Resilient cities governance when encountering external turbulence in the Greater Bay Area of China: an ESG perspective

Yan Xu[1] , Zhongren Zhao[2*]

[1]Department of Applied Social Sciences, Hong Kong Polytechnic University, Hongkong, China
[2]Cheung Kong School of Journalism and Communication, Shantou University, Shantou, China

Abstract: Since the 2020's, a series of crises, ranging from public health issues to economic recession, countries around the world have been trying to assess the impact on the social environment, and countries and regions have also actively formulated and enacted plans and policies to improve urban governance and urban regulation after the crises. How such public health, economic, and social emergencies can evoke urban resilience and self-healing capacity after urban destruction. Based on the ESG concept, this essay establishes a new model of resilient urban development, including reconstructing the model of sustainable urban development from the aspects of energy, land, education, health, digital economy and finance, to cope with the devastation resulting from emergencies. This model will also redefine a theoretical resilience framework that can be in accordance with ESG principles, offering future researchers a new perspective to assess the vulnerability and recovery capacity of a specific city.

1.Introduction

With the soaring risk and vulnerability of many cities around the world, the concept of resilience has gained attention in both academic and governance fields. With the frequency and intensity of disasters expected to increase from climate change, as well as geopolitical conflicts and international epidemics, most regions and cities will continue to give priority to how to drive resilience-building activities.

Under such circumstances, climate change monitoring, new energy utilization, the integration of information and communication technology, and the popularization of big data analysis will change or even overturn almost all aspects of social life. These changes in thought and technological advances will help cities meet the challenges of global change and advance national and regional sustainable development goals. In this way, governments and businesses will promote the "ESG (Environment, Social, and Governance) concept. The evaluation system which measures the sustainable development of enterprises and organizes is widely used in different areas, and smart solutions will be more common in urban development. Various solutions will also shape a green urban future in energy, health, land use, education, finance, transportation, and waste disposal. Therefore, cities around the world will develop and choose different smart solutions to govern their cities to be fair, sustainable and resilient.

This essay selects cities in the Greater Bay Area of China (Guang-dong province, Hongkong and Mocao) as the research objects to explain the necessity of integrating the ESG framework and resilience concept in the Greater Bay Area, to improve the understanding of the practical value of applying ESG concept to urban governance. This essay analyzes the current situation and problems of cities of GBA according to the environment, social and governance of ESG theory framework and puts forward suggestions.

2.Literature review

2.1. Resilience and Resilience City

Resilience-related research was widely discussed in the 1960s and 1970s, initially to measure the resilience of social ecology and to link community responses to natural environmental protection (Wilson, 2015)[10]. Among them, the most important concept of resilience evolves through three important stages in the development process, from early engineering resilience to middle ecological resilience, and late socio-ecological resilience. Different states of resilience also bring different directions for the construction of resilient cities. Different scholars have different research perspectives on urban resilience, including studies on urban business and organizational resilience, impacts and disruptive operations on the city's tourism industry, urban environmental and ecological sustainability, urban resilience to climate change, urban community resilience and community engagement, and human capital and human resilience in building resilient cities (Clark & Bailey, 2018)[3].

* Corresponding author: zrzhao@stu.edu.cn

© The Authors, published by EDP Sciences. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

2.1.1. Resilience and resilience system

The concept of resilience was first proposed by Canadian ecologist C.S. Holling (Holling, 1973)[5]. He believed that the performance behavior of ecosystems could be defined by two different attributes, namely resilience and stability, and divided resilience into engineering resilience and ecological resilience, which enriched the content of resilience research. In the 1980s, the application of resilience theory was extended to the field of disaster management, leading scholars in the field of disaster to shift their focus from vulnerability to resilience. In the late 1990s, the study of resilience gradually expanded from natural ecology to human ecology. As the main subject of human ecology, the idea of resilience was naturally applied to urban research, laying a foundation for the formation of the resilient city theory. With the continuous development of the concept of resilience, researchers have different views on the definition of resilience, but there are also some commonalities: resilience could adapt to changes in the external environment and learn from disasters, as well as the diversified balance and self-organization of the system.

2.1.2. Resilience City and Composition

As a complex system, the resilience of a city needs to be considered from multiple dimensions, including the physical limit, ecological limit, and cultural limit of the city. Resilience Alliance emphasizes that a city can maintain its original main characteristics, structure, and key functions despite external disturbances. They also pointed out that resilient city refers to the ability and degree of absorbing and resolving changes before the change and reorganization of urban structure. Mileti (1999)[11] defines local resilience as the ability of a local area to ensure that it does not suffer devastating losses, that productivity is normal and that life can continue in the event of a disaster without outside assistance.

The characteristics of resilient cities are largely consistent with those of resilient systems. Ahern (2011)[1] believes that resilient cities should have five characteristics: versatility, redundancy and modularity, ecological and social diversity, multi-scale network connectivity, and adaptive planning and design. When resilient cities recover from sudden disasters or epidemics, they need to follow the principles of diversity, efficiency, autonomy, strength, interdependence and collaboration. In this way, resilient cities are on the path to sustainable development that is resourceful, flexible, inclusive and integrated.

The deepening of the concept of urban resilience also transforms urban physical and social ecology to find the development direction (Olsson et al., 2014)[9]. Because of the increased resilience of new technologies, the relationship between cities, communities and citizens are much smoother. The resilient elements of cities include citizen creativity, knowledge and information sharing and new technology applications. Building resilient cities requires developing socio-technological solutions and (re)designing better responses and recoveries in times of crisis, including the use of open data, such as data maps, to better guide and serve people. Niaros (2016)[8] has developed the Resilient Smart City concept, which follows the idea of enabling citizens to co-create value. It relies on top-down policy guidance to promote citizens' participation in urban planning and governance in new forms, create new urban spaces led by communities, and co-build creative urban projects.

2.1.3. City resilience and sustainable development

City resilience and sustainable development are the two main goals of future urban development (Mallick et al., 2021)[7]. The concept of sustainable development advocates that urban development should meet the needs of the present generation without weakening the ability of future generations to meet their own needs. City resilience means that a city can respond positively to external shocks. City resilience and sustainable development complement each other. The UN Sustainable Development Summit in 2002 emphasized that resilience is the prerequisite for the sustainable development of cities. The hazardous event occurrence (HEO) is a part of city life cycle, which is included in the framework of urban sustainable development.

The life cycle of a city is divided into three stages: utilization, maintenance and HEO. The framework describes urban resilience as one of the ways to achieve sustainable urban development. Sustainable development requires safe development to avoid the impact of disasters. This requires resilient cities to withstand the negative effects of disasters and enable cities to maintain their daily functions. Therefore, sustainable development is the most important principle of current urban governance of resilient cities.

2.2. ESG Framework and application

ESG Framework is a theoretical system including environmental (E), social (S), and governance (G) factors. The official concept was first proposed by United Nations Environment Programme(UNEP)in 2004. The United Nations Principles for Responsible Investment was launched in 2006, which promoted the ESG principle to gradually become mainstream.

This framework was initially applied in the investment decision-making process. ESG Framework shifts investors' single concern on corporates' financial performance to a broader view. Especially, when experiencing a financial crisis, Lins et al. (2017)[6] found the non-financial corporates in the USA that scored high in ESG delivered better financial performance than other firms during the 2008-2009 global financial crisis. Similarly, Broadstock et al. (2021)[2] also found that higher ESG corporates in China presented lower price volatility in the stock market during the COVID-19 period.

Gradually, the ESG Framework has been widely accepted by other social activity practitioners. European Banking Authority argues that ESG factors may impose a significant effect on the financial performance or solvency of not only an entity but also a sovereign or an individual.

Li et al. (2021)[12] state to build a sustainable and coordinated development should take ESG into account, thus the governing bodies in pursuit of long-term growth should apply this comprehensive and down-to-earth governance approach. Crifo et al. (2017)[4]proved that a higher ESG score sovereign could decrease government borrowing costs via empirical research in 23 countries in the Organization for Economic Cooperation and Development (OECD). As a developing country, the Mexican parliament starts to discuss building an independent ESG system on the grounds that they have already accepted and complied with European or internationally advanced standards in taxonomy and supply chain due diligence system. In developed countries, Korea's Ministry of Trade, Industry and Energy jointly announced the K-ESG guidelines in December 2021, aiming at supporting the ESG management of Korean corporates and helping Korean workers to achieve the work-life balance.

The World Bank provides a platform to publicize data relevant to sovereign ESG, whose framework provides data on 17 major sustainability themes as shown in Table 1.

Table 1. The World Bank's Sovereign ESG Data Methodology.

Environment	Social	Governance
Emissions & pollution	Education & skills	Human rights
Natural capital endowment & management	Employment	Government effectiveness
Energy use & security	Demography	Stability & rule of law
Environment/climate risk & resilience	Poverty & inequality	Economic environment
Food security	Health & nutrition	Gender
	Access to services	Innovation

(Source: World Bank, 2022).

In the framework, all category depicts how a sovereign gain long-term economic growth while balancing other factors. The environmental (E) factor mainly examines the performance of a government's environmental behavior including reducing greenhouse gas emissions and other pollution, energy exploitation and use, and natural resilience capacity. The second (S) factor relates to how a government efficiently caters to the fundamental goal of its population including providing education and training in transferable skills, job opportunities and feasible access to encompassing services. The governance (G) factor evaluates the financial, legal and political strength to guarantee human rights, social stability and economic innovation.

3. Analysis and Finding

From the accelerated process of global urbanization to the development of urban social environment, the developing process of the urban resilience needs to be analyzed from a more macro perspective. As an extension of sustainable development theory, ESG can provide theoretical support and policy classification suggestions for relevant aspects of urban governance. Based on the ESG concept, this paper draws a resilient city development model as shown in Figure 1.

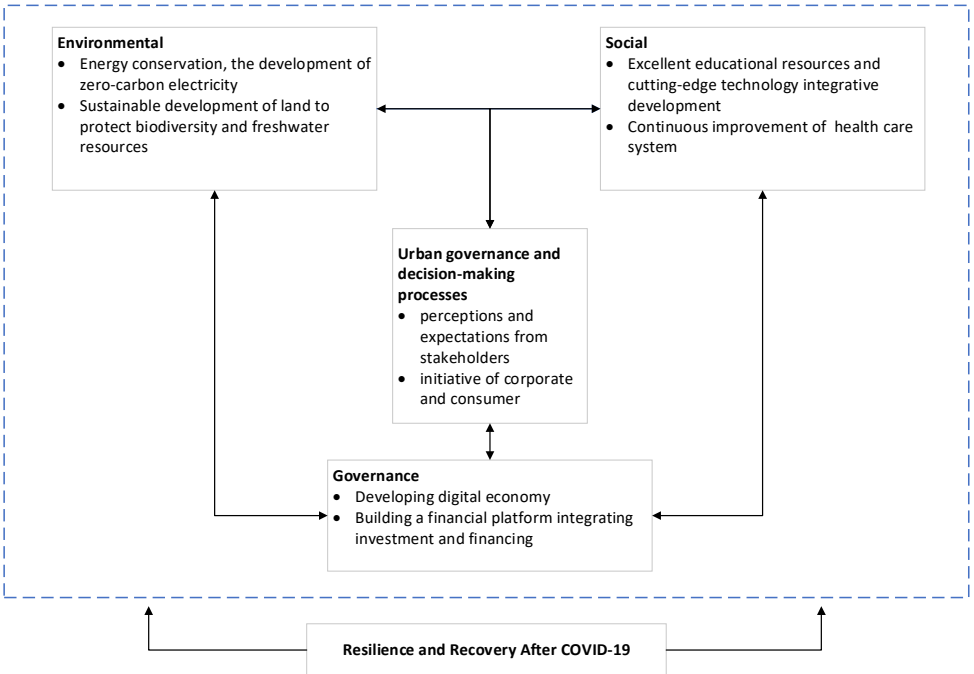

Fig.1. Determinants of urban resilience and recovery.

This model mainly focuses on how urban governing can pursue the desired resilience and recovery capacity after turbulence and subsystems that can maintain sustainability across scales, sectors and time. Under the ESG concept, all governing factors center on an encompassing and cooperative urban governance and decision-making scheme, which to a largest extent caters to the expectations of the stakeholders and should initiate the practitioners, including corporates and individuals to be engaged in.

However, cities are a complex and interconnected system, with different sectors responsible for different work. Only through cross-departmental cooperation can the balance of economy, society, infrastructure and ecology be achieved in resilient urban governance. Therefore, from this perspective, the connotation of a resilient city just includes environmental resilience, social resilience, and institutional and economic resilience under the ESG framework, but with more emphasis on the dependence and connection between parts. Similarly, the ESG concept also reflects the improvement of ecological resilience in the environment, economic and social resilience at the social level, and people-centered institutional resilience in governance.

Therefore, this chapter will specifically and thoroughly discuss and explain how seven inter-dependent major factors from the ESG concept can be operationalized in the Greater Bay area of China.

3.1. Environmental

3.1.1. Take low-carbon energy as a booster to reduce the cost of urban development.

Energy is the basic fuel for a city's daily operation and economic development. But if cities excessively rely on traditional and non-environmentally friendly energy sources, their resilience will be negatively affected. Fuels such as coal and oil will not only pollute the urban environment but also increase the cost of urban development to varying degrees because not all cities have affluent traditional energy reserves. Vigorously developing green energy cannot only create a clean urban environment and improve the recycling of resources but also benefit the sustainable development of cities in the long term, as well as reduce the supply shortage caused by the energy crisis, natural disasters, epidemic havoc, war and other emergencies in the development process. For example, Hong Kong is gradually increasing its share of electricity generation from renewable sources; Shenzhen launched green financial services to support the development of the new-energy vehicle industry.

In 2020, the total carbon emission of the Greater Bay Area was 113.05 million tons, ranking second among all provinces in China; by 2022, the annual emission quota of the Guangdong carbon market also reached approximately 400 million tons, ranking first in the national regional market and fourth in the world; Besides, among major cities in the Greater Bay Area, the level of carbon development varies significantly due to differences in population size and industrial structure. According to China's Net Zero Carbon City Development Report (2022) released by the 21st Century Business Herald, Shenzhen topped the net zero carbon index among the 30 sample cities in China, while Guangzhou, Foshan, Dongguan and other cities only ranked 9th, 18th and 26th. Take Guangzhou as an example, although the carbon emission intensity, energy consumption intensity, and power consumption intensity delivered an eye-catching performance, its thermal power generation accounted for more than 95%, far exceeding the national average level.

Therefore, the changes in energy structure and carbon emissions in the Greater Bay Area of China need to be evaluated through the construction of a macro "energy-economic" model for the Greater Bay Area (See Fig. 2), which is from Integrated Assessment Model of Climate Policy And Air Pollution for Greater Bay Area: ICAP-GBA, developed by Guangzhou Institute of Energy Research, Chinese Academy of Sciences, which is an "energy-economy-environment" model for analyzing the economy, energy and climate of the Greater Bay Area of China.

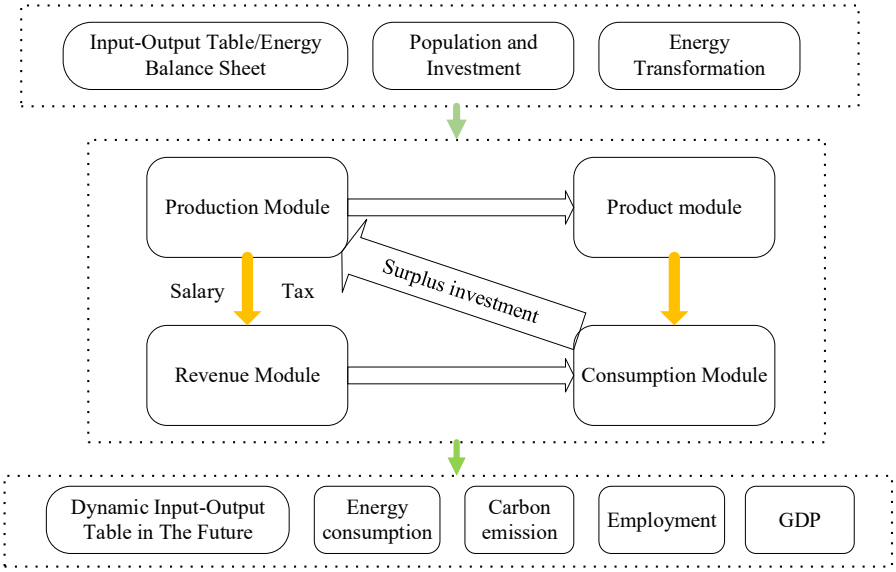

Fig.2. Macro "Energy-Economic" Model for the Greater Bay Area.

Based on the Input-Output Table, combined with the data from the energy balance sheet, industrial statistical yearbook, power generation structure, power generation cost and other data of the Greater Bay Area, this model constructs a hybrid dynamic Energy-Economic model for the Greater Bay Area of China. The production module covers 33 major production sectors in the Greater Bay Area, seven of which are related to energy. Product module refers to intermediate products and energy products produced by the production department. The revenue and consumption module includes the income and consumption of residents and the government. Residents get the income from factors of production and the income of government transfer payment and use it for personal consumption and investment. The government receives tax revenue to provide public services for residents to consumption.

Therefore, from the perspective of reducing carbon emissions and sustainable development, the Greater Bay Area can follow the model of balanced development of energy and economy.

Build an energy-saving and carbon-reducing production module. Strengthening energy conservation and carbon reduction in key areas and constructing a green and low-carbon manufacturing system should be prioritized. Dongguan city in the 14th Five-Year Plan of Dongguan ecological environment protection strictly restricted the construction and expansion of petrochemical, chemical, and non-ferrous metal smelting projects in the non-planning areas, prohibited the construction and expansion of cement, plate glass, chemical pulp, raw leather projects, investigated and controlled the "Two High" (High-pollution and high-energy-consumption industries) industry capacity. Foshan city government in the 14th Five-Year Plan of Foshan city ecological environment protection proposed to accelerate the green upgrade of traditional manufacturing, including smart home appliances, ceramic building materials, metal products, modern furniture, food and beverage, and the textile and clothing industry. Anchoring the international industry benchmark, industrial parks should be constructed as "new energy storage" centers, comprehensively applying energy-efficient manufacturing, recycling, and technological transformation to achieve intelligent, green and service-oriented manufacturing goals.

Develop a product module with focusing on clean energy and green technologies. Local governments should realize the industrial development and transformation of the Greater Bay Area through the innovation and application of clean energy and green technologies. In the 14th Five-Year Plan for Shenzhen Ecological and Environ-mental Protection released in January 2022, the Shenzhen Municipal government clarified the key missions of green technology: producing and utilizing renewable energy, new energy vehicles, hydrogen energy technology, and ecological and environmental protection technology. Meanwhile, cities in the Greater Bay area should shape the green manufacturing industry and implement the concept of low-carbon cycle in the whole process of the design, production and recycling of industrial production and manufacturing. Through information technologies such as the Internet of Things (IoT), cloud computing and big data, a green supply chain management system should be built.

Green development should be the basis for collaborative development among cities in the Greater Bay Area. Strengthening industrial development coordination: promote the formation of low-carbon industrial division of labor to prevent the disorderly expansion of energy-intensive production capacity in the process of industrial transfer. The optimization of industrial structures is an important means to reduce greenhouse gas emissions. As industries with high energy consumption, high emission and low added value are gradually replaced by green, low-carbon and high added value industries, economic growth and carbon dioxide emissions can be decoupled. The key to enhancing the synergy of industrial development in the Bay Area is to scientifically plan low-carbon industries, rationalize the division of labor among cities in the Greater Bay Area, pro-mote the synchronous transformation and upgrading of high-carbon industries in the Greater Bay Area, build a green supply chain, guard against the disorderly expansion of high-energy production capacity in the process of industrial relocation, promote structural carbon reduction, and ensure the overall carbon emission reduction effect in the region.

3.1.2. Promote environmental protection and enhance ecological resilience.

The protection of the ecological environment, especially land and water resources, is an important cornerstone for biodiversity protection and a necessary condition for promoting the harmonious development of nature, economy and society. The abuse of natural resources and the destruction of the ecosystem by human activities and economic development will threaten the diversity of species, make the ecological chain be changed, destroyed, and even overturned, and bring a devastating blow to human survival. Although the ecosystem has a natural self-healing power, its resilience will naturally be greatly weakened or destroyed, if the degree of man-made sabotage exceeds the self-healing capacity. At this time, once natural disasters, wars, virus spread and other emergencies occur, the damaged eco-system is even more difficult to restore, forming a vicious circle. Therefore, cities in the Greater Bay area should protect the ecosystem, maintain the ecological balance, and improve their self-repair ability, immediately and effectively.

Greater Bay Area should strengthen cooperation to jointly safeguard ecological security. Through the establishment of the Greater Bay Area Joint Conference Mechanism, regular discussion on the overall environmental protection, ecological restoration, disaster prevention and mitigation of the region can be effectively negotiated, with possible plans and actions being figured out. For mega-development projects involving the three places, for example, the construction of the Guangdong-Hong Kong-Macao Bridge, the Greater Bay Area Joint Conference can discuss the possible ecological im-pacts

and coping strategies during and after the construction and operation. Moreover, The Greater Bay Area ecological expert think tank can be set up, which could extensively absorb experts and scholars in the fields of ocean, land, environment, economy and other related fields to participate in the formulation, consultation and demonstration of policies and related management systems (From "Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area" by The CPC Central Committee and The State Council of China).

Local governments in the Greater Bay Area should plan their own regional ecosystem restoration blueprints. In the 14th Five-Year Plan for Ecological Environment Protection of Guangzhou, the Guangzhou authority proposes to adhere to the "overall coordination" of the Pearl River, Liuxi River Reservoir and Huanglong Belt Reservoir, restore the ecosystem of Baiyun Lake and Haizhu Lake in the central city, to build a beautiful, resilient and safe lake system. It is also proposed to protect and utilize the coastal river shoreline and re-store and improve the coastal zone of Nansha Wetland and Jiaomen Wetland, to maintain wetland ecological diversity. Zhuhai mentioned the plan in the 14th Five-Year Plan for Water Ecological Environment Protection in Zhuhai that it is expected that by 2025, Zhuhai will comprehensively build a water-saving society, effectively prevent and control land and sea pollution, build five beautiful bays, and strengthen the control and protection of the ecological environment along the coastline.

Greater Bay Area should use technology to improve the resilience of ecosystems. An ecosystem monitoring, evaluation and early warning system can be established. In the Greater Bay Area, unified monitoring content and evaluation standards from the scheme can be used to promote data sharing among the three local governments, and grasp the real-time natural coastline retention rate, the number and spatial and temporal distribution of flagship species, the changes of various protected natural areas at all levels, and typical marine ecosystems such as mangroves, coral reefs and seagrass beds. At the same time, a database of soil treatment and re-mediation technology in the Greater Bay Area should also be established to share the treatment means and modeling cases of various types of contaminated land for the reference of local governments that can productively realize the restoration of contaminated soil and farmland and ensure the quality of agricultural products and the safety of the living environment.

3.2. Social

3.2.1. Integrate education and technology to build an intelligent education system.

Traditional offline education could not come into play during the disasters. The lack of campus learning in school absences the operation of the traditional education system, which does not only decrease students' learning effectiveness but also aggravates learning inequality. Since the outbreak of COVID-19 in 2020, the phenomenon that schools across China have been required to close due to the fact that the epidemic occurred from time to time. Repeated suspension of classes does not only compel the progress of learning to be postponed, but also result in students' lack of social abilities caused by social distance and quarantine, and even psychological issues deriving from staying at home for a lengthy period. In addition, the problem of inequality in education has been further magnified under the influence of the epidemic, and the gap between students studying at home and their counterparts in other nations has widened.

In the sustainable development of resilient cities, the exploration of educational resilience is crucial. Especially under the normal epidemic prevention and control policy, it is imperative to integrate a smart education system into new technology. Including interactive learning management system construction, smart reading, education cluster, and smart teaching. Governments in the Greater Bay area should explore the reform of the urban education system to make education more resilient. It includes establishing a resilient interactive education system for all students and preschoolers; urban governance should fully consider the safety issues of students' offline learning, try to compensate for the learning loss caused by the epidemic, and provide more digital learning support services. Cities should formulate long-term systems in line with local educational needs to deal with the public crisis that may last longer than prediction. Combining domestic and foreign practices, governments in the Greater Bay area should enhance the ability of the education system to respond to crises and emergencies, including the establishment of student database, the cultivation of teachers' online teaching ability, and the coordination and sharing of basic teaching materials within the Greater Bay area. At the same time, local governments should ensure adequate education funds during the crisis. Government establishes a tripartite cooperation mechanism between cities, schools and society including city epidemic control, schools in charge of education, society to provide services to continuously enhance the educational resilience network.

3.2.2. From spatial, governance, social, institution and digital to strengthen public health resilience.

There are great differences between major public health events and natural disasters in disaster evolution and practical consequences. Therefore, in the face of public health events, the urban system has obvious particularity and heterogeneity in the way, path and basis of resisting, absorbing and adjusting the risk of major public health emergencies. In the past two decades, the world has experienced several major pandemic outbreaks, such as SARS, influenza A and H1N1 influenza, and Ebola virus. Historically, every major public health event has promoted the development of the governance of a country or a city. For example, the cholera sweeping Europe in the 19th century replaced Paris' dilapidated slums with boulevards and monuments; during SARS, China established a top-down epidemic prevention network covering cities and

villages in 2003, which played an important role in eliminating the epidemic.

The resilience development of urban public health security needs to start from the five perspectives of selective redundancy, functional transformation, diverse substitution, decentralized organization and agile response, and establish five dimensions of spatial resilience, governance resilience, social resilience, digital resilience and institutional resilience. (See Fig.3)

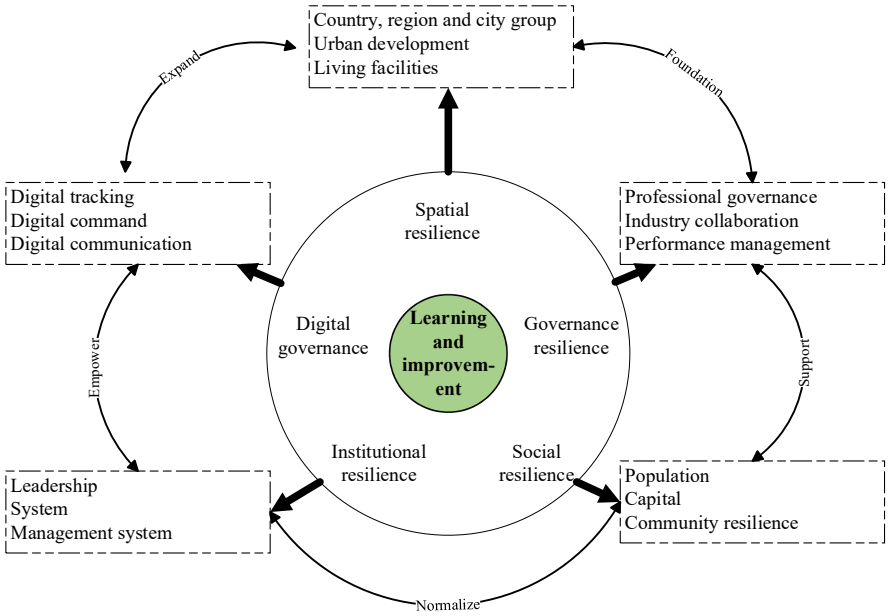

Fig.3. Components of Urban Health Security Resilience.

Joint management mechanisms and emergency coordination platforms promote spatial resilience. Spatial pattern and resource allocation are of great significance and value for the prevention and response to major public health emergencies. In terms of macro coordination, the Greater Bay Area should establish a cross-regional and cross-institutional joint management mechanism for disasters and formulate regular guidelines and rules for handling consultations. In terms of micro-implementation, a unified emergency coordination platform for the Greater Bay Area should be established, and a new unified information sharing platform for emergency management, prevention, prediction and early warning should be established.

Governance specialization and multi-organization alignment promote governance resilience. Governance resilience refers to the ability of the governing body to withstand the impact of the epidemic and maintain the basic functions of the city. This is achieved through a series of activities, such as prevention, preparation, handling and recovery. The Greater Bay Area Government plays a key role in implementing professional and multi-level public health emergency management. Effective disease prevention and response rely on a comprehensive and coordinated approach, including accurate dis-ease detection and monitoring, timely and appropriate response measures, and a well-trained team of experts. This requires a robust epidemic prevention system, a reliable disease surveillance network and information system, and strong research and development capabilities.

Social organization and public engagement promote social resilience. Social resilience refers to a community's demographic profile and social capital profile, including gender, age, race, health, socioeconomic status and other characteristics. Social resilience in the face of major public health emergencies includes not only demographic characteristics and social capital, but more importantly, social organization patterns conducive to decentralization and the ability to connect on the basis of them. Social connectivity, including volunteer mobilization, participation of social organizations, mass prevention and governance, resource delivery and mutual support, is crucial to building urban resilience in the Greater Bay Area.

The application of information technology enhances digital resilience. In the digital age of rapid information technology development, digital governance capabilities will be an important component of urban resilience. Digital resilience refers to the use of emerging information and communication technologies (ICTs) to improve the ability of urban organizations and their members to communicate information, thereby enhancing the organization's awareness of infectious diseases and organizational collaboration. The widely adopted "health code" makes a comprehensive judgment of social members' activity tracks and close contacts through comprehensive data such as medical detection, transportation, inspection and quarantine, location tracking, disease cases, community registration and self-filling. This is a typical case of big data and cloud computing technology.

Institution is the most basic and important constraint and norm for social action. Urban governance is the collective action of many subjects at the

same time and space and the formation of mutual relations, they are all developed in a specific institutional framework. The power structure of the city and the leadership of the administrator constitute an important part of the resilience of the system, and determine whether the governance behavior can be stable, sustained and long-term. Different cities in the Greater Bay Area have developed city-specific handling modes in the prevention and control of health emergencies, thus enhancing the agility and precision of crisis handling in the region.

3.3. Governance

3.3.1. Take digital economy construction as a breakthrough point to strengthen the resilience of urban economy.

Urban economic resilience amounts to the stability shown when a city's economic system is impacted by unpredictable factors. Natural disasters caused by climate change and public health challenges brought by the ecological environment both bring a considerable number of risks and tests to urban development. High economic resilience means that the economy has diversified structural elements, and the data and resources involved in economic production can flow efficiently and freely within the economy. The resilience of the urban economy should be guaranteed by flexible systems and policies, and also by the ability of scientific and technological innovation as a means to resist external economic risks.

Digital industry can enhance the industrial resilience. The development of the Greater Bay area mainly relies on the secondary and tertiary industries, so all regions in the Greater Bay area should promote the digital transformation of the secondary and tertiary industries, enhance the construction of information infrastructure. They could incorporate 5G, artificial intelligence, big data, cloud computing and other new technologies into the industrial chain of up-stream and downstream, in pursuit of information transmission ability promotion and the industrial digital upgrade. By this means, the limitation of the traditional manufacturing and processing industry can be broken through, and the local industrial resilience can be enhanced.

The digitalization of infrastructure provides a basic guarantee for the digitalization of industries and enterprises. Especially after the epidemic, various industries are increasing the proportion of digital resource allocation, and the degree of digitalization of urban infrastructure can affect the effectiveness of digital implementation of industries and enterprises. For example, the construction of basic in-formation-sharing platforms and the construction of online government service platforms are all prerequisites for the enhanced resilience of urban basic services.

Digital governance is the key to improving people's social life, which involves the tripartite cooperation between the government, enterprises and society. Local governments need to coordinate regional intelligent development between cities and within cities, especially policy support and resource tilt for underprivileged areas; enterprises should promote knowledge and technological innovation, and digital sharing to become the main force of digital development; the public should actively participate, through providing feedback on digital platform about the public service and goods to enhance social resilience.

3.3.2. Promote the development of financial platforms to serve the economy of the Greater Bay Area.

There are a considerable number of small, and medium enterprises (SMEs) in the market economies in the Greater Bay Area. Under the epidemic, SMEs are often the most severely affected business entities, especially facing the threat of cash flow fracture. Therefore, the construction of financial service platforms should be jointly built by collective banks, securities, insurance, financing guarantee and other financial institutions, which provide integrated financial services such as financial consulting, financial support, and business consulting for SMEs.

The government in the Greater Bay Area should lead the construction of financial service platforms, enact corresponding service and regulatory policies, guide the flow of funds to target enterprises, and provide target services for more enterprises that need temporary capital turnover. In April 2020, the Shenzhen government launched the "Financial Ark" project, a financial service platform within the epidemic zone, providing more than 100 billion yuan of financial support for local private enterprises, and generating a promising effect on fueling SMEs and ensuring employment.

Green finance and sustainable financial development should be the major objectives. On the one hand, financial institutions themselves need to develop a green development strategy, including the green industry in the investment management system; on the other hand, financial institutions should formulate systematical and scientific green financial preferential and evaluation policies, and provide more financial support to the ESG industry.

Regions in the Greater Bay area need to promote the development of fintech enterprises. Fintech ways could bridge SMEs and banking institutions, including the financial practice of charity projects, ESG enterprise investment and financing evaluation. At the same time, ordinary consumers can also enjoy the convenience and security brought by fintech, such as Tencent insurance financial services, and We Remit foreign labor remittance business of WeChat Hong Kong.

4. Conclusion

From a broader view, multidimensional and resilient urban governance is an effective way to deal with public health emergencies and other crises. This paper mainly emphasizes that under the framework of the ESG framework, the concept of resilience will be more widely acknowledged. The environment, society and governance factors can interact and help build an urban strategy to

resist sudden disasters to enhance the resilience of cities in economic, health and environmental aspects. Incorporating big data analytic and multi-dimensional management system, resilient city data portal can benefit not only individual city, but also neighboring cities and spatial regions, as different urban backgrounds and socio-economic attributes can be integrated into a systematic management system. The ESG concept is essential to resilient urban planning and design, offering urban people enough security, and providing a sustainable approach to respond to the shocks and pressures that may arise in the wake of public crisis. Therefore, an urban network should be built in the Greater Bay Area, with high-quality development as its goal. A concept of resilient urban development should be fostered in the Greater Bay Area taking full account of the effects of uncertainty, particularly pollution and environmental damage; Cities in the Greater Bay Area should not only learn from each other, but also have local characteristics. There should be a completed urban cooperation system to avoid isolated island decision-making; With a focus on water resources protection, a resilient development model should adapt to the natural environment, economic society and urban network; An information and knowledge sharing platform should be constructed so as to digitalize and innovate the urban governance model of the Greater Bay Area.

In short, decision-making at the three spatial scales of the environment, society, and regulation will be a strategic, feasible and influential approach to support the restoration capacity of cities and will more effectively respond to sudden disasters. Meanwhile, the new model of resilient urban development, even though merely selecting seven major factors from the ESG concept, proposes a new framework for future researchers to assess the resilience of a specific city. To conclude, whether it is a new normal or merely after the pandemic, resilient urban governance will benefit urban sustainability in the long run.

Acknowledgments

STU Scientific Research Initiation Grant Support (STF23031)

References

1.Ahern, J. (2011). From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. L*andscape and urban Planning*, 100(4), 341-343.

2.Broadstock, D. C., Chan, K., Chen, L.T. W., Wang, X.W. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, 38 (2021), 101716

3.Clark, J., & Bailey, D. (2018). Labour, work and regional resilience. *Regional Studies*, 52(6), 741-744.

4.Crifo, P., Diaye, M. A., & Oueghlissi, R. (2017). The effect of countries' ESG ratings on their sovereign borrowing costs. *The Quarterly Review of Economics and Finance*, 66, 13-20.

5.Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, 1-23.

6.Lins, K. V., Servaes, H., & Tamayo, A. (2017). Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *the Journal of Finance*, 72(4), 1785-1824.

7.Mallick, S. K., Das, P., Maity, B., Rudra, S., Pramanik, M., Pradhan, B., & Sahana, M. (2021). Understanding future urban growth, urban resilience and sustainable development of small cities using prediction-adaptation-resilience (PAR) approach. *Sustainable Cities and Society*, 74, 103196.

8.Niaros, V. (2016). Introducing a taxonomy of the "smart city": Towards a commons-oriented approach. *tripleC: Communication, Capitalism & Critique. Open Access Journal for a Global Sustainable Information Society*, *14*(1), 51-61.

9.Olsson, P., Galaz, V., & Boonstra, W. J. (2014). Sustainability transformations: a resilience perspective. *Ecology and Society*, *19*(4).

10.Wilson, G. A. (2015). Community resilience and social memory. *Environmental Values*, 24(2), 227-257.

11.Mileti, D. (1999). *Disasters by design: A reassessment of natural hazards in the United States*. Joseph Henry Press.

12.Li, Y. (2021). The Influence of the Development of Digital Economy on the Upgrading of China's Industrial Structure. *In E3S Web of Conferences* (Vol. 235, p. 03062). EDP Sciences.