

Article

New Direction of Sustainable Urbanization: The Impact of Digital Technologies and Policies on China's In Situ Urbanization

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Abstract: As part of the process of sustainable urban planning in China, digital technologies have led to major practical and academic concerns. However, few scholars have focused on the impact of digital technologies on in situ urbanization from a policy–technology perspective. This interdisciplinary work aims to analyze how digital policies and their technologies contribute to the transformation of in situ urbanization patterns. This study follows the structure of law and policy research regarding the path of phenomenon presentation–institutional analysis–limitation interpretation. First, the legislation and policies for digitalization of the countryside has drastically changed the logic of how traditional in situ urbanization works. The concept of in situ urbanization 2.0 is used to describe this new phenomenon. Second, historical legitimacy, performance legitimacy, and socially sustainable reproduction are three reasons why rural digitalization reform has triggered in situ urbanization 2.0. Finally, the double dilemma of overreliance on technological change in the in situ urbanization 2.0 process is pointed out; these dilemmas need to be addressed through legislation and policy adjustments. Four recommendations for action are proposed to address these dilemmas. The findings of this research contribute to the literature on sustainable urban planning and rural digitalization reform.

Keywords: sustainable urban planning; digital legislation and policy; rural digitalization reform; digital technology



Citation: Zhang, C.; Zhou, W. New Direction of Sustainable Urbanization: The Impact of Digital Technologies and Policies on China's In Situ Urbanization. *Buildings* **2022**, *12*, 882. <https://doi.org/10.3390/buildings12070882>

Academic Editor: Mattheos Santamouris

Received: 27 April 2022

Accepted: 13 June 2022

Published: 23 June 2022

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1. Introduction

Rapid urbanization is an enormous challenge to sustainable development [1–3]. The urbanization rate in China, the world's largest developing country, increased from less than 20% in 1978 to 60.6% in 2019, an average increase of one percentage point per year [4], which means that the sustainability challenges facing the country are extremely serious. In facing this challenge, scholars have advocated that digital technologies, along with digital policies, should be widely applied in rapid urbanization [5]. For example, ul Hussnain et al. point out that digital technologies can sustainably contribute to urban spatial planning. Sharif et al. [6] focus on the innovation of s-technology for intracity traffic management. Zhan et al. [7] focus on the great utility of data technology in urban climate regulation. Scott et al. [8] highlight the utility of digital technology in emergencies [9]. Moreover, digital technologies enable sustainable urban development in the commercial [10], industrial [11], and consumption sectors [12]. Despite these challenges, as an innovator of sustainable urban planning, digital technologies have received widespread attention in theory and practice [13].

The rapid urbanization model, transformed by digital technology, is a hot topic in academia at the moment. Surprisingly, however, few studies have focused on what digital technologies have brought to in situ urbanization, which is more characteristic of urbanization under Chinese planning than of metropolises [14]. Only a few studies have paid

attention to this topic and those that do mention it only tangentially. For example, while some studies address the innovation of digital technologies on the path to in situ urbanization planning, the core topic is online services in China's rural transformation. Some studies [15] focusing on in situ urbanization have largely ignored digital technologies [16]. Considering the great sustainable potential of in situ urbanization [16], the focus on digital technologies is important for bringing innovation to in situ urbanization.

Regarding this topic, this study aims to analyze how digital policies and their technologies contribute to the transformation of in situ urbanization patterns. The innovation that digital policies and their related technologies bring to in situ urbanization and common paths of small city development have not been systematically clarified. This activity is thus the research objective of the article. The core argument of the article is that digital policy and its related technologies innovate a different path for in situ urbanization than before. This article develops a systematic argument from three sub arguments: innovation phenomena, institutional logic, and limitations of contemporary innovation, and proposes in situ urbanization 2.0 as a core concept for use in this field. The introduction of new concepts provides a possible path for future research. The study makes contributions to the contemporary literature. In addition, the research perspective is different from that of previous studies, which mostly used empirical methods to demonstrate the efficacy of data policies in the process of in situ urbanization. In contrast, this paper takes a normative research perspective to logically classify the changes that policies and their technologies bring to in situ urbanization. Such a method is rare in recent studies and can contribute to the literature.

The article follows three stages of research: describing phenomena, conducting institutional analysis based on a conceptual framework, and interpreting limitations to develop an argument. This is a common argumentation structure in law and policy studies. The typical study can support this argument structure. Specifically [17,18], this article comprises five parts. The second part examines in situ urbanization innovation phenomena under digital policies using four official indicators, arguing that the process of in situ urbanization 2.0 has begun. Building on the second part, the third part uses the theoretical framework of political economy to analyze the institutional logic of the Chinese government's promotion of in situ urbanization 2.0. Three types of logic—political, economic and social—not only form the motivation for the Chinese government to promote in situ urbanization 2.0, but are also the source of internal and external constraints in the process of in situ urbanization 2.0. The fourth part proposes two types of limitations of contemporary in situ urbanization 2.0 derived from the theoretical framework in the previous section. These limitations are concentrated in internal non-self-consistent dilemmas and external conflict risks. Based on the limitations analyzed in the fourth part, possible future responses are presented in the fifth part. The last part summarizes the article and presents the limitations of this study.

2. In Situ Urbanization Innovation under Digital Policy

2.1. In Situ Urbanization Effects of Rural Digitalization Reform: 1.0–2.0

The United Nations provides a fundamental definition of in situ urbanization: it occurs when a rural population reaches an urban standard of living without having to migrate to cities [19]. Although more specific definitions have been debated, the term in situ urbanization is mainly used to describe the process of moving from rural to urban areas [20], which is accompanied by a social process of farmers becoming urban residents [21]. The process usually begins with the transfer of the workforce from the agricultural sector to the nonagricultural sector [22]. There are two traditional drivers of in situ urbanization, namely, the development of industrial activity in rural areas and government-facilitated foreign investment [23]. These two drivers have led to different forms of in situ urbanization. In general, the process of in situ urbanization in China has contributed to changes in settlement patterns that have led to differences between villages and towns. Officials believe that the specific utility of in situ urbanization should be measured in terms of four

areas: infrastructure development, agricultural industrialization, public service levels, and rural local governance [24].

Since 2019, a series of digital policies, such as digital platforms for rural development strategies and digital plans of action for rural development, have had an enormous impact on the path to in situ urbanization [25]. These impacts have been so great that they have mechanically changed the traditional process of in situ urbanization. Therefore, we call in situ urbanization under the digital reform of the countryside “in situ urbanization 2.0”. Based on officially published criteria, we explain how digital reform has changed traditional in situ urbanization in terms of four aspects: infrastructure development, agricultural industrialization, public service levels, and rural local governance.

2.2. Construction of Digital Infrastructure

China’s digital infrastructure in rural areas can be divided into two phases: physical infrastructure development and recent digital infrastructure development. The recent digital infrastructure development, supported by the rural digitalization reform policy, has comprehensively renewed rural digital facilities, which is a prerequisite for the realization of in situ urbanization 2.0.

In in situ urbanization 1.0, the construction of the interface end of Internet information facilities, as physical infrastructure construction, is the main digital infrastructure task. This construction was largely completed in the 1.0 period. By the end of 2021, the proportion of administrative villages with access to both fiber optics and 4G nationwide exceeded 99%. Broadband networks are gradually being extended to key areas such as rural population clusters and production operation areas and along major transport routes. The scale of rural broadband users continues to expand and the penetration rate of the fixed broadband population exceeds the average level of member countries of the Organization for Economic Co-operation and Development. By the end of 2021, the total number of rural broadband access users had reached 158 million, a net increase of 15.81 million over the end of 2020. Physical infrastructure development has largely transformed the basic rural landscape, driving in situ urbanization 1.0.

In recent times, digital infrastructure, a fully upgraded version of physical infrastructure construction, has comprehensively updated digital technologies in the process of in situ urbanization 2.0. Digital infrastructure refers to the internet base, internet user base, and technical base necessary for digital development by means of internet technology. The popular concepts of network communication, big data, cloud computing, blockchain, artificial intelligence (AI), quantum technology, the internet of things, and the industrial internet all need to be based on digital infrastructure. As the basis of in situ urbanization 2.0, digital infrastructure offers the opportunity to urbanize production and life in the countryside in a completely different way from the traditional path. Notably, because of the rapid nature of China’s development and the high rate of iteration of digital technologies on the internet, some villages that have not yet entered the traditional process of in situ urbanization have made the leap.

For example, basic industries in certain rural areas have skipped straight to physical infrastructure construction and moved directly from the traditional development model to a digital infrastructure-based rural e-commerce platform. This kind of leap is an example of how digital infrastructure development has been widely promoted and practiced in rural areas. Additionally, in Chengdu, the installation of video surveillance systems is the main security measure in public safety construction in rural areas [26]. However, with the advancement of video surveillance technology, security measures have received significant technological enhancements in terms of software. The storage capacity of traditional communication devices and the ability to analyze video content have been greatly enhanced by AI and big data cloud storage technology, which in turn has brought about efficient public security governance.

2.3. Digitalization of the Agricultural Industry

Chinese agriculture is characterized by a small amount of land per capita; thus, the mainstay of agricultural production remains the small family farm, with an average of approximately ten acres of land [27]. For small family farms, the labor force, cultivation technology, and funds for investing in machines are the main constraints on production [28]. Therefore, in in situ urbanization 1.0, the agricultural industry has been upgraded mainly around mechanization and cultivation techniques. However, breaking with the traditional logic of industrial upgrading, in situ urbanization 2.0 has reshaped the whole system of agricultural production by means of digital technology.

First, the revolution of in situ urbanization 2.0 as part of agricultural industrialization is mainly driven by digital technologies used to enhance agricultural production capacity. In recent years, digital technology has comprehensively changed the logical production of industries such as agriculture, forestry, animal husbandry, fishery, agricultural and side-line product processing, industrial product manufacturing, and leisure tourism. In production activities, digital technology enables artificial intelligence to control automated agricultural production and management processes. For example [29], new digital technologies such as sensor technology, geo-information technology, mobile computing processing technology, and AI technology can comprehensively collect all kinds of data in the agricultural production process and perform dynamic task planning and planting management based on this technology. The results undoubtedly greatly enhance the efficiency of agricultural production.

Second, the agricultural digital ecosystem is reconstructed by rural digitalization reform. In terms of the sale of agricultural products, digital technology has reconstructed the ecological chain of the production, purchase, and sale of agricultural products [30]. On the production side, a digital agricultural production system based on technical equipment that ensures production and is supported by data algorithms is formed. On the retail side, a system of blockchain traceability, AI quality grading, and comprehensive logistics that ensures product quality is constructed. On the sales side, a system for ensuring the product sales of all-channel production and for marketing docking and regional public brands is improved. The efficiency of the agricultural ecosystem reconfigured by digital technology is enhanced.

Finally, traditional specialty industry clusters, which are an important pillar of in situ urbanization, are being reshaped by digital technologies. In the late modern period, through specialized manufacturing, a large number of rural areas gained economic power, which promoted in situ urbanization. However, as the demographic dividend declines and labor costs rise, in situ urbanization slows as the economic growth rate declines. The digitalization of rural areas has brought new economic growth points. Some regions are seizing the opportunity for digital development to accelerate the transformation through the upgrading and innovative development of clusters. For example, Guangdong's rural areas have initiated the digital transformation of specialty industry clusters. The industrial internet system constructed through digital technology collects data from multiple links, such as branding, production, processing, and material supply. The data collection and coproduction model based on this system has greatly improved local production efficiency, providing a new impetus for local economic development and in situ urbanization.

2.4. Digitalization of Basic Public Services

The large-scale application of digital technology is an important feature of the national basic public service system to be established during the period of the 13th Five-Year Plan. We summarize the digital government construction plans for each province in China for 2022; see Appendix A Table A1, which reflects the general investment of governments across China in the digitalization of basic public services. This feature intuitively reshapes the basic public services of in situ urbanization. This reshaping is reflected in two ways. After digitalization, the threshold for the construction of basic public services is significantly lowered. Scholars point out that basic public services are a difficult aspect of in situ urban-

ization because the construction of basic public services involves high demands on finance, technology, human resources, and the quality of citizens. In situ urbanization 1.0 policies, such as new rural cooperative medical services, have also focused on basic public services such as education, healthcare, and social security, but they have had poor results [31]. However, this reality has been reshaped by data technology. Through digitalization, such as the construction of a unified online administrative service platform, digital technology has enabled the reshaping of the way in which power operates, and the cost of running administrative power has been significantly reduced [32]. Currently, through the organizational hierarchy of the administrative bureaucracy, digital technologies and their public service models are beginning to be transmitted to rural areas that are not endowed with digital technologies. The elements of finance, technology, human resources, and citizenship are also being empowered by digital technology in rural areas. This means that basic public service provision, as part of in situ urbanization, is made much less difficult.

The digital reengineering of public services creates public service parity. In addition to infrastructure provision, the most important public services are education and healthcare. With these public services being widely covered by digital technology and its infrastructure enhancement, quality educational resources and medical resources are digitally accessible to urban and rural people on a near-parity basis. In 2018, the proportion of multimedia in rural primary and secondary schools reached more than 50%. There are 2843 county-level centers for digital cultural services, 32,179 grassroots service points in townships, 32,719 public electronic reading rooms in townships, 14,136 digital cultural stations, and cell phone applications that provide farmers with more accurate science and technology services, skills services, etc. [33]. Overall, by reducing factor costs, digital technologies have dramatically reduced the difficulty of public service provision, which indirectly accelerates in situ urbanization 2.0.

2.5. Digitalization of Rural Governance

The top-level design of rural digitalization, such as the Law of the People's Republic of China on the Promotion of the Revitalization of Rural Areas and the Outline of the Digital Village Development Strategy, has also changed the logic of rural local governance. Digitalization policies divide the governance of in situ urbanization into public administration, public security, and public service, and revolutionize the logic of governance through the large-scale use of digital technologies.

Public management and public services include local government services, rural party construction, and village public affairs governance, which are almost fully reliant on digital technology. In Chinese Communist Party (CCP) construction projects [33], digital technology has been used to build several sets of governance programs, such as "Internet and party construction", "smart party construction", "online party branches", and "online village (residents) committees". These systems have changed the model of offline CCP construction and strengthened the party's control over rural areas. In addition, through the digital platform, local government services and village public affairs governance have been moved online, which has greatly improved the efficiency of governance. Rural public administration has been transformed by digital technologies in terms of the organizational structure and forms of content.

The governance logic of public security, which mainly includes social security management and public health governance, has been completely changed by digital technology. At present, the digital technology-led "Snow Bright Project" has basically replaced the traditional social security management model. The "Snow Bright Project" is an extension of the digital security management model in metropolitan areas called the "Skynet Project" in the process of in situ urbanization, which manifests in the installation of real-time surveillance systems in almost all public areas of a city without blind spots to effectively combat crime. Unlike the traditional model of human patrolling, digital technology can transmit and analyze video data in real time to efficiently monitor and manage the security of a city and rapidly act to prevent and combat crime. In place of traditional methods, the digital

technology-led “Snow Bright Project” has yielded excellent results in practice. One example is the adoption of the “Snow Bright Project + Grid” governance model in Sichuan Province, which has resulted in a significant reduction in muggings and burglaries in towns [26].

Additionally, digital technology, which differs from traditional governance methods, has greatly improved the efficiency of public health governance [30]. For example, the traditional offline model has been abandoned, and the digital platform of government-enterprise cooperation directly helps residents learn about epidemic prevention and conduct health self-examinations online to help with prevention, control, and monitoring activities. Similarly, village organizations use new methods for enhancing epidemic prevention activities and to monitor compliance, efficiently realizing public health prevention and control efforts simultaneously.

The above compendium shows the innovation of rural digitalization reform based on in situ urbanization from four key perspectives. Digital infrastructure construction has revolutionized the trend of infrastructure construction; the digitalization of the agricultural industry has realized the transformation and upgrading of rural industrial clusters; the digitalization of public services has enhanced the supply capacity of public services; and the digitalization of rural governance has completely changed the traditional logic of rural governance. These corrections are undoubtedly efficiency enhancing. The development of the digital economy can directly reduce the income gap between urban and rural areas and can also promote the return of the labor force [34]. The digitalization of public services and rural governance will further enhance people’s quality of life. As a result, a perhaps unexpected picture is presented: digital technology facilitates the rapid development of in situ urbanization along an unconventional path. Digital reform-based development paths and the development outcomes of digital urbanization are compatible with traditional in situ urbanization. Traditional in situ urbanization, particularly in China, developed along a single path in the late 1990s; large cities needed to accelerate their urbanization by better coordinating with smaller surrounding cities and towns [35]. This means that the path of in situ urbanization is large city–peri-urban–rural, which has significant spatial concomitance. However, digital reforms have altered this path. Under the new path, the extent of digital reform in rural areas, rather than the distance from large cities, is one of the key elements influencing in situ urbanization. In addition, traditional in situ urbanization involves four aspects: infrastructure development, agricultural industrialization, public service levels, and rural local governance. In terms of development outcomes, a number of scholars have pointed out that digital urbanization has greatly accelerated the efficiency of these indicators [15]. Based on the differences in development paths and outcomes between the old model and new model, this phenomenon is called “in situ urbanization 2.0”. Thus, the different paths and accelerated efficiency of in situ urbanization 2.0 are the features that distinguish it from urbanization 1.0.

3. The Institutional Logic of In Situ Urbanization 2.0

The current digital reform of the countryside could create an unconventional phenomenon of in situ urbanization called “in situ urbanization 2.0”. A logical question arises: why is rural digitalization reform being pushed by the state? We argue that the official formulation recognizes the irreplaceable political and economic significance of the digital reform of the countryside as a process of legitimacy reproduction. In addition, the in situ urbanization 2.0 triggered by rural digitalization reform can bring important social benefits. These three reasons constitute the institutional logic behind the official promotion of rural digitalization reform and, thus, in situ urbanization 2.0.

3.1. Politics: The Reproduction of Historical Legitimacy

The Marxist theory of communism, which is the foundation of the Chinese governance, defines the development of the countryside as one of the measures of the reproduction of legitimacy. Marxists have argued that human society goes through three stages: the unification of urban and rural areas without any distinction, the separation and conflicting

interests of urban and rural areas, and the integration of urban and rural areas. This means that the Marxist conception of the Kingdom of Heaven on Earth includes a commitment to the equal development of urban and rural areas. The advancement of in situ urbanization logically becomes the process of fulfilling this promise and completing the reproduction of legitimacy.

This process of legitimacy reproduction has been followed in this country and written into the constitution. Article 1 of the Constitution of the People's Republic of China explicitly states that the masses are important allies in governance. Article 1 of the Constitution of the People's Republic of China states: The People's Republic of China is a socialist state governed by a people's democratic dictatorship that is led by the working class and based on an alliance of workers and peasants. Given the specificity of the state system as defined in Article I of the Chinese Constitution, it is imperative that the CCP consider the development of the countryside to protect the interests of its ruling allies. The CCP has placed rural development in a strategic position. Officials have argued that the CCP's practical exploration of the "three rural issues" embodies the mission of changing historical tasks [36]. The exploration of this issue is an important component of the internal logic of balancing urban and rural development in the process of national modernization. Due to the CCP's strong reliance on the legitimacy production process, the regime has been actively practicing legitimacy reproduction through rural reform for a long time. This practice is evident in various important programs across different eras. It is clear from the narrative of official documents that the digital reform of the countryside can be seen as a process of legitimacy production in the digital age. Officially, the digital reform of rural areas connects the "rural revitalization strategy" and the "digital China strategy". The construction of the digital countryside is the main method of rural revitalization in the digital era, and it is also a key feature of digital China. Digital village construction can be very useful for rural areas in China seeking to solve the problems of in situ urbanization and sustainable development, and thus to realize rural revitalization. Therefore, in terms of ideology, the digital reform of the countryside is an indispensable and timely strategy for continuing the reproduction of certain ideologies.

3.2. *The Economy: Reproduction of Performance Legitimacy*

In the economic sphere, rural digitalization reform is seen as the solution to many performance legitimacy challenges. This perception is shaped by the fact that rural China has long been seen as providing fuel for sustainable urbanization. Means of production and productivity dispossession has become a dominant mechanism of Chinese urbanization [37]. Specifically, based on the criteria for identifying urbanization [16], the markers of urbanization are mainly seen in the development of the industrial economy and job growth.

At the moment, rural digitalization is the response chosen to ensure sustainable urban planning and the continuation of the legitimacy of economic performance. The current model of urbanization is predicted to be unsustainable, and in situ urbanization is a natural development. After four decades of development, the process of urbanization is now slowing down [38]. To ensure continued economic development, industrial migration and consumer markets will radiate to surrounding towns and cities, and in situ urbanization is an inevitable choice to avoid triggering enormous risks to the decades of progress made under sustainable economic growth brought about by urbanized development. However, the process of developing industrial migration and consumer markets is not without obstacles. This development can be accomplished with low attrition only if the countryside is close to the city in all aspects of infrastructure. By promoting in situ urbanization 2.0 through rural digitalization reform, rural infrastructure has been greatly developed, which significantly reduces attrition in developing industrial migration and consumer markets and increases the sustainability of urbanization and economic development.

In addition, rural digitalization is a response to ensure sustainable rural development to perpetuate performance legitimacy. During the first 40 years of modern urbanization, the low cost of absorbing labor from the countryside was one of the main tools of traditional

urbanization. For example, in 2011, there were 230 million migrant workers, approximately 80% of whom came from the countryside [21]. As a result of this massive and continuous siphoning, the economic and social functions of rural China have been completely degraded. Traditional patterns of production and life have been completely disrupted by traditional urbanization [31]. However, the labor absorption capacity of cities is not unlimited. As the Lewis turning point approaches, the declining countryside will have to absorb the surplus labor that has not yet been siphoned off by cities [39]. Moreover, as the urban economy transforms and large cities become saturated by development, some of the displaced labor will have to be accepted by the declining countryside. Unless there is massive reform, there will not be enough infrastructure and jobs in the decaying countryside to support and utilize this workforce. Rural digitalization offers a path to reform for the countryside. The recasting of rural economic and social functions through rural digitalization and other rural revitalization policies can change the industrial and employment structure of the countryside, which means that the capacity of surplus and eliminated labor can be more fully stimulated. Additionally, with the policy's enhancement of rural public services and public administration, the reshaped countryside will begin to have a siphoning effect on labor from other regions. This virtuous circle will further unleash rural productivity for sustainable rural development. Thus, by promoting in situ urbanization 2.0 through digital rural reforms, the government can free up more resources for sustainable rural development, which implies a reproduction of performance legitimacy.

3.3. Society: A Realistic Driver of Sustainable Development

Urbanization aims to promote citizenization, under which people's social needs must be sustainably satisfied [40]. In situ urbanization 2.0 offers great social sustainability utility through rural digitalization reforms. According to the EU definition, social sustainability generally encompasses poverty eradication, healthcare, education, labor structure optimization, and digitalization [41]. In situ urbanization 2.0 has a significant impact on these areas.

For labor structure optimization, in situ urbanization 2.0 is significant. This phenomenon has been corroborated by the digitization of rural areas abroad [42]. Through digital infrastructure construction, new technologies are introduced and used to transform and empower the promotion of the cultivation of competitive digital agriculture industries. These new industries change the structure of the local workforce, opening up employment space for local and foreign top talent and causing them to stay in the local area. In addition, the supply of basic public services such as distance education and online training has facilitated the reproduction of local top talent. All of these measures directly change and optimize the local labor structure and achieve sustainable human resource development.

In poverty eradication, if governments enable agricultural markets to function well, supply the necessary financial and technological support, and create the necessary public infrastructure, large agricultural productivity and growth gains can be reaped [43]. In situ urbanization 2.0, as an effect of rural digitalization reform, can accelerate the upgrading of industries, help farmers become rich, and help them efficiently connect to the market. In particular, the development of rural e-commerce can help improve the solution to the information asymmetry disadvantage of traditional agricultural markets. In situ urbanization 2.0 has strongly developed local industries and increased jobs and income for local farmers, helping to further consolidate the results of poverty eradication and prevent farmers from returning to poverty.

In situ urbanization 2.0 also makes a unique contribution to healthcare and education. Digital infrastructure construction objectively reduces the cost of public services and public administration, especially healthcare and education. Currently, low-cost digital infrastructure platforms and telemedicine platforms are widely used by farmers. In addition, electronic reading rooms and libraries are widely opened to meet the differentiated educational needs of farmers.

Finally, as the most fundamental element, digitalization directly changes the overall logic of rural governance. Party construction and social security, the two most important concerns of the CCP for rural governance, have been completely transformed by digitalization. On the other hand, the traditional model has been abandoned. Currently, in rural governance, digital technology has demonstrated its disruptive nature in terms of organizational, technological, and institutional innovation. Through digital reform, rural governance undergoes practical and institutional innovation to strengthen government leadership in rural areas and to enhance the efficiency of grassroots governance.

4. Dilemmas and Risks of In Situ Urbanization 2.0

The phenomenon of in situ urbanization 2.0 at scale has forced researchers to investigate its institutional causes. Based on the theoretical framework of political economy, the institutional logic of the Chinese government's promotion of in situ urbanization 2.0 has been analyzed above from three institutional perspectives: political, economic, and social. However, a legitimate question that immediately follows is whether in situ urbanization 2.0 can be soundly developed based on the current institutional logic.

The answer is not optimistic. It is true that reformers have a strong incentive to advance digital reforms to promote in situ urbanization 2.0 for the three reasons mentioned above, but this does not mean that the institutional logic desired by reformers is thoroughly implemented in institutional designs. UN research has pointed out that as with many of China's reforms, the institutional design of in situ urbanization in China has been largely top-down and led by the central government [35]. Empirical research has shown that the top-down reform model in China has several general limitations, such as authority–responsibility distribution and fiscal dilemmas [44–47]. Political economy usually develops institutional analysis from the conceptual framework of endogenous and exogenous causes. Based on this conceptual framework, the article argues that there are *internal non-self-consistent dilemmas* and *external conflict risks* in the current in situ urbanization 2.0 regime.

4.1. The Internal Non-Self-Consistent Dilemma of In Situ Urbanization 2.0

Although the four scenarios of in situ urbanization 2.0 described above are currently seeing success, this does not mean that this process is free from dilemmas and risks. The logical starting point of the internal dilemma of digital reform is the tension between the traditional and digital systems. Based on the perspective of policy construction, the dilemmas of the transition period are a topic that must be considered. For example, in terms of the subject of promotion, are the financial and administrative powers of reformers sufficient to support reform? In terms of the target implementers, is the grassroots governance model compatible with digital reform? In terms of the content of promotion, does the specific content of digital reform meet the current requirements of in situ urbanization 2.0? These and other questions warrant specific analysis.

4.1.1. The Reformer's Dilemma: Ambiguous Authority and Responsibility and Fiscal Dependence

In the process of in situ urbanization 2.0, reformers face the twin dilemmas of fiscal dependence and ambiguous authority and responsibility. The blurring of authority and responsibility is caused by the incomplete top-level design of the system. At present, the overall planning of agricultural and rural digitalization, such as that described in the Outline of the Digital Countryside Development Strategy and Digital Countryside Construction Guide 1.0, does not provide a planning design from the top level to the bottom level, which leads to overall confusion regarding authority and responsibility. Specifically, since China's political structure is a "strip–block (Tiao–Kuai)" model [48–50], the confusion regarding authority and responsibility disrupts the "strip–block" relationship. This confusion has caused problems in both the "strip–strip" and "block–block" structures.

In the "strip–strip" structure, the confusion regarding powers and responsibilities at the top has led to a conflict between the universality and specificity of administrative

operations. The current master plans for the digitalization of agriculture and rural areas, such as the Outline of Digital Village Development Strategy, have only national guidelines and do not consider the realities of each region. In provincial development, there are varying roles of rural development within the overall development of the country. This is widely present in the context of the second part: “digitalization of the agricultural industry”. For example, in provinces on the southeastern coast and in the plains, rural areas may play the role of a major food-producing region. In contrast, in hilly provinces, rural industries may be better suited to the development of specialty agriculture, such as the forestry, fruit, and tea industries. The top-level design should empower local governments with sufficient autonomy, which can help them build digital facilities, adjust agricultural industry, digitalize basic public services, and develop rural governance and other construction based on regional characteristics. However, the current abstract and universal top-level design does not give clear authority or guidance to local governments. This issue causes problems such as an unclear development direction and ambiguous development authority for local governments, which ultimately creates many difficulties for in situ urbanization 2.0.

In the “block–block” structure, there is no comprehensive top-level plan to regulate what different levels should be responsible for in rural digitalization reform. This issue directly leads to the replication of a simple set of mechanisms at different levels of government, where the competencies of different levels of government are clear. In the “block–block” structure, the authority and responsibility of government departments and state-owned enterprises are confusing; for example, a large number of business overlaps exist. Taking the scenario of digital infrastructure construction as an example, infrastructure construction may involve overlaps in the authority and responsibility of the three major mobile communication service providers. Agricultural industry restructuring may involve dealing with numerous construction units outside the Ministry of Agriculture and Rural Development and the Ministry of Industry and Information Technology. Basic public services, on the other hand, involve at least the Ministry of Education and the Health and Wellness Commission. Rural governance, which encompasses public administration, public safety, and public services, involves almost all government departments. The existing institutional design has not succeeded in clarifying the powers and responsibilities of various departments, and the confusion that this issue has caused is obvious. The linkage and coordination mechanism among various departments is not smooth enough, and each subject is in a state of its own promotion plan, making it difficult to share basic data resources, let alone imitate construction methods.

Excessive fiscal dependence constitutes another dilemma of in situ urbanization 2.0. Fiscal dependence manifests in two ways. First, there is a lack of finances. Rural digitalization reform, as the focus of rural revitalization, is a strategic and logical part of political and economic legitimacy, but financial problems are common in practice. After the tax-sharing reform was implemented, the tax revenue of local governments was insufficient to allow large-scale rural investments. The relevant financial resources are scattered across many departments and have not yet been unified [51]. Many construction projects that require joint efforts and long-term funding, such as the digitalization of basic public services, have difficulty obtaining long-term, stable financial investment. This issue has limited the progress of rural digitalization reform to certain extent. The second is the lack of social capital. The participation of market players in government-led rural digitalization reform is insufficient. Apart from rural enterprises, the external force of rural digitalization reform is mainly the government. However, local governments can provide only limited policy and financial support. The lack of inclusion of more diverse development agents may lead to a lack of sustainability in the development of in situ urbanization 2.0. Historical experience shows that government investment cannot bring sustainable development to in situ urbanization, which is mainly seen in the lack of motivation among the public and the lack of industrial dynamism. To sustainably develop in situ urbanization 2.0, stimulating long-term, stable financial support to leverage the market’s own dynamism will be a key component of the government’s future efforts [25].

4.1.2. The Target Implementers: Incentive Deficiency and Incentive Distortion

In regulating the target actors in the in situ urbanization 2.0 process, grassroots paralysis must be overcome by reducing the cost of communication of various types of information and shortening the chain of governance. However, in practice, there are notable performance distortions and deficits at the grassroots level.

On the one hand, incentive distortion causes rural digitalization to fail to break up the information monopoly of grassroots cadres. In some critical issues, such as poverty alleviation, distorted performance incentives encourage grassroots cadres to provide false data to meet targets. This issue has led to the failure of rural digitalization to connect with the deep rural social power structure and social life production process, and rural digitalization is thus rendered as only a new municipal project. Digital technology has no realistic value for decision-making in local social governance.

On the other hand, incentive deficiency leaves local government officials with little incentive to complete rural digitalization to drive in situ urbanization 2.0. Currently, most of the reforms involving rural digitalization rely on village-rank administrators. China's "county-township-village" structure of local public service organizations suffers from a lack of financial resources as administrative rank decreases. Zhou's research (2012) found that financial allocations at the county-rank level are almost entirely used to support the salary expenditures of county-rank authorities and cannot fully cover the finances of the township-rank officials. At the village-rank level, even the base salaries of the main technical departments are not covered by current financial allocations. If village technical departments are able to perform technical services, they can be self-supporting. Otherwise, they cannot obtain sufficient financial means, even if they are working. Thus, the work of the technical departments at the local level is often paralyzed. In short, government employees at the village-rank level lack both financial and promotion incentives, which limits their motivation to efficiently promote village digitalization.

In addition, the talent support for rural digitalization reform is insufficient [52]. First, although all governments have introduced talent-attraction policies, these are implemented mostly in urban areas, and the digital talent within villages is small in number and stays only briefly. Second, at present, most of the beneficiaries of rural digitalization reform construction projects in China are local residents in the countryside who are less digitally literate and less innovative than digital professionals, and have difficulties mastering the necessary digital skills. Coupled with the problem of rural labor turnover, there is still a shortage of labor for digital rural construction.

4.1.3. The Content Dilemma: Insufficient Economic Volume and Hollowed-Out Population

The two vectors of in situ urbanization are industrial urbanization and demographic urbanization [23]. Although top government documents indicate the way forward for rural digitalization reform, the current challenges of the rural context still make it difficult to implement rural digitalization reform. Specifically, in situ urbanization 2.0 has encountered obstacles related to both industrial urbanization and demographic urbanization, which are the main impediments to successful rural digitalization reform.

First, regarding industrial urbanization, rural digitalization reform is unable to address the transition of industry in its entirety. The most prominent problem is that rural digitalization reform currently has minimal impact on primary industries. According to the data in the "White Paper on China's Digital Economy Development", the digital economy penetration rate of agriculture is only 8.9%, the lowest among all industries. Although rural digitalization reform still has an enormous effect on increasing the income of the rural agricultural population (an increase of 8.9% after the first reform [53]), the small scale of rural digitalization reform in agriculture is nevertheless undeniable. This means that a vast market space has yet to be tapped and the digitalization of the industry is far from limited at the moment. Another even more significant issue is the scale of the agricultural industry, which is hardly able to support in situ urbanization 2.0. Among all industries, the agricultural industry accounts for the smallest share of China's economy. Although

the widespread application of a new generation of digital information and communication technologies can empower the economic vitality of township regions, such empowerment cannot escape the reality that the agricultural industry itself does not carry enough weight in the market-oriented national economy. This means that digital reform relies solely on the agricultural industry and industrial urbanization is difficult to accomplish. A recent idea is to open up secondary and tertiary markets in the digital reform of the agricultural industry, but a clear plan has not yet emerged.

Second, in population urbanization, the contemporary problem of the hollowing out of the rural population creates an enormous obstacle to launching in situ urbanization 2.0. Currently, China faces the challenge of a shrinking rural population. Some Chinese scholars argue that the urban–rural dichotomy has led to a siphoning effect of cities on rural populations. Because of the way the system is set up, the factors of production in rural areas cannot obtain the same market value as those in cities, and compared to urban residents, farmers face limited access to public services [54]. Under this predicament, farmers move to cities in large numbers based on the great attraction of urban development opportunities and space, which directly breaks the social structure of rural areas and causes the hollowing-out and atomization of rural areas [21]. These problems constitute the current dilemma of in situ urbanization 2.0. The core focus of in situ urbanization 2.0 is changing the employment structure and lifestyle of the local population and attracting more people to return to rural areas. Doing so requires a sufficient population during the initial construction of rural digitalization; otherwise, the slow progress of the most basic construction will lead to a significant decrease in the efficiency of rural digitalization. Ultimately, the initial stages of in situ urbanization 2.0 are difficult.

4.2. External Conflict Risk of In Situ Urbanization 2.0

4.2.1. The Conflict between Governance Power and Individual Rights

In in situ urbanization 2.0, digital technologies have thoroughly impacted the logic of traditional governance. New governance theory radically challenges the traditional norms of individual rights [55]. Traditionally, the right to privacy, as a traditional fundamental right of the individual, was protected by the Chinese constitution. Unless specifically reserved by law, it is illegal to violate a citizen's constitutionally guaranteed fundamental rights. However, the “panoramic society” created by new methods of rural security management, such as the “Skynet Project” and the “Snow Bright Project”, which involve 24/7 monitoring with no blind spots, has a direct impact on Chinese citizens' right to privacy. (These are closely related to the expansion of the functions of the Ministry of Public Security [56]) Even more concerning is the fact that the current national video surveillance system construction is based on norms determined mostly by low-level administrative department regulations. According to Chinese law, administrative departmental regulations do not supersede the constitution; thus, these video surveillance systems are currently suspected to be illegal for use on a large scale.

In practice, the application of new technologies still brings all kinds of secondary problems. The scale of control has a negative correlation with social dynamics. Strict control would inevitably lead to a loss of vitality in economic development, technological innovation, institutional iteration, and resource utilization, while deregulation would engender negative impacts from disorderly development. Therefore, how can the scale of monitoring be weighed? In addition, the excessive use of aspects of the “Snow Bright Project”, such as the drone video surveillance of private activities in villagers' homes, is a serious violation of the basic rights of people that has grown out of digital reform. How can such breaches be regulated? Various secondary issues constitute the most serious risks of in situ urbanization 2.0.

4.2.2. The Conflict between Digital Society and Acquaintance Society

By examining practices such as precision poverty alleviation, scholars have argued that digital technology is an important way for the state to intervene and penetrate rural

areas, but the operation of digital technology often hovers above grassroots governance and rural social life. As a standardized and normative industrial technological discourse, digital technology lacks the space for flexibility in some cases. This means that technological governance that pursues policy precision may neglect village community ethics and fail to serve as a mediator between the overall discourse of state governance and local ethical discourse, instead leading to a lack of social ethics and legitimacy resources for the state governance process.

A typical example is local conflict governance. For example, new types of mediation, such as online standardized mediation and online litigation by local conflict mediation centers and “Internet and people’s mediation”, which has the potential to escape the domination of social structures, can self-generate authority and gain the trust of the parties involved precisely because of their characteristics, such as neutrality and procedural fairness. However, standardized technical governance cannot meet the needs of the audience of grassroots governance for flexible considerations such as human feelings and customs, which is precisely what the traditional Chinese model of rural governance relies on. The rural governance models currently considered to be effective, such as the Ma Xiwu dynamic trial and the Fengqiao experience, cannot be separated from the framework of moral governance, which is determined by the fundamental characteristics of China’s rural acquaintance society. Currently, rural China is still unable to completely break away from the acquaintance society framework, which creates a conflict between standardized digital governance and a resilient human society. This issue limits the further establishment of digital governance in rural areas.

5. The Future of In Situ urbanization 2.0: From Technical Reform to Institutional Adjustment

5.1. *The Limits of Digital Technology in In Situ Urbanization 2.0*

As early as the 1.0 era of digital reform, technology reform and system adjustment were key components of China’s digital reform of government affairs. Policy makers realized early on that technological reform should be promoted together with institutional reform. However, institutional reforms involve more difficulties and are slower at producing results than technical reforms are. To quickly obtain results that are close to matching expectations, it is rational to prioritize the investment of many resources in the broad area of technological reform rather than institutional reform. Therefore, technical reform is currently the main component of in situ urbanization 2.0, and institutional, organizational, and environmental factors are supporting components, while the institutional reform under this phenomenon comes into contact with only the instrumental side of the administrative system and does not fundamentally change the layout and mechanism of administrative power operation [14].

As the Department of Economic and Social Affairs of the UN initiative suggests, technology cannot solve the problems involved in in situ urbanization processes, such as poverty. Technical advances need to be made following a holistic approach in in situ urbanization [35]. Technological change is no longer sustainable for the process of in situ urbanization. There are two reasons why. First, the marginal effects of digital technology in the urbanization process have been widely demonstrated [57–59]. Based on the marginal effect of resource inputs, the current input–output ratio of technological reforms is approaching a critical point, resulting in an involution of technological reforms. This can result in ineffective in situ urbanization. Second, and most importantly, the institutional challenges of in situ urbanization 2.0 cannot be solved by technological reforms, due to the defining characteristics of in situ urbanization. In situ urbanization is a collective concept that mixes technology, policy, and other elements [35], and digital reform, a single term for describing multiple technological changes, is destined to include only some of the connotations of urbanization. Thus, while digital technology initiates the process of in situ urbanization 2.0, it is the immediate institutional adjustments that can sustainably contribute to the process of in situ urbanization 2.0.

5.2. Specific Instruments of Policy Adjustment

In responding to the above dilemmas in in situ urbanization 2.0, institutional adjustments need to be seriously considered. First, the institutional flexibility of the rural management system should be enhanced to enable an efficient enhancement of township government (Qiang Zheng Kuo Quan). In in situ urbanization 1.0, the main way in which such enhancement is achieved is through the promotion of strong towns within the administrative hierarchy. With the rise in the administrative hierarchy, powerful towns gain powers of governance that they would not otherwise have [60], such as the administrative enforcement of building violations, administrative approval of certain economic developments, and more autonomy in administrative matters. The logic inherent in this style is the CCP's traditional financial-private power matching governance, a doctrine that requires a district's administrative rank to be tied to its economic capacity [61,62]. This means that a town can be promoted to an administrative level only if it is strong enough. It is almost impossible for a commune to acquire these powers if it is weak. This empowerment mechanism does not meet the needs of the in situ urbanization 2.0 process. In in situ urbanization 2.0, the digitalization of the countryside, covering all rural areas, has rapidly brought to a large number of villages new industries that were previously available only in strong villages and towns, but it has not brought the associated governance powers to the countryside. The sluggish empowerment system has not been able to empower these villages; thus, a change in the empowerment model at the top level is one option. In the top-level design, a list of adjustments should be established and a wide range of eligible villages and towns should be empowered. In addition, a "development trigger" should be established within traditional administrative-level reform. Villages and towns that meet basic requirements related to, for example, economic size and population density, should automatically be further empowered in accordance with the "development trigger" to meet the actual needs of social governance.

Diversified financial models, such as public-private partnerships, should be more strongly encouraged to efficiently promote in situ urbanization 2.0. Specifically, these models deserve consideration. First, in the process of rural digitalization reform, the construction of infrastructure and public services, which are not profitable areas per se, requires government agencies, not investors, to bear the costs. As an appropriate solution, provincial treasuries should set up special construction funds to guarantee the adequacy of funds. Second, financial and policy support from state-owned financial institutions, such as special lending policies, should be more strongly encouraged. Third, in construction projects and public services that the government does not have to undertake, it is advisable to actively develop policies for public-private partnerships to increase the inflow channels of social capital. In addition, appropriate tax rebate policies should be considered for potential villages and towns in the process of in situ urbanization 2.0.

In agriculture, the large-scale promotion of e-commerce is a path worth considering to precisely empower agriculture in in situ urbanization 2.0. First, qualitative research points to the sweeping changes that large-scale e-commerce has brought to rural areas. These changes include increasing local incomes, restructuring production patterns, and increasing jobs, and these changes have significantly promoted in situ urbanization. Second, official data and many scholars indicate that there is great room for e-commerce development in rural areas. On the one hand, in terms of quantity, official data reveal that e-commerce in rural areas is extremely unevenly developed. Counties with less than a 50% household broadband access rate and counties with less than a 5% informatization level of agricultural production are the subject of 21.7% and 26.9% of all domestic research, respectively [63]. On the other hand, in terms of quality, e-commerce currently faces outstanding problems, such as end-transportation capacity, professional training, and imperfect service systems. These problems have directly led to the inefficient operation of rural e-commerce [15]. Therefore, in the context of rural digitalization reform, a new, targeted and large-scale rural e-commerce policy system should be established. Such a policy system should actively

expand e-commerce coverage on the one hand and guide e-commerce farmers towards entrepreneurship, specialization, and branding on the other hand.

Policies to promote the balanced supply of urban–rural public services should be set up and scaled up on a large scale in the process of in situ urbanization 2.0. The new policies should focus on two aspects. First, the public service system in villages and towns should be configured based on actual needs, taking into account the standards of urban-type public service facilities. Specifically, in the administrative system, in addition to government agencies (such as the police, business bureaus, and tax services), neighborhood committees adapted to the needs of community management should replace the original village committee system. In terms of educational facilities, in addition to improving elementary schools, a certain number of kindergartens, nurseries, and other educational institutions should be located in densely populated townships to improve the educational level of these areas. In cultural construction plans, theatres and lighted stadiums should be appropriately allocated based on the level of economic development and population. In terms of healthcare, permanent health centers (clinics, offices), family planning stations, etc., should be founded in these areas. Moreover, public services specifically needed for the development of rural agriculture should be a focus. For example, after the digital restructuring of the agricultural industry, such as the transformation of family-oriented production, the demand for public services such as training in modern agricultural techniques should be met.

6. Conclusions

Digital technologies have led to major practical and academic concerns in terms of sustainable urban planning in China. However, few scholars have focused on the impact of digital technologies on in situ urbanization from a policy-technology perspective, which is what this article is concerned with. The article argues that digital technologies have changed the development process of in situ urbanization from 1.0 to 2.0 based on four officially defined criteria: infrastructure development, agricultural industrialization, public service levels, and rural local governance, under the influence of rural digitalization policies. These changes have altered the traditional logic of in situ urbanization and revolutionized its efficiency by accelerating it. The article argues that the decapitalization and great efficiency gains generated by innovations based on digital policies constitute the key features that distinguish in situ urbanization 2.0 from 1.0. Accordingly, this paper proposes the concept of in situ urbanization 2.0 to describe this change. Historical legitimacy, performance legitimacy, and socially sustainable reproduction are three political, economic, and social reasons why rural digitalization reform has triggered in situ urbanization 2.0. Finally, this paper identifies the double limitation of the overreliance on technological reforms in the process of in situ urbanization 2.0, where there is an internal non-self-consistent dilemma and external conflict risk. Due to the limitations of digital technology, these dilemmas cannot be eradicated by technological updates. Therefore, this paper argues that an institutional change in the mode of operation of power can overcome the dilemmas faced by in situ urbanization 2.0 and it proposes some recommendations to address these issues.

This article does not consider regional characteristics, which could weaken the strength of the argument. It focuses on a holistic picture. Reform in rural areas of China, a very large country, will be greatly complex, and the focus of reform varies greatly from region to region. The intensity of reforms can also vary across regions due to differences in fiscal construction capacity. None of these phenomena are carefully considered in this paper. Furthermore, the concept of in situ urbanization 2.0 proposed in this paper has not been tested by empirical research. Thus, the concept needs further empirical research before theoretical refinement and revision can be pursued. Thus, future studies should focus on regional characteristics and conduct empirical research to test the current results.

Author Contributions: Conceptualization, W.Z. and C.Z.; methodology, W.Z. and C.Z.; resources, W.Z.; writing—original draft preparation, C.Z.; writing—review and editing, W.Z.; supervision, W.Z.; project Administration, W.Z.; funding acquisition, C.Z. and W.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the “National Key Research and Development Project of China (2021YFC3300300)”, “Shandong University Humanities and Social Sciences Innovation Team (Data Use and Data Governance Innovation in the Strategic Implementation of the Comprehensive Rule of Law)”, “urban digital security Evaluation Index System & Construction of urban digital security evaluation and monitoring database” and “Qingdao City Social Science Planning Research Project (QDSKL2201006, Study on Qingdao In-situ Urbanization 2.0 under the Threshold of Digital Urbanization Policy)”.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The authors declare no data availability statement.

Acknowledgments: The work described in this paper was jointly supported by the Shandong University Humanities and Social Sciences Innovation Team (Data Use and Data Governance Innovation in the Strategic Implementation of the Comprehensive Rule of Law).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Emphasis of digital government construction in China’s provinces in 2022 [63].

Province	Emphasis of Digital Government Construction
Beijing	Create “Trouble-free Ubiquitous ‘6 + 4’” integrated, comprehensive supervision system
Tianjin	Create a number of application demonstration scenarios, and strengthen the “Double Random, One Public” supervision
Hebei	Accelerate the standardization of administrative licensing matters and achieve full coverage of electronic licenses
Shanxi	Further promote the reform of “Separation of Operating Permits and Business Licenses”, and implement inclusive and prudent supervision over new formats and fields.
Inner Mongolia	Optimize “Government Online-offline”, start “Government Online-offline Unified Management”, deepen the “Mengsuban. Siban” service
Liaoning	Explore and carry out the reform of a beneficial enterprise policy “Enjoying without Application” and enhance the application level of “Liaoshitong”.
Jilin	Create an efficient and convenient government environment, and continue to deepen the “Separation of Licenses” and “One Code License Passing” reform
Heilongjiang	Promote the “Separation of Licenses” and “Integration of Multi-licenses” reform, and continue to improve the ease of access of market entities
Shanghai	Promote the iterative upgrade of “Government Online-Offline Shanghai”, lay out region-wide application scenarios, and accelerate the digitization of governance
Jiangsu	Deepen the “One Thing” reform, promote “Inter-provincial Government Services” ‘Wangtongban’, and promote the effective combination of market and the government service
Zhejiang	Improve the integrated intelligent public data platform and iteratively upgrade the digital reform
Anhui	Establish “Internet + Government Services” and promote “One Screen Services” reform
Fujian	Continuously optimize the online government service platform and build a good government information “One Net”
Jiangxi	Upgrade the new mode of separating front and back-end functions of “Ganfutong
Shandong	Improve the province’s integrated big data platform and build a “Paper-Proof-Free Province”
Henan	Organize provincial government services hall to promote provincial approval matters and no approval outside the hall
Hubei	Continue to promote “Efficient Service of One Thing” to achieve maximum online and local service
Hunan	Accelerate the construction of digital government and create an upgraded version of “One Thing One Time”
Guangdong	Comprehensively promote the “Digital Government 2.0” construction

Table A1. Cont.

Province	Emphasis of Digital Government Construction
Guangxi	Promote the application of “Zhiguitong” platform, deepen the “Separation of Licenses” reform
Hainan	Reinforce the concept of whole government and promote digital transformation of government
Sichuan	Promote the digitalization and convenience of public services, and create a “City Brain” and a “Government Hub”
Guizhou	Take “One cloud, One network, One platform” as a carrier to accelerate the construction of digital government
Yunnan	Continuously upgrade the integrated government services platform and “One Phone Service”
Chongqing	Promote the reform of government service matters and enhance the “Yukuaiban” efficiency
Tibet	Promote “One Network for Government Services” and “Internet +” model
Shaanxi	Achieve more government services through Government Online-offline, cross-province service, second approval seconds service
Gansu	Focus on the goal of “Leading in the Midwest, First-class in the Country” goal, accelerate the construction of a digital government welcomed by enterprises and the people.
Qinghai	Promote more government services online, online and local handling cross-province service
Ningxia	Simplify business-related permits, implement “One Permit To Operate” “Simple Cancellation
Xinjiang	Vigorously promote the construction of “Digital Government”, accelerate the construction of business environment of marketization, legalization and internationalization

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