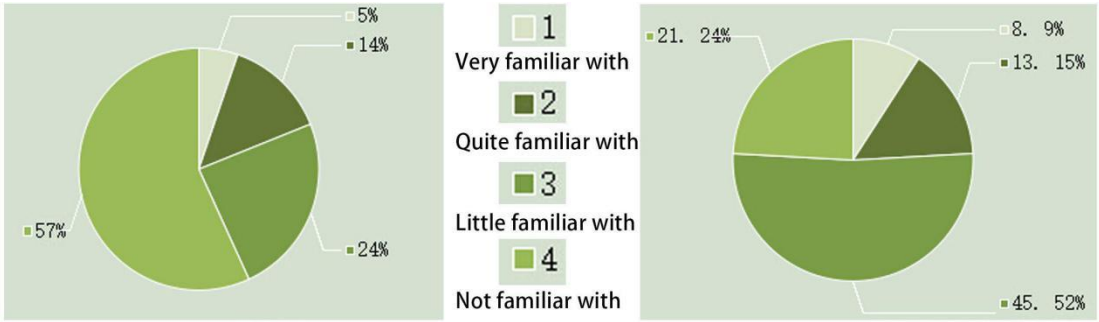

Fig 1.14: The Survey Statics of Citizens and Government Official Acquaintance of Smart City

Source: According to the Questionnaire

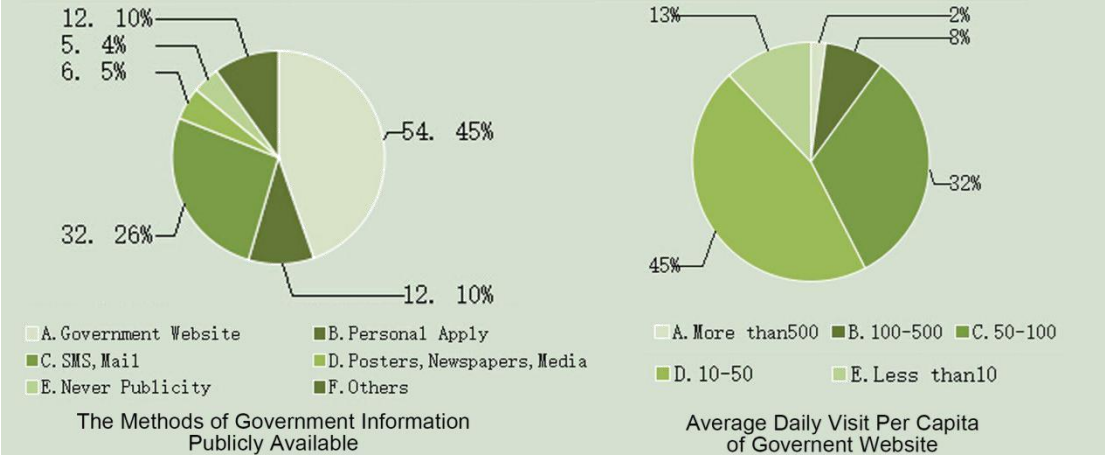

Fig 1.15: The survey Statics of Public Participation in Dongguan

Source: According to the Questionnaire

Fig 1.16: The Suggested Solution for Public Participation

Source: Drawn from the Author

1.11 Improve the Infrastructure

The citizen welfare in Water Area offered by the smart city strategy is rather limited according to the survey. 65% of the interviewee showed that they never had experienced the benefit of the smart city, and more than half of interviewee had not applied or employed the smart family applications, purchase tickets and payment online, and intelligent transportation query tools. The current mode of Dongguan smart city is led by the government and invested by the enterprise, which could promote the public infrastructure. However, this would cause the long-term project lack of support. Especially, in some remote areas in Water Area, it is difficulty to operate the smart family application because of the local poor condition. The Fig 1.17shows some key applications of the smart city for citizens, which is far behind the figures proposed by IBM.

To solve this problem, we suggest to improve the infrastructure construction for the citizens in Water Area (Fig 1.18). As the material basis for the whole society producing and living, it could promote economic growth and living standards. It has been argued by the Singapore smart city that improving the infrastructure could effectively improve the citizens welfare. And for improving the infrastructure, the six areas, which are health, public service, living, education and social insurance, could be the high-efficient and straightforward solution to achieve the objectives.

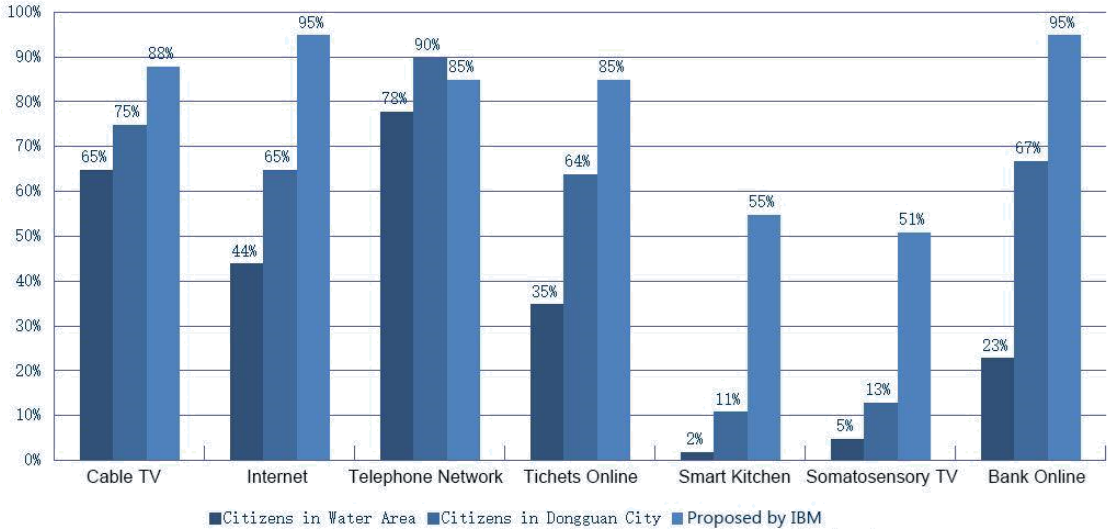

Fig 1.17: The Poor Application Condition in the Water Area, Dongguan

Source: According to the Questionnaire

Fig 1.18: The Proposed Infrastructure Construction for Water Area

Source: Government Website, edited by the author

1.12 Satisfy the Urban Sustainability

In terms of environment, two major issues are the biggest challenge for the current Water Area and they are the irrational energy consumption structure. The electricity accounts for more than 60% of the final energy consumption, and the petrol accounts for nearly 20%, the coal 10%, and natural gas less than 1%. While the environment pollution is mainly the water pollution and solid waste garbage (Fig 1.19). During our survey, we found that the current Water Area had caught in the cycle of polluting —managing —re-polluting —re-managing. The Dongguan Government

has proposed to improve the economic development structure, actively promote the development mode transformation, and create low-carbon smart city. However, the effectiveness is very limited, and this just because of the gap between current policy and the smart environment essence, in total.

Smart environment, as one of the important dimensions of the smart city, aims to access to the true sustainable city, which faces the serious environment issue. Therefore, we suggest the current policy and law should review the current environmental predicament and absorb true meaning of smart environment into the environmental policies and regulations in order to achieve truly sustainable development of cities. Based on the fundamental platform of smart infrastructure, continued to promote sustainable behavior management specification and implement the smart planning, in order to obtain the final sustainable development of economy, society and environment (Fig 1.10).

Fig 1.19: The Water and Solid Waste Pollution in Water Area
Source: Photograph by the author

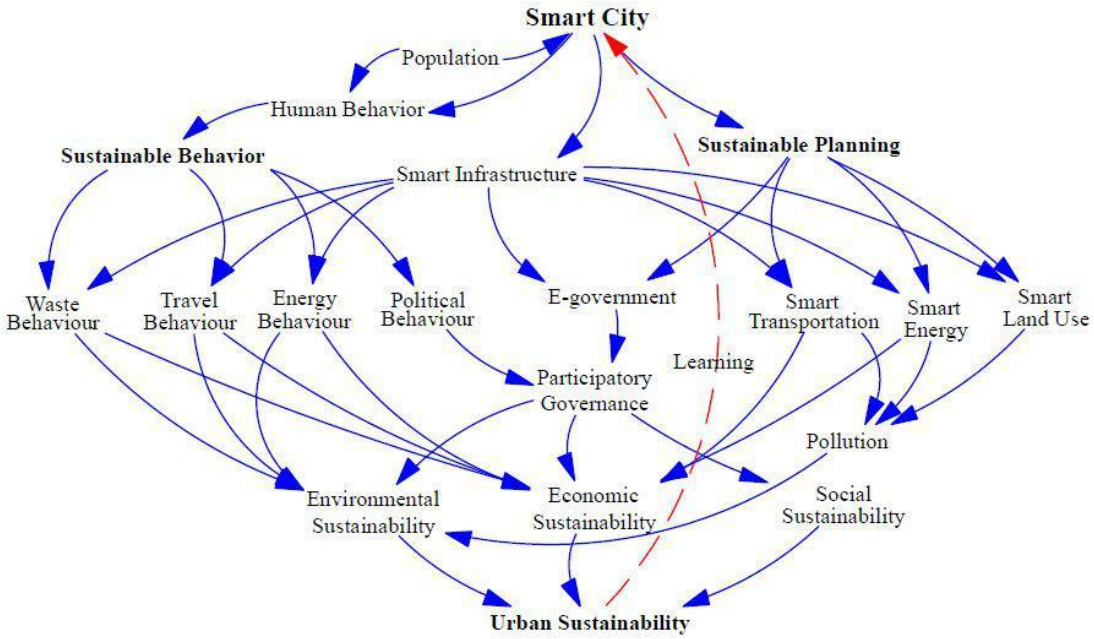

Fig 1.10: The Network from Smart City to Urban Sustainability
Source: Government Website, edited by the author

1.13 Improve Laws and Planning

Currently, the Water area still followed the tradition of congress-led regulations and government-led planning, which is the traditional Chinese style of management. There are numerous of laws and regulations from the Chinese central government to the Guangdong Provincial Government, the Dongguan Municipal Government, for the smart city at all levels of policy interpretation, and accordingly introduced a number of legal norms (Fig 1.11). Some of these laws and regulations are:

- ·Smart City Public Information Platform Guide (Trial) Ministry of Housing
- ·China International Urban Development Smart City Blue Book (2013) MIIT
- ·National Smart City Pilot Interim Measures MIIT
- ·Guangdong Big Data Development Plan (2015-2020) Guangdong Government
- Dongguan City Master Plan (2016-2030)
- Dongguan City Twelfth Five-years Plan
- Dongguan Environmental Protection and Ecological Construction Twelfth Five-years Plan
- Dongguan City of Major Information Infrastructure Twelfth Five-years Plan
- Dongguan City Accelerating the Construction Development of IoT Implementation Plan (2014-2017)
- City Development ----- Construction of IoT (2013-2015)

However, carefully comparing the relevant documents, the legal system is not difficult to find that Water Area is still quite imperfect in the system of smart city. Furthermore, there are even conflicted laws and regulations among others. For example, the "City Development Construction of IoT (2013-2015)" proposed that the Internet of Things industry is currently one of the major industries and should become an important source of national income. While it was not confirmed in the "Dongguan City of Major Information Infrastructure Twelfth Five-years Plan", which would cause the funding problems for the development of IoT industry.

Therefore, we propose to formulate strategies for the smart city, and create specialized agencies to revise the existing laws and regulations to conduct a comprehensive review, and form a clear division of responsibilities between different departments. Based on the existing regulations and planning networks, it ensures to completely be implemented for different levels of planning and urban policy (Fig 1.12). For example, for the level of urban master plan, it should ensure that smart city to be the basic development strategy. While for the level of regulatory plan, it suggests to combines the smart infrastructure and smart living.

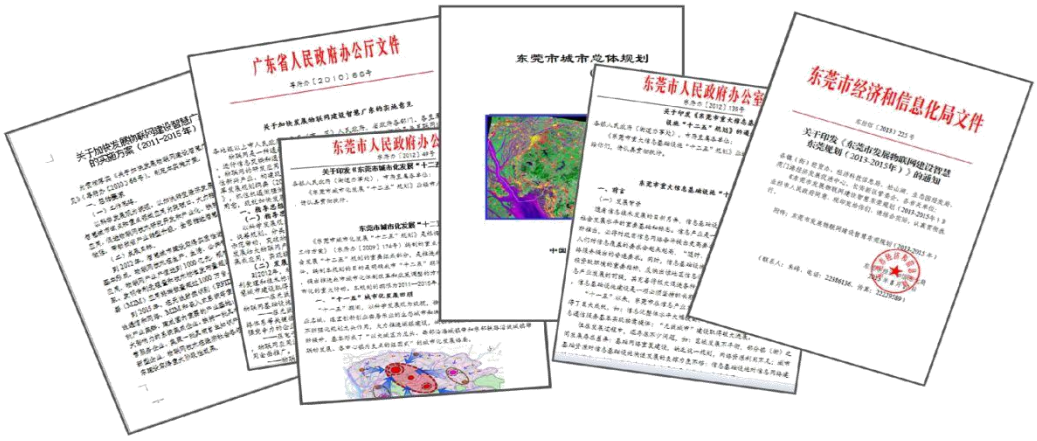

Fig 1.11: Some of the Laws and Regulations Related to the Dongguan Smart City
Source: Government Website, edited by the author

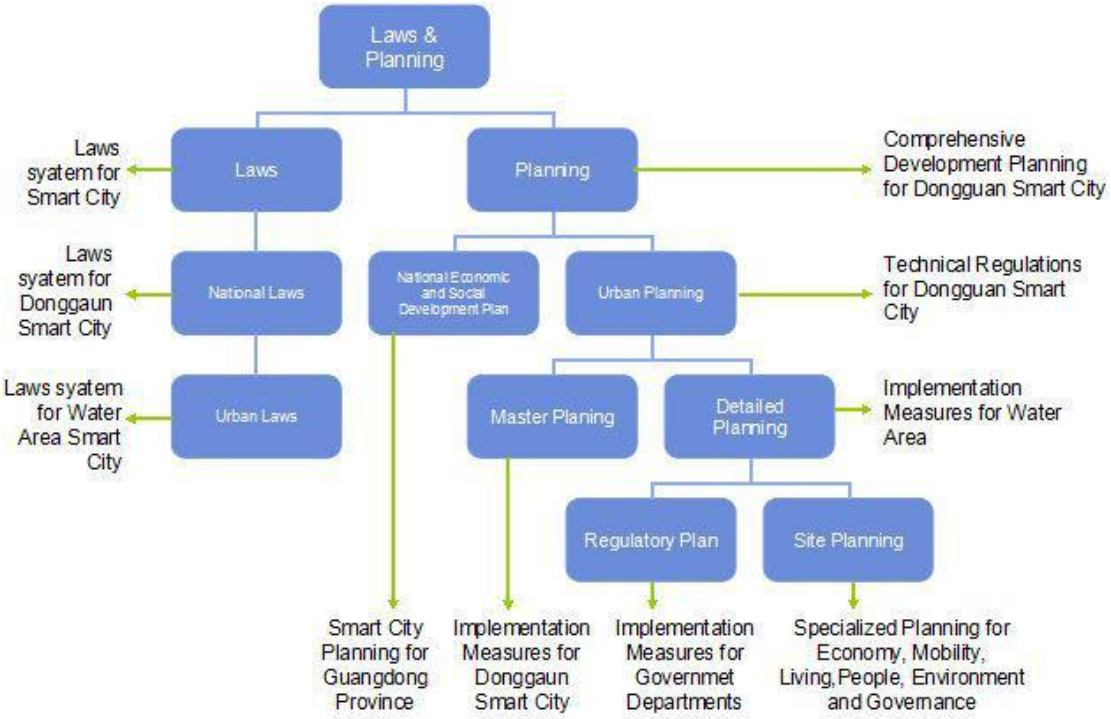

Fig 1.12: The Suggested Smart City Policy Laws and Regulation System
Source: Drawn from the Author

1.14 Build the E-government

For the current smart city construction in Dongguan, there is not continues effort after the implementation in one field, which shows that the smart city policy did not obtain all the targets. This is largely because the lack of government information caused by various departments in the field of planning, resulting in the low efficiency of local government. According to IBM, which raised about smart government applications, Dongguan city government application rate is very low, or the usage is very low ever since purchased a similar device (Fig 10). For example, when communicated with the staff of Shatian government, we generally found teleconference frequency

use rate is very low, while the government has purchased such equipment in 2012. In the research process, residents generally did not satisfied with the efficiency of the local government, especially obvious in Water Area (Fig 1.13).

We believe that the establishment of smart service-oriented government is the effective solution to the current government information transfer and inefficient. First, to improve the efficiency of the government, the key lies in the smart governance applications and how to mobilize the enthusiasm of government staff. IBM and Huawei, two major enterprises in the smart city applications, proposed a series of applications. According to the actual situation in Water Area, we divide these applications into different groups: some have been fully applied, some are nearing completion, some should be carried out immediately, and some should not be applied (Fig 1.14). For low satisfaction to the local government, it primarily is to build government public services and social security service. In the current Water Area, we can follow other smart cities such as Singapore and Malaysia, to build the intelligent online government, which could provide the necessary requirements for people's daily lives.

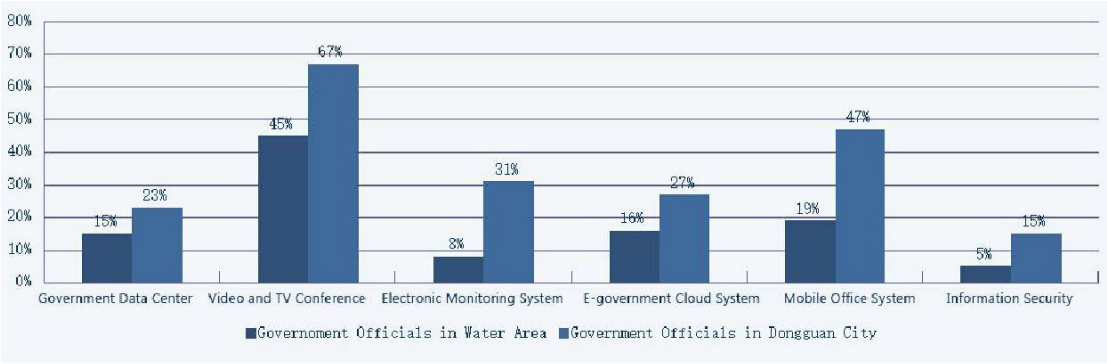

Fig 1.13: Poor Condition of Smart Government Applications in Water Area
Source: According to the Questionnaire

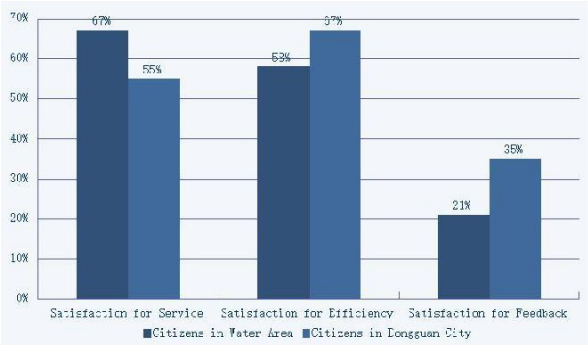

Fig 1.14: Low Satisfaction for the Local Government
Source: According to the Questionnaire

Fig 1.15: E-governance Applications Proposed by IBM and Huawei
Source: IBM Smarter Cities IBM Smarter Cities: How to Reinvent a City

Existing	Being implemented	The proposed	Not recommended
Public Distribution Systems	Citizen Identity Cards	Computerization of Road Transport Authorities	IT Infrastructure & related Facility
Social Security Benefit management	Employee Benefits data management	Citizen Surveys and Data collection initiatives	Electronic Records Management
Electronic Libraries	Human Resource Management Systems	Land Records Management	
Scanning and Digitization		Commercial Taxes computerization	
		Grievance Redress System	

2. Conclusion

2.1 Macro Level

With the rapid development of urbanization, and vigorously promoting by the high-technology, the intelligence level of the city rise to unprecedented heights. Smart City is a more thorough perception, more comprehensive combination, and deeper intelligence services. The key information in Dongguan Water "smart city", should be able to make full use of information and communication technology to sense, analyze, integrate urban, in order to ensure the people's livelihood, environmental protection, public safety, urban services, industrial and commercial activities in various needs within the making intelligent response and creating a better city life for humanity.

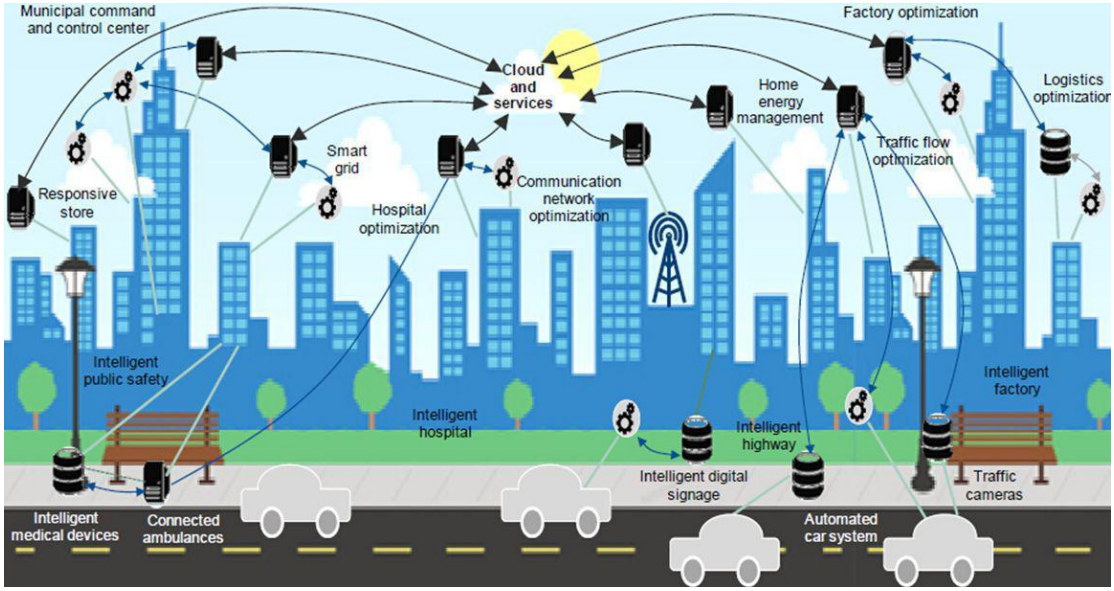

Fig 1.15: The Ideal system of Water Area Smart City

Source: IBM Smarter Cities IBM Smarter Cities: How to Reinvent a City

2.2 Meso Level

From the meso level, it is mainly about to combine smart city policy with the current situation in Water Are. For the practical problems of six areas for smart economy, smart mobility, smart environment, smart people, smart living and smart governance, made the corresponding solution measures, combined with the existing laws and regulations to ensure that the outcome of the wisdom of the city's residents can truly benefit.

Fig 1.16: The Current Exiting Problems and Recommendations for Six Dimensions

Source: Drawn from the Author

	Exiting Problems	Recommendation
Smart	Limited Cognition for IoT Lack of Integrity and Harmony	Sustainable Planning Improve the Infrastructure

Economy	ŀLimited Welfare for Citizens	ŀImprove Laws and Planning ·Improve Public Participation
Smart Mobility	ŀLack of Integrity and Harmony ŀPoor Condition of Smart Infrastructure	ŀImprove the Infrastructure ŀSustainable Behavior ŀImprove Laws and Planning ·Improve Public Participation
Smart Environment	ŀLack of Integrity and Harmony ·Weak in Smart Environment	ŀSatisfy the Urban Sustainability ŀSustainable Planning ŀImprove the Infrastructure ŀImprove Laws and Planning
Smart People	ŀLimited Cognition for Education ·Weak in Smart People	ŀSustainable Behavior ŀImprove the Infrastructure ŀImprove Laws and Planning ·Improve Public Participation
Smart Living	ŀLack of Integrity and Harmony ŀLimited Welfare for Citizens	ŀImprove the Infrastructure ŀSustainable Planning ŀSustainable Behavior ŀImprove Laws and Planning
Smart Governance	ŀLimited Cognition for E-governance ŀLimited Welfare for Citizens ŀLow Government Efficiency and Satisfaction	ŀBuild the E-government ŀElectronic Records Management ŀGrievance Redress System ŀImprove Laws and Planning

6.3 Micro Level

From the micro level, combined with the actual situation of Water Area, it should organize the material resources and information resources to promote new generation of innovative applications of information technology, cloud computing, big data and so on. It also should strengthen information networks, data centers and other information infrastructure. We mainly focus on five aspects: improving the public participation, improving laws and regulation, improving the infrastructure, satisfy the urban sustainability, and building the e-government.

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