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Understanding Governance Policy Concerning Sustainability of Smart Cities in China

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Abstract

The current study focused on a developmental approach to study sustainability and public administration in the smart cities of China. The concept was based on an analysis of how cities are being reinvented using data and new technology in urban settings to enable sustainable practices, while taking into account the best possible balance between managing environmental resources and managing urban and rural areas. In this context, the goal is to present the development of China's so-called smart cities, considering the Chinese government's plan to create a new phase of economic growth, sustainability, and greater regional integration, through institutional management, improving infrastructure, and protecting the natural resources with an emphasis on energy transition and innovation... At the same time, COVID-19 pandemic is considered to have intensified the global debate on sustainable development by highlighting the vulnerability of humans towards diseases, amid the culture of hyper consumption and climate change.

***Keywords*:** China, ESG, neutral carbon, smart cities, sustainability

Introduction

The challenges of reinventing cities to make sustainable practices possible through institutional design are taken into consideration in this research. The concept was based on an analysis of how cities are being reinvented using data and new technology in urban settings to enable sustainable practices, while taking into account the best possible balance between managing environmental resources and managing urban and rural areas. The current study focused on an approach to study sustainability and public administration in the smart cities of China.

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It was also considered that the new coronavirus pandemic has intensified the global debate on sustainable development by highlighting the vulnerability of humans towards diseases, amid the culture of hyper consumption and climate change. The link between environmental and climatic disasters and hyper consumption forces to rethink or reconsider the ways in which natural resources are exploited. Given that the current state of global socioeconomic and technological development has already considered post-pandemic difficulties as a prime factor that has changed the economic paths as a whole.

An examination of the COVID-19 pandemic crisis and its management as a public policy action (Peneluppi & Bulla, 2021) demonstrated that the contagion of COVID-19 triggered specific challenges in each country, horizontalizing the globe in the face of the same public health emergency. Consequently, it was noticed, while comparing the effective implementation of policies to other liberal democracies that China's response in combating the spread of the new coronavirus serves as an effective example of how strategic policies should be implemented.

Official statistics that take into account the disease incidence and mortality rate in proposition to China's overall population, as well as economic growth since 2020 measured by the Gross Domestic Product (GDP), comparing stats with other countries, allows us to understand the difference in the functioning of State policy in China in relation to the rest of the world.

Thus, the argument that the postponement of measures to adapt to the endemic character of the disease in China affected economic activity (The Economist, 2022) turned out to be a weak one. In China, there was no false dilemma between the quality of life and economic growth, as if people had to choose between both.

In a likewise manner, protecting the environment and combating the adversities caused by climate change was assumed by China as an obligation in the middle of the first year of the pandemic. President Xi Jinping, during a speech at the United Nations (UN) General Assembly in 2020, declared China's goal of reaching peak carbon dioxide emissions by 2030 and subsequent carbon neutrality by 2060. To achieve the "3060" goal, China must consider the combination of renewable energies with new

technologies, based on the technical-scientific and social disruptions that were accelerated during the pandemic.

In this context, the current study argued that the evolution of smart cities in China has provided the possible use of data and new technologies, enabling an ecosystem in cities that can be capable of guaranteeing sustainable development through urban management, improving infrastructure, and protecting natural resources and the environment. It turns out that by the implementation of this approach automate low-carbon solutions, enabling "nature-based solutions" (NbS) can be possible.

As a result, firstly, the following sections will provide a brief discussion on the following: Section 1 deals with the effective use of technology to improve public administration toward sustainability. Subsequently, the next section will discuss the Chinese government's proposal for the development of smart cities, along with an overview of regional integration, which will be described as a new phase of opportunities for the overall economy, with urbanization as a principal signifier in the economic-sustainable axis. To explore these issues, this study aims to examine China's domestic policies with a focus on energy transition and innovation, while also taking into account sustainable finance.

The current study also aims to present the evolutionary framework in China using technology in the public management of cities for sustainable socio-economic development and to identify possible lessons that may be learned from Chinese experience. As a theoretical study, this study uses prior literature reviews to point out challenges and identify solutions in order to contribute to a better understanding, ultimately, providing guidelines for decisions and policies on the subject matter.

Literature Review

China employed various tools to alleviate the effects of the global health crisis, which produced practical solutions for the real applications, opening a new path for economic growth that was more in line with the UN 2030 Agenda. In order to achieve the UN's Sustainable Development Goals (SDGs), this convergence allows to combine the use of digital technology to promote economic development and global cooperation, alongside green finance and carbon emissions trading.

Among the projects that the Chinese government aims to promote, based on the 14th Five-Year Plan (2021-2025) and the medium-term goals

until 2035, is the transformation of social reality through smart cities. With the full digital application, China aims to modernize the industrial sector and accelerate the stages of production, circulation, distribution, and consumption, in order to increase the economic growth through the adoption of sustainable practices. With information and communication technologies (ICT) managing public spaces, this process is considered the greatest balance in the management of environmental resources between urban and rural areas, as well as between different regions of the country.

To comprehend the effects of sustainable practices, which enable the development and coordination of other initiatives aimed at society, it is vital to evaluate the mechanisms used in the COVID-19 Pandemic as a public policy. Rubin and McMichael (1978) explained that good public policy development requires laws that are sensitive and negative in all contexts and that also identify the tradeoffs involved in the regulation of a specific environment by following a systematically characterized regulatory practice.

Therefore, cross-media analysis and life cycle analysis must be taken into account, generating environmental impact assessments (EIR). It is understood that the "cross-media" environmental impact refers to a situation in which the reduction of the emission of pollutants for a specific environment (air, land, or water) result in the increase of emissions of other pollutants for the same or other environments. Thus, compliance with socio-environmental rules as well as the possibility of providing ecosystem services at the local level must be deeply aligned with municipal public policies through the review of their environmental impact criteria and the parameters of land use and occupation, as well as the dynamics of licensing the productive activity and the references of public purchases and public tenders for urban infrastructure works.

As long as it is adapted to local circumstances, NbS works in all these contexts (environmental, social, and economic). Expanding its positive potential, however, requires greater quantification of the magnitude of benefits, as the integration of NbS into planning processes, partnerships with the public administration, and promotion of innovative business models, as well as payments for environmental services, sustainable finance, carbon, attracting green funds, and orchestrated multi-level governance result in implementation challenges.

Likewise, several fronts need to be tackled at the same time to create sustainable cities. Moreover, most of the themes have diffuse impacts affecting different aspects of the city, according to the cross-media analysis. For example, air pollution, in addition to generating global warming, also affects human health and the quality of life on Earth.

A recent study investigated the impacts of air pollution on mortality in 1,000 European cities estimated that compliance with World Health Organization (WHO) guidelines would save more than 52,000 lives a year while reducing air pollution to lower levels could still save 205,000 lives a year (United Nations Development Programme, [UNDP], 2021). Thus, greenhouse gas (GHG) reduction measures have indirect gains that need to be identified and potentially included in planning.

To collaborate with this, the Observatory of Innovations for Sustainable Cities (OICS) created a website with case studies of sustainable and safe mobility, energy transition to renewable sources, integrated waste management, water stress, etc. However, three-quarters of the global infrastructure does not yet exist (UNDP, 2021) and must be designed with nature and people in mind.

To guide this type of planning, the International Union for Conservation of Nature (IUCN) has prepared a list of standards to be followed by 2050 in order to achieve effectiveness (International Union for Conservation of Nature [IUCN], 2020) in actions to protect, manage and restore ecosystems that provide human well-being and the benefits of biodiversity. However, there are social challenges, related to specific issues such as infrastructure, urban management, and environmental protection, among others.

By this, China is moving to fulfill its promises on climate change and energy transition (Chuping, 2021), despite the third year of the pandemic and in the face of persistent uncertainties about COVID-19. It is worth remembering that the international community still knows little about the disease and the main doubt is regarding the ability of the coronavirus to mutate, the emergence of new variants - the rate of transmissibility and lethality - in the face of the effectiveness of vaccines and the long-term collateral effects. It is important to put this in context when entering the discussion on public policies and sustainability.

Urban renewal in China considers the 14th Five-Year Plan, which shifted long successful model of growth from export-driven and fixed-asset

investments towards a conservation approach, emphasizing green and low carbon; and efficiency, increasing the functions and vitality of cities, in line with rural revitalization. The Chinese proposal that raises the city and environment's influences at the same time focuses on the development of super-regions, intensifying the economic progress of the Coast to the West and thus reducing the asymmetry in the country to build a unified national market.

According to Newsgd (2021), "people-centric" urbanization helps promote social well-being through digital infrastructure, with smart cities strengthening economic growth and urban. Therefore, understanding smart cities involves the use of new technologies, and creating a digital network capable of guaranteeing economic, social, and environmental sustainability, while improving people's quality of life, governance, and development.

Study Area

Currently, in China there are 34 metropolitan circles surrounding major central cities, which tend to centralize the population. Three of them, in addition to the Beijing-Tianjin-Hebei (Jing-Jin-Ji). There are also eight medium-sized clusters and eight smaller ones are "super cities", located in the Pearl River Delta (Shenzhen, Dongguan, Guangzhou, Foshan, and five other cities) alongside with the Yangtze River (Shanghai, Hefei, Nanjing, Hangzhou, and Ningbo).

According to the Chinese model, Yangtze River the middle course (Wuhan 9+1) and western clusters in the West (Chengdu-Chongqing or Cheng-Yu) will be operational in 2035. That is, Wuhan, the epicenter of the first coronavirus outbreak, which is the centerpiece of this project, and serves "Nine Cities, One Dream".

At the 18th National Congress in 2012, The Chinese Communist Party (CCP) defined, the plan is to complete the construction of a moderately prosperous society in all aspects by 2049, the year that marks the centenary of the founding of the People's Republic of China. There were two phases to the process. The centenary of the CCP's founding in 2021, marked the year in which the goal of a moderately prosperous society was achieved. China seeks to achieve socialist modernization by 2035.

Within the scope of this discussion, it is crucial to emphasize the following among eleven strategic goals set for the period up to 2035: 1) a significant increase in China's national strength, including in the economic,

scientific, and technological fields; 2) realization of new types of industrialization, computerization, urbanization, and agricultural modernization, together with the establishment of a modern economic system; 3) formation of green production and lifestyle with carbon emissions in constant decline after reaching their peak and improvement of the ecological environment; 4) GDP per capita at the level of a "moderately developed" country, with disparities between urban and rural regional development and living standards significantly reduced.

Therefore, in less than 15 years, the modernization of urban areas and integration with rural areas should be the main structuring potential for China's development and economic growth. With this, the Chinese government intends to fight regional divergence between rural and urban areas, so as to make the vast areas of the countryside the main zone to fight poverty and organize population migration between regions until reaching an urbanization rate of 65% of the population in 2025 and 75% - a level similar to that of an advanced economy - in 2035.

Statistical Analysis

According to the country's most recent census[1], 63.9% of China's population of 1.44 billion lived in urban areas in 2020, up from just 10% in 1950. With the latest rate, China has entered the middle and late stages of urbanization, expected to reach a peak of around 80% between 2040 and 2050. At the same time, China has entered the upper middle-income stage, in which GDP per capita, or the ratio of wealth produced by the country, as measured by GDP divided by inhabitants, is between US$ 4,200 and US$ 12,500.

Bingwen (2013) states that this stage of "upper middle income" started in 2010 and should continue until the end of the 14th Five-Year Plan, in 2025, promoting the transformation of Chinese economic growth from "driven by factors" to "driven by efficiency". "This means improving the input-output ratio, raising the rate of investment return, and increasing economic competitiveness to achieve sustained growth" (p. 33). According to the author, the improvement in the relationship between input and output brings an increase in productive forces, which, in turn, results in an increase

[1] National Bureau of Statistics of China (NBS): Available at: http://wap.stats.gov.cn/jd/202105/t20210512_1817338.html Access in October. 2022

in the investment return rate, which is the “driving force” for growth and includes raw materials, human resources and technology.

Therefore, the development of smart cities results in increased efficiency in commercial, industrial, energy, and living standards by integrating several urban conglomerates located close to each other. In this way, the beginning of a new era of urbanization in China tends to help meet the “3060” target.

The urbanization process is also linked to overcoming the so-called “middle- income trap”, a concept that emerged at the World Bank and deals with the difficulties that many countries have to overcome at a certain level of income of the population when they reach a certain stage of economic development and end up getting stuck in a certain range of GDP per capita, between US$1,000 and US$10,000.

Latin America is the region with the highest concentration of middle-income countries, with around 80%. This phenomenon is the result of the accelerated process of urbanization in Latin countries, with large portions of the population still in extreme poverty, which is reflected in the widespread existence of disordered urban occupations, such as slums, and in social degradation. China, on the other hand, is moving towards “high income”, having to face important challenges in the new phase of its process of economic development and social progress, motivated by technological innovation, in a period after the 14th Five Year Plan.

> Raising the capacity for technological innovation and building a country model in innovation is the core of China’s current development strategy to overcome the 'middle-income trap', as well as being the fundamental channel that gives direct access to the high-income level. (Bingwen, 2013, p. 33)

Findings and Discussion

By identifying the internal mechanisms that China promotes to carry out its economic development process, circumventing the risks associated with the so-called middle-income trap, it is also possible to point out the possible lessons that the Chinese experience transmits to developing countries, especially Latin America. It is understood that China seeks to transform its economic growth model, with the objective of promoting technological development, inserted in a context of energy and environmental restrictions imposed by the “green economy” and sustainability issues.

In this path, two challenges stand out: 1) the great regional imbalance in China; and 2) agricultural modernization. As a result, for the next decade or longer, starting in 2035, China is focusing on three strategic priorities: improving the urban environment, reducing the total volume of pollutant emissions, and generating energy through renewable sources.

The core of these goals is technological advance and scientific innovation. Yang (2013) explains that the efficiency of economic growth decreases as energy consumption and the emission of pollutants increase, while technological advances have a "notable negative relationship" (p. 337) with energy consumption. "Therefore, under energy and environmental constraints, the Chinese economic growth model must avoid the extensive growth path of 'high spending, high pollution and high emission'".

To achieve sustainable development, China's economic growth transformation model is crucial. Therefore, when comparing the growth paths between countries that fell into the "middle income trap" and those that managed to enter the high-income path - or are heading in that direction - it appears that the difficulty of overcoming this challenge is associated with problems in the transition of the economic model.

In the case of Latin American countries, as many have not carried out a fundamental reform of the agrarian system, the industrialization process is interrupted by significant deficiencies in the basic structure (Shijin et al., 2013). Such an imbalance results in the legacy of severe inequality, forming "poor urbanization". The authors show that growth patterns and countries' trajectory that fell into the "middle income trap" are similar to those that crossed the "high income wall".

However, the nature and causes of the declines are different. It is from there that a bifurcation in Chinese strategy can be seen through smart cities to avoid a fatality in economic development. This process takes place through the creation of appropriate strategies and policies divided into two axes: 1) the evolution of industrialization as a process of technological progress and 2) of rural revitalization as a more advanced stage of modernization.

Peneluppi and Bulla (2022) show that during the fight against the coronavirus pandemic, China used location data via smartphones and sophisticated computational methods to contain the spread of COVID-19.

Through Artificial Intelligence (AI) and Big Data analysis, the country was able to establish the virus transmission chain, identifying all possible points of intersection, ranging from neighborhoods to individuals exposed to the coronavirus or already infected.

"Based on this technological innovation, the Chinese authorities made combat measures more efficient, including in the outbreaks in the country after Wuhan" (p. 247). Thus, the effectiveness of China's response to the pandemic added to the effort to reach the "3060" Goal accelerates the process of digitization in society through the mass use of technological tools within a constantly improving ecosystem.

At the same time, it encourages the advancement and modernization of Chinese industry towards the so-called quaternary sector of the post-industrial era, through the encouragement of information and new communication technologies (ICT). At this stage, industrial practices are integrated into an infrastructure that relates information activities and communication services to the digital application, fostering deep-level machine learning.

With the maturity of manufacturing and the mastery of automation combined with the use of data, China is moving up the higher steps of the "technological ladder", improving the efficiency and productivity of processes by updating the industrial sector. The so-called Industry 4.0 enables, for example, the execution of "smart" factories and cities. Together, the Internet of Things (IoT) and Cloud Computing (cloud) create physical spaces that communicate and coordinate processes with each other and with people, optimizing the service sector, generating intra-organizational opportunities, facilitating convenience, and adding consumer value.

These information technologies (ITs) work as a large network, in which the IoT allows connecting devices and people, collecting all types of data, which feed a Big Data system, with the cloud infrastructure giving support for storing and processing it. This is where Artificial Intelligence (AI) comes in, which processes and analyzes the algorithms generated by the vast resources in the cloud and the immense amount of data, extracting, transforming, and loading this material to generate new insights and enable data-driven decisions and information.

In the context of cities, this digital-technological empowerment allows the solution of public problems, such as the relocation of factories to industrial parks or urban fringes; centralized treatment of water and solid waste; the transition towards green energy; the incentive to electric transport; the increase in public space and green areas; and the restructuring of the "old city", among others. As a result, the structure of ICTs promotes the technical-scientific transformation of cities to achieve a better quality of life.

After all, connectivity is not an end in itself, but a means that encompasses economic sectors, capable of increasing the wealth produced by the country and creating a new business world, awakening individuals, companies and governments to a futuristic reality, hitherto uninhabited. In addition, technology supports these applications, serving as a foundation for the emergence of innovations.

This is where the need for a case study methodology comes in, in order to investigate the smart urbanization policy of Chinese cities. The research method chosen allows social interaction and social construction of meaning *in situ* (Lewin & Somekh, 2015, p. 90). According to the authors, the case study definition combines a focus on policy (or a development "case") with a physical location (i.e. carried out in certain places) and assumes that "social reality is created (...) and seeks to recognize and describe before trying to analyze and theorize" (p. 91), enabling an exploratory analysis.

Therefore, it is necessary to collect data on the Chinese cities to be chosen, considering aspects such as investment in "green technology", renewable energies, and nature-based solutions for mitigating or adapting to climate change, among others, as well as the forms of financing and the relationship between companies and governments. Thus, partnerships not only between public administration entities but also with the private sector will be essential to face the most urgent challenges of our time.

In the countryside, Document No. 1 of the CCP Central Committee (Xinhuanet, 2022) shows that the Chinese government's focus is on rural revitalization and food security, in order to guarantee food to the population in a comprehensive way and consolidate the achievements of eradicating misery. Based on the purchasing power parity (PPP), China achieved its aim eradicating extreme poverty in the first year of the pandemic, lifting more than 800 million people out of poverty over the previous 40 years,

As part of the transition from Deng Xiaoping's policy that "some areas could get rich before others", which worsened social inequality between the coast and interior of the country until the beginning of this century, to the pursuit of "common prosperity" during the Xi Jinping era to build an ecological civilization, China is currently carrying out a plan to boost agricultural production, rural development, and peasant incomes. In order to further, reduce the disparity between urban and rural areas this process goes through a harmonious cycle of development and "green" consumption, which has natural resources and the relationship between society and nature as its central axis.

At the 20th National Congress of the Communist Party of China (CPC) opening, on Oct. 16, 2022, Xi Jinping delivered a report and emphasized that nature is a prerequisite for human survival and development. In order to effectively implement stringent environmental protection measures and of the highest level of development from the height of harmonious coexistence between man and nature, he emphasized the importance of firmly practicing a concept that "lucid waters and lush mountains" are invaluable assets, which leads to the effective implementation of strict.

By allocating resources, such as money and technology, and fortifying the fundamental infrastructure in rural areas, effective steps to eliminate severe poverty have additionally assisted in containing the detrimental effects of COVID-19. During the process, improvements were made through the construction of rural roads in poor areas by undertaking projects for water conservation and potable water access initiatives, irrigation and drainage installations for agricultural land, and supply of energy through electrical networks and internet access, among others.

Together, these initiatives give impetus to the rural revitalization strategy, fostering the development of green industries and biodiversity preservation. Thus, in order to construct a new economic base, China's long-term goal is sustainable, inclusive, and balanced development. Sustainability, scientific-technological innovation, and institutional planning, which are integral to China's new stage of socioeconomic development, which is advancing the process of reform and opening that began 40 years ago.

Fang (2022), stated that the construction of a new pattern of development in China requires the implantation and expansion of the

economically developed southeastern coastal zone towards the region along the "Aihui-Tengchong line" – that is a proposed virtual border by economic geographer Hu Huanyong in 1935 from Aihui, in Heilongjiang Province, on the northeast border, and crossing 45 degrees southwest to Tengchong in Yunnan Province. He asserted that by developing this "imaginary line", it is essential to ignite a new wave of industrialization and address the regional imbalance in China has caused a misbalance over the last few decades.

The "Aihui-Tengchong line" reflects the unequal distribution of population and resources between China's southeastern and northwestern regions. In contrast, the territory east of this imaginary line represents less than 40% of Chinese territory and about 90% of the population, while the west territory's line represents over 60% of the country's land area and only about 10% of its population.

Improving the supply of important products, such as rice, wheat, corn, soy, pork, beef, and dairy products is among the top aim of China's agricultural modernization. Food security is very important to China, as the frequent political instability has often been associated with hunger. China is a net importer of food; therefore, the CCP is concerned about possible future trade restrictions. Hence, the emphasis is primarily on domestic food supply.

The Chinese government refers (Xinhuanet, 2022) to the "diversification of imports" of agricultural products and the "support for the integration of companies in the global supply chain", in its dealings with the global market, in addition, to promote green commercial investment, for example through the Belt and Road Initiative (BRI). The New Silk Road focuses on providing infrastructure to late developing countries, which can benefit from China's efforts and achievements related to extreme poverty eradication and rural revitalization belonging not only to the Chinese people but also to the "Third World".

In this regard, China's initiative consists of a number of project including a series of political, economic, technological, cultural, and institutional arrangements. It appears, therefore, that at the end of the current Five Year Plan, in 2025, China's objective is to achieve a dynamic balance between supply and demand, ensuring an economic flow both internally and externally, along with the integrating production and consumption factors.

The Chinese proposal consists of involving the economy in a "dual circulation", in which domestic consumption becomes one of the pillars, with smart cities building access bridges within the country. At the same time, the export of excess supply is expanded via industrial and capital capacity, with the BRI creating new connecting routes between the world and intensifying existing relationships.

Conclusion

By this, the main challenges for China, in terms of urban governance and considering the long-term impacts of the pandemic, is related to the empowerment of cities. Provincial governments have taken on greater responsibilities in the face of Covid-19, at a time when China's debt problem is primarily local. Therefore, there is a shortage of tax revenue to meet the targets set by the central government.

According to a MacroPolo Institute (2021), China is still recovering from the "debt hangover" that was largely caused by the explosion of local government financing lines (LGFV) after the 2008 financial crisis. According to the Institute's economist, Houze Song, what is worrying is the fact that many local investments financed by LGFVs can no longer pay this debt, causing the rate of return on these investments to be, on average, less than 2% and below the cost of the loan. On the other hand, it does not matter whether taxes are imposed which have the effect of raising the price of the resource to the point of exceeding its real cost.

Thus, the way in which each region in China manages debt deleveraging will be one of the most important determinants of local economic performance, and may deepen the already existing disparity between local governments and provinces. Therefore, while in the short term cities are able to meet the demands related to the fight against Covid-19 and the development of sustainable and smart practices, there is a need to significantly improve the integration of central and regional actions in China, sharing responsibilities.

The current study proclaimed that China has the potential to play a greater role in global climate governance, as well as helping to create the fiscal field in the local cities to promote sustainable development (SD) in inner urban spaces and in developing countries. Through the exposition proposed in this article for building smart cities, it is emphasized that the dimensions of sustainability must be adequately integrated into urban

planning and economic development. “Collaborative” governance and the use of technology aligned with innovation are necessary perspectives for the construction of public policies that involve a multisectoral approach, joining forces with the business community and local governments.

In short, it is a strategy that clearly reflects China’s worldview and its place in it, seeking to become a fully integrated market that keeps foreign markets open to Chinese products and demands. With this, the “new normal” in the post-pandemic world is an opportunity to put into practice socio-economic development projects in China and in allied nations, through policies that encourage the installation of infrastructure and connectivity aimed simultaneously at self-sufficiency and the exchange of knowledge, goods, and services between peoples and nations.

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