



CHINA | TRENDS

BY INSTITUT MONTAIGNE

HOW AI WILL TRANSFORM CHINA

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INTRODUCTION

FRANÇOIS GODEMENT

China's digital and IT sector has grown so much, and become such a leading global supplier, that it has spawned images that are even larger than life: such is the case for "social credit", or pandemic contact tracing, and currently with AI.

China is clearly in the forefront, thanks in part to central decisions and market scale. It possesses unique advantages: the scale of its big data, a fast growth that favors leapfrogging and the introduction of innovation, a public that is often digital native, and the government's uncontested power to make decisions and undertake large projects. A generation of data and computer specialists has sprung up, and start-ups are helped by abundant venture capital, itself pushed ahead by the certainty that this is a sector promoted by the government. **However, China has been less impressive in developing algorithms, and slowed down in public developments** by the silos and local fragmentation of its bureaucracy. How else could hybrid giants such as Alibaba or Tencent draw the party state's ire because of the breadth and potential applications of their own data banks? It is at this point that the issue of data privacy was picked up by the government. But if one defines the leading edge by the amount and quality of R&D, the "D" for development prevails over the "R" for research. **It is social, managerial and marketing inventiveness that defines China's edge in AI applications, which is of course linked to the absence of overt social resistance and the competition among local administrators to appear at the forefront of a new wave.**

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Our three authors have focused on three cases of AI use across the board in China. The most appealing at this point is clearly educational AI, because it fits so well a stereotype on surveillance. Beyond facial (and face mood) recognition and speech recognition software, it promises a level of student monitoring that includes the tracking of brain waves. Neither Michel Foucault with his famous panopticon nor Neo-Confucian moralists could have thought

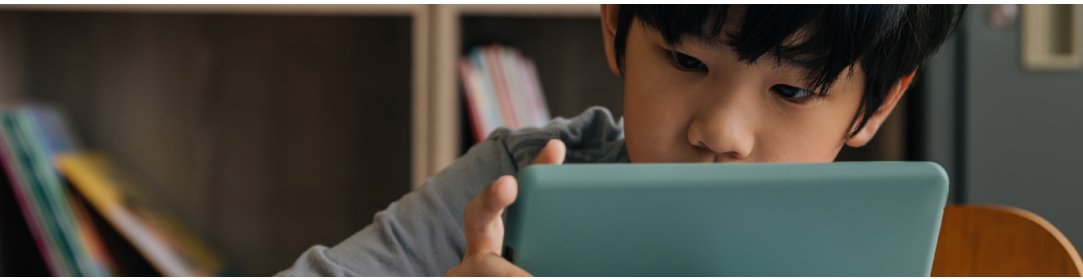
this up. The risk is clearly outlined by perceptive Chinese critics that this innovation ends up stifling innovation even more among students.

The second sector is the auto industry and autonomous driving. Fascinatingly, China is looking for solutions that spring from new collective infrastructures rather than from individual self-driving cars loaded with sensors. **While this may also be in relation to China's political culture of control, one should admit that many IT developments around the global auto industry increasingly allow the surrender of massive data to auto, telecom, and insurance companies.** China's priority to road infrastructure for autonomous driving, on the other hand, fits well with congested urban landscapes. As such, it fits well with our third test case – smart cities. China's advances there can be deduced, as is the case for smart ports, from the speed of 5G based Internet of Things (IoT) introduction. Again, China's bulldozer approach to infrastructures may pay off. As with the two other cases, **one can only wonder how much societal resistance to innovation in our own societies, often coated into the preservation of a traditional environment and the complexity of property and user rights, may be an obstacle to innovation.** But this case also hints at examples of entrepreneur hype, selling superficial AI projects to gullible city administrators.

A fitting conclusion is that any plan for AI introduction to our own societies would do well to study China's test cases – their drawbacks certainly, but also their advances.

ABOUT

China Trends seeks understanding of China from Chinese language sources. In an era where the international news cycle is often about China, having a reality check on Chinese expressions often provides for more in-depth analysis of the logic at work in policies, and needed information about policy debates where they exist. China Trends is a quarterly publication by Institut Montaigne's Asia program, with each issue focusing on a single theme.



SMART EDUCATION: BETWEEN HYPE AND REALITY

In 2019, deep learning and image recognition company Megvii, one of China's most successful Artificial Intelligence (AI) unicorns, came under fire for demonstrating a pilot monitoring software that could analyze and grade student behavior in classrooms through their expressions and body language.¹ Following a public outcry against privacy risks, the Ministry of Education (MoE) declared that the use of education apps in schools, especially those employing facial recognition, should be strictly controlled.² Megvii is far from an isolated case; since the Chinese government started rolling out plans for developing smart education (智慧教育), a host of tech companies and startups have rushed to create education technology (EdTech) products, while local governments and schools compete for the adoption of the most innovative solutions. Back in 2018, a similar system developed by security firm Hikvision for a middle school in Hangzhou had already sparked a debate regarding the necessity, accuracy, or even effectiveness of these technologies at evaluating students' performance.³

In an environment where learning takes place amid tightening political and ideological control, it seems inevitable that controversial surveillance applications are finding fertile ground.

Digital education is part of the Chinese Communist Party (CCP)'s vision to improve governance efficiency by harnessing information and communication technologies (ICT) for public service provision, thereby promoting social and economic development, and bolstering its own legitimacy.⁴ China has placed high hopes on digital technologies to fix problems in its education system, such as a consistently wide rural-urban divide and the

prevalence of traditional, teacher-centered learning methods discouraging creative thinking. Besides supporting institutional reforms, in education just as in other realms of domestic governance, digitalization should also boost the state's monitoring capabilities to safeguard social stability and regime security. In an environment where learning takes place amid tightening political and ideological control, it seems inevitable that controversial surveillance applications are finding fertile ground.⁵ This piece explores Chinese official and expert discussions on the country's flashy smart education plans and initiatives. The sources assessed reveal tensions between techno-optimism and sober assessments of the risks and limitations of technology.

Efforts to spur education informatization (教育信息化, or the integration of ICT technologies into the education system) date back to the early 2000s and gained momentum in the 2010s, with policies focused on promoting online learning and teaching to increase the quality and inclusivity of education resources.⁶ Since 2017, the government has strongly incentivized the



REBECCA
ARCESATI

Rebecca Arcesati is an Analyst at the Mercator Institute for China Studies (MERICS). Her research focuses on China's digital and technology policies and how they impact Europe. She covers digital infrastructure and the global expansion of Chinese tech firms, data and emerging tech governance issues, as well as EU-China relations in the technology and innovation spaces.

1. "AI is watching what people are doing (人在做, AI 再看)", Sina Weibo, 3 September 2019, <http://tech.sina.com.cn/csj/2019-09-03/doc-icczueu3069038.shtml>

2. Ministry of Education of the People's Republic of China, "The Ministry of Education clarifies: the introduction of 'face swiping' on campus demands caution (教育部明确: 校园引入'刷脸'应慎重)", 5 September 2019, http://www.moe.gov.cn/fbh/live/2019/51185/mtbd/201909/t20190909_398368.html

3. "'Smart management' all-round monitoring causes controversy: what kind of 'high-tech' does the classroom need?", China Education News, 5 June 2018, <https://archive.is/isPJQ>; "So the 'smart campus' started: is it a business or a problem? ('智慧校园'就这么开始了, 它是个生意, 还是个问题?)", Haoqi Ribao, 30 May 2018, <https://baijiahao.baidu.com/s?id=1601820765893936408&wfr=spider&for=pc>

4. Katja Drinhausen & John Lee, "Chapter 2: The CCP in 2021: Smart Governance, Cyber Sovereignty and Tech Supremacy", in Nis Grünberg & Claudia Wessling (eds.), "The CCP's Next Century: Expanding Economic Control, Digital Governance and National Security", MERICS Papers on China, June 2021, <https://merics.org/en/ccp-2021-smart-governance-cyber-sovereignty-and-tech-supremacy>

5. "China to add 'Xi Jinping Thought' to national curriculum", Reuters, 25 August 2021, <https://www.reuters.com/world/china/china-add-xi-jinping-thought-national-curriculum-2021-08-25/>

development and application of AI EdTech products (AI+Education, 人工智能+教育) as part of its ambitious AI innovation plan, leading to a market boom as enterprises looked to tap into the vast amounts of student data available in order to train algorithms, and China's highly competitive education culture fuels EdTech adoption.⁷ The Education Informatization 2.0 Action Plan (教育信息化2.0行动计划) and Modernization of Chinese Education 2035 (中国教育现代化2035) further spurred smart education construction, in line with the new requirements of talent cultivation and education reforms of Xi Jinping's innovation-driven development strategy.⁸ Innovation-driven development places scientific-technological innovation at the center of China's modernization and aims to improve indigenous innovation in core technologies. While the first stage of education informatization focused on applying information technology as a tool and bringing schools online, Shouxuan Yan (闫守轩) and Yun Yang (杨运), both professors at Liaoning Normal University, explain in an overview article published in English that **smart education is about revolutionizing education to increase efficiency and promote individualized learning.**⁹

During the annual Global Smart Education Conference in August, Lei Chaozi (雷朝滋), the Director of the Department of Science and Technology at MoE, said that smart education reflects the requirements of talent training in the new era and helps drive forward China's education reforms, which aim to build a high-quality education system and turn the country into an education powerhouse by 2035. **The scientific and technological revolution has changed people's demands for education: from standardized and supply-driven curriculum education to ubiquitous, flexible, and personalized lifelong education** (从标准化的、供给驱动的学校教育, 变为更加泛在灵活的、满足个性化需求的终身教育). China faces the challenge of promoting the high-quality and balanced development of education while considering both large-scale education and personalized training (如何促进教育高质量发展均衡, 如何兼顾规模化教育与个性化培养).¹⁰

China is therefore moving from digital to smart education, or the advanced stage of education informatization. Liu Bangqi (刘邦奇), a professor in the College of Education at Capital Normal University in Beijing and Executive Dean of iFlyTek's Educational Technology Research Institute, confirms this trend. Last year, Liu co-edited the "China Smart Education Development Report" for the State Key Laboratory of Cognitive Intelligence, which was built by iFlyTek, China's champion in speech recognition technology.¹¹ Like many other commentaries on the subject, his article credits American technology company IBM for introducing the concept of smart education, which is unsurprising given how heavily IBM influenced the Chinese thinking on smart cities. Liu emphasizes personalized and individualized learning as the goal of smart education, requiring the transformation of classrooms into perceptive learning environments through the integration of the Internet, cloud computing, big data, and AI. **In such an environment, big data should make teaching and evaluation rigorously evidence-based, and classroom decision-making scientific (科学决策).**¹² The reference matters, as scientific decision-making is a tenet of Xi Jinping's thought on effective social and economic governance. The party-state strives to improve governance and monitoring capabilities through harnessing data and emerging technologies.¹³

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6. Ministry of Education of the People's Republic of China, "Notice of the Ministry of Education on the issuance of the 'Ten-Year Development Plan for Education Informatization (2011-2020)' (教育部关于印发《教育信息化十年发展规划(2011-2020)》的通知)", 13 March 2012, <https://archive.is/Gqcih>

7. Liu Yi-Ling, "The Future of the Classroom? China's experience of AI in education", in NESTA, "The AI Powered State: China's approach to public sector innovation", May 2020, pp. 27-33, https://media.nesta.org.uk/documents/Nesta_TheAIPoweredState_2020.pdf

8. Yan Shouxuan & Yang Yun, "Education Informatization 2.0 in China: Motivation, Framework, and Vision", ECNU Review of Education 2021, Vol. 4(2) 410-428, <https://journals.sagepub.com/doi/full/10.1177/2096531120944929>

9. Ibid.

10. "Lei Chaozi: enhancing the realm of smart education and leading the future development of education (雷朝滋: 提升智慧教育境界, 引领未来教育发展)", China Education News Web, 19 August 2021, <https://archive.is/uAE96>

11. "The first of its kind in China! 'China Smart Education Development Report' was released (国内首部!《中国智能教育发展报告》重磅发布)", China Daily, 1 September 2020, <https://ex.chinadaily.com.cn/exchange/partners/82/rss/channel/cn/columns/sz8srm/stories/WS5f4dbef9a3100849784226b5.html>

12. "Smart education: educational reform and transformation in the new era (智慧教育: 新时代的教育变革与转型)", sohu.com, 18 February 2021, https://m.sohu.com/a/451328404_678524?ivk_sa=1024320u

13. "Scientific decision-making is the linchpin of solving practical problems (科学决策是解决实际问题的关键一环)", dangjian.people.com.cn, 2 January 2021, <https://archive.is/FDNM8>; "Relying on digital technology to improve scientific decision-making capabilities (依托数字技术提高科学决策能力)", qstheory.cn, 13 November 2020, <https://archive.is/rrY2j>

Speaking at an EdTech conference last November, Wang Tao (王涛, not to be mistaken with the Vice-President of Tencent Education) offered a similar perspective. Wang is affiliated with Tsinghua University's Wuxi Research Institute of Applied Technologies and the MOE-China Mobile Joint Laboratory for Mobile Learning, in addition to having founded an EdTech company. He coined the concept of "Internet of Rooms" (室联网), which envisages the full interconnection and integration ("全联通"、"全融合") between each element of the learning environment through new technologies. **The ambition is to create a radically new education ecology (教育生态) where teaching and learning become ubiquitous, expanding from the classroom to the whole of society, into people's homes and community venues.**¹⁴

Wang's vision ties nicely with the government's push for smart education as a component of a smart society (智慧社会), a concept which has a section of China's 14th Five-Year Plan devoted to it.¹⁵ It refers to the ubiquitous adoption of next-generation information technologies, such as AI, cloud computing, and 5G, to improve the quality and inclusivity of public services, as well as the party-state's social management (社会治理) capabilities.¹⁶ Preventing risks to social stability through constant monitoring is a key part of that vision. Therefore, the emergence of an entire industry that develops tools for monitoring students, from facial recognition cameras to headbands tracking attention levels, is hardly surprising.¹⁷

Despite the general enthusiasm surrounding EdTech adoption, China's smart education push needs to confront mounting risks for ethical, safety, privacy, and data security. Lei Chaozi cautions that **emerging technologies bring about new challenges, ranging from application biases caused by black box algorithms ("算法黑箱" 造成的应用偏差) to negative effects on young people's physical and mental health, privacy violations, and commercial motives in EdTech products and services taking control of teachers and students (教育产品和服务中的商业意图对师生的挟持).**¹⁸ Undoubtedly, the MOE is aware that emerging technologies, when mismanaged, can carry significant social risks. Notably, concerns over private sector interests overtaking educational considerations played a role in the recent government crackdown on private EdTech and tutoring companies, which the authorities view as a rip off for parents which also exacerbates social inequalities.¹⁹

Digital and smart technologies are merely replacing human teachers in forcefully feeding information into students' minds.

(把原来的 '人灌' 变成了现在的 '电灌' 和 '智灌'), affirms the Deputy Director of the Future School Laboratory at the Chinese Academy of Educational Sciences, Cao Peijie (曹培杰).²⁰ Cao makes a similar argument in a recent commentary where he urges teachers to understand the technologies they are using and their pedagogical potential, rather than treating them as technical equipment; in his view, the latter approach only reinforces a tendency to indoctrinate students.²¹

Interviewed on the sidelines of an EdTech expo, some Chinese experts weighed in on the promises and pitfalls of the array of solutions (解决方案) tech firms have developed amid the Internet+Education (互联网+教育) and AI+Education booms. In some cases, digital and smart technologies are merely replacing human teachers in forcefully feeding information into students' minds

14. "Wang Tao: expanding the new theory of "Internet of Rooms" education, constructing a new ecology where daily life and learning are intertwined (王涛: 拓展"室联网"教育新理论, 构建"生活即学习"新生态)", *Guodu Zhiku*, 30 November 2020, <https://archive.is/vK6SI>

15. The State Council of the People's Republic of China, "Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and Long-Term Targets for 2035 of the People's Republic of China (中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要)", *Xinhua News Agency*, 13 March 2021, http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

16. "The beautiful vision of smart society (智慧社会的美好愿景)", *People's Daily*, 2 December 2018, http://www.cac.gov.cn/2018-12/02/c_1123794825.htm

17. "Firm denies using AI headband to monitor students", *Global Times*, 31 October 2019, <https://www.globaltimes.cn/content/1168640.shtml>

18. "Lei Chaozi: enhancing the realm of smart education and leading the future development of education (雷朝滋: 提升智慧教育境界, 引领未来教育发展)", *China Education News Web*, 19 August 2021, <https://archive.is/uAE96>

19. Shen Lu, "China's edtech crackdown isn't what you think. Here's why", *Protocol*, 31 July 2021, <https://www.protocol.com/china/china-edtech-crackdown-education-inequality>

20. "Facing the future, how to transition towards "smart education" (面向未来, 智慧教育如何"转轨")", *Education INFO*, 6 May 2021, https://www.edu.cn/xhx/zyyy/zxhy/202105/t20210506_2105776.shtml

21. "In the future teachers must be technology savvy, know how to apply it and be good at innovation (曹培杰: 未来教师要懂技术、会应用、善创新)", *China Education Network*, 8 September 2021, <https://archive.is/3g932>

Zhang Sheng (张生), Director of the Internet Platform Department at the MOE's Collaborative Innovation Center of Assessment for Basic Education Quality, agrees with Cao. He urges a **return to the essence of educating people (回归育人本质)**, where the experience of students, parents, and teachers should be the yardstick to judge EdTech's effectiveness. School managers have a key role to play. For Zhang, many managers blindly adopt new technologies, thinking that putting up a few smart cameras and placing an 'AI' label on top (放上几个智能摄像头和贴上人工智能的标签) is enough to modernize education. The two experts concur that the rule of law must be strengthened, and relevant laws and regulations established, to prevent data leakage and privacy infringements and ensure that technology is not misused while limiting its negative impacts (确保技术不被滥用、限制技术的负面影响.)

No matter how advanced the technology, Cao and Zhang believe that there can be no true educational reform unless teaching and learning methods change. These remarks are a reminder that **China's smart education plans must come to terms with the reality of the education system and its enduring weaknesses and contradictions, which technology may exacerbate rather than fix.** Given that ideological indoctrination and school surveillance are key parts of the party-state's vision for education in Xi Jinping's China, school managers and teachers have clear incentives to use EdTech for those purposes.²² Another problem is the gap between urban and rural areas. China made early investments in ICT adoption to improve universal access to educational resources, for example by promoting computer-assisted learning to connect rural students to qualified teachers.²³ "Let hundreds of millions of children share high-quality education under the blue sky," Chinese President Xi Jinping once said at a conference on education informatization.²⁴ Internet penetration in rural areas in China rose from 36.5 percent in 2018 to 59.2 percent in June 2021, according to official government figures.²⁵ Yet, coverage remains significantly lower compared to urban areas. Other factors, such as poor signal or socioeconomic barriers, also prevent many rural residents from using the internet.²⁶

In response to the Covid-19 outbreak, online schooling surged as per the government's encouragement to confront the disruptions caused to the education system. The number of online education users in China was estimated to increase by 62 percent last year, to 420 million.²⁷ According to Zhang Wenwen (张雯雯), from South China Agricultural University, and Zhong Jingxun (钟景迅), from South China Normal University, **the one-size-fits-all (一刀切) approach to online learning in primary and secondary schools exacerbated the educational gap between rural and urban areas.** The former's ICT infrastructure is lagging, and students and teachers have fewer resources and skills to adjust to live-streamed education.²⁸ Wang Tao similarly points to some of the technical and operational challenges China is facing in implementing its smart education plans. The surge in online education following the health crisis has led to an inflection point in education informatization, exposing the urgency

The surge in online education following the health crisis has led to an inflection point in education informatization, exposing the urgency to improve and standardize the underlying infrastructure to better integrate online and offline classrooms.

22. A 2018 policy document calls on using AI to "monitor the teaching process, analyze students and assess their academic work," "set up comprehensive, multi-dimensional, smart assessments based on big data," and "accurately evaluate both teacher and student performance." Ministry of Education of the People's Republic of China (2018), "Notice of the Ministry of Education on the Issuance of the 'AI Innovation Action Plan for Higher Education Institutions'" (教育部关于印发《高等学校人工智能创新行动计划的通知》), 3 April, http://www.moe.gov.cn/srcsite/A16/s7062/201804/t20180410_332722.html

23. Nicola Bianchi et al., "The Effect of Computer-Assisted Learning on Students' Long-Term Development", available at SSRN, 30 November 2020, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3309169

24. "Xi Jinping sends a letter to congratulate the opening of the International Education Informatization Conference: Let hundreds of millions of children share high-quality education under a blue sky (习近平致信祝贺国际教育信息化大会开幕让亿万孩子同在蓝天下共享优质教育)", *Zhongguo Jiaoyu Bao*, 25 May 2015, http://www.moe.gov.cn/jyb_xwfb/s5147/201505/t20150525_188463.html

25. China Internet Network Information Center, "The 48th Statistical Report on the state of China's Internet Development (第48次中国互联网络发展状况统计报告)", August 2021, <https://www.cnnic.net.cn/hlwfzyj/hlwzbg/hlwjbg/202109/P020210915523670981527.pdf>

26. "The 4G coverage rate has reached 98%, so why are people struggling to find a good connection for attending online classes? (4G覆盖率达98%, 上网课为何还在找信号?)", *cppcc.china.com.cn*, 24 March 2020, http://www.china.com.cn/txt/2020-03/24/content_75851892.htm

27. "Covid-19 outbreak was a boon for China's online education, e-commerce and social networking, China Internet Report finds", *South China Morning Post*, 23 August 2021, <https://www.scmp.com/business/companies/article/3145913/covid-19-outbreak-was-boon-chinas-online-education-e-commerce-and>

28. "In the context of the epidemic, how to get online education in rural primary and secondary schools right (疫情之下, 农村中小学在线教育怎样做才好)", *The Paper*, 7 March 2021, <https://archive.is/fk8K1#selection-1897.0-1897.19>

to improve and standardize the underlying infrastructure to better integrate online and offline classrooms. Major bottlenecks remain, such as the lack of industrial standards for EdTech equipment and teachers' limited informatization literacy.²⁹

In sum, China's smart education push continues to be accompanied by lively discussions about EdTech's promises and pitfalls. The integration of emerging technologies into the education system proceeds, with "smart" classrooms and campuses emerging across the country and new "smart education demonstration zones" (智慧教育示范区) being approved.³⁰ Against this backdrop, the mainstream techno-optimism, encouraged by the highest levels of leadership and shared by many education experts, finds a counterbalance in voices that point to the risks and limitations of smart education. This complex debate is not unique to China, and we can expect it to continue well beyond the Covid-19 pandemic.

²⁹. "Wang Tao: expanding the new theory of "Internet of Rooms" education, constructing a new ecology where daily life and learning are intertwined (王涛: 拓展"互联网"教育新理论, 构建"生活即学习"新生态)", *Guodu Zhiku*, 30 November 2020, <https://archive.is/vK6SI>

³⁰. "Smart Education Demonstration Zones: a pioneering exploration", *China Education News*, 17 March 2021, https://www.sohu.com/a/455974975_243614

OVERRIDING THE RISKS OF SMART TRANSPORTATION

"To get rich, build roads first (要想富, 先修路)". The old Chinese saying, quoted by Xi Jinping in an article published in *Qiushi*, emphasizes the importance of transportation infrastructure for economic development.³¹ Road building has also been a major component of China's infrastructure projects abroad before the BRI was even conceived.³²

But in China, the rapid urbanization has led to an increasingly severe problem of traffic congestion.³³ To address a problem crucial to air quality and life quality in general, China has embarked on the journey of "smartening" its transportation system – a project of strategic importance. An inefficient transportation system is not only an obstacle to urban development (城市顽疾), it is also harmful to the economy as a whole. **The annual economic loss caused by traffic congestion in China is put at USD 39 billion (RMB 250 billion).**³⁴ It is therefore imperative to have a transportation system that is better planned and more flexible. Chinese official documents stress the goal of becoming a "strong transportation country" (交通强国).³⁵ They encourage efforts in advancing smart transportation (智慧交通) projects, so that "people enjoy their travels and goods are transported efficiently (人享其行、物优其流)".

Smart transportation is also a major component in the construction of smart cities. It aims to include system planning, facility construction, demand management, operation regulation and control, and transportation services. As a result, **it must upgrade urban operation efficiency, enhance road traffic safety, improve the quality of life of residents, save energy and reduce emissions, etc.** According to the China Intelligent Transportation Systems Association (中国智能交通协会), from 2011 to 2020, the total size of China's smart transportation market grew from USD 6.6 billion (RMB 42 billion) to USD 25.9 billion (RMB 165.8 billion).³⁶ The industry is expected to continue thriving in the coming years.³⁷

Autonomous driving, a case in point, shows how different components of smart transportation are highly dependent on an overall smart transportation ecosystem to enable it.

"capable" (智)而不"能". Autonomous driving not only requires "smart cars". It also needs "smart roads".³⁸

While the market grows and investment increases, some smart transportation projects fail to meet original expectations due to the lack of a comprehensive view and blueprint. Autonomous driving, a case in point, shows how different components of smart transportation are highly dependent on an overall smart transportation ecosystem to enable it. One missing component might cause the system to malfunction and make it "smart" but not



VIVIANA ZHU

Viviana Zhu is the Policy Officer for Institut Montaigne's Asia Program. She became the editor of the Institute's quarterly publication, *China Trends*, in March 2020. Before joining Institut Montaigne in January 2019, Viviana worked as Coordinator of the Asia Program of the European Council on Foreign Relations (ECFR). She holds a Master's degree in International Politics and a Bachelor's degree in Politics and Economics from the School of Oriental and African Studies (SOAS), University of London, where her primary focus was China and international politics.

31. "Strive to progress from a large transportation country to a strong transportation country (奋力从交通大国向交通强国迈进)", *Qiushi*, 15 October 2017, <http://archive.today/JxCre>

32. Jonathan Holslag, China's Roads to Influence. *Asian Survey* 1 August 2010; 50 (4): 641–662. doi: <https://doi.org/10.1525/as.2010.50.4.641>

33. "Analysis of the current market situation and development prospects of China's smart transportation industry in 2020 - The market will maintain high growth in the next five years (2020年中国智慧交通行业市场现状及发展前景分析 未来五年市场将保持高速增长)", *Guan Bang Fund*, 10 October 2021, <http://archive.today/053Ed>

34. Zhou Jiagao, "How much do you know about the losses from traffic congestion in China? (中国交通拥堵损失知多少?)", 6 September 2021, <http://archive.today/mCajb>

There are currently two paths to achieve autonomous driving: the traditional vehicle-only (单车智能) autonomous driving approach and V2X (vehicle-to-everything, 车路协同) autonomous driving approach. The former mainly operates and makes decisions based on its own sensors and calculations, while the latter relies on road-based infrastructure to decrease the actual technical requirements of the vehicle itself. During a forum in Shanghai, Chinese stakeholders noted that the first solution is not realistic.

Such assessment is based on several observations. So far, the cost of the traditional, car-only approach has remained high. Therefore, relying on the information provided by other infrastructures to assist driving is not only safer, but also more economical.³⁹ In addition, although a People's Daily article notes that China is leading in the areas such as autonomous driving and connected cars thanks to the early application of big data, 5G, AI and so on, it also recognizes that China is lagging behind on software and hardware that collect, perceive and analyze traffic information. **Focusing solely on the improvement of automated vehicles to counter such weaknesses is unwise, given the strength China already developed in other areas that can feed into autonomous driving.**⁴⁰ As the planning and construction of roads and other infrastructures remain controlled by government authorities, policy makers can easily pull the resources together to create a fully connected environment for V2X autonomous driving. That is why it is often emphasized that smart transportation is a major component in the construction of smart cities.

As the planning and construction of roads and other infrastructures remain controlled by government authorities, policy makers can easily pull the resources together to create a fully connected environment for V2X autonomous driving.

The analysis is echoed by a recent article published by China Automotive News. It notes that from policy makers to industry players, **China's domestic autonomous driving industry is increasingly paying attention to V2X, which have the advantages of higher safety, stronger cost-effectiveness, and leading 5G technology application, making it the best choice to meet actual road traffic situation in China (符合中国道路交通实际情况的不二之选).**⁴¹ There is also less resistance from the public transportation authorities when asked to contribute to the establishment of a coordination system as it also fits into other government priorities. Ran Bin, Director of the Working Committee on Automated Driving at China Highway and Transportation Society, breaks down V2X into four stages: cooperative perception (协同感知), cooperative decision-making (协同决策), cooperative control (协同控制) and vehicle-road integration (车路一体). He notes that up to now, the domestic V2X is still in the first stage.⁴²

While being praised for its advantages and benefits, smart transportation also brings along new concerns and risks. Zhao Pengjun and Zhu Junyi, both from the College of Urban and Environmental Sciences at Peking University, note that while providing convenience for users, the high-precision real-time monitoring and control system of smart transportation also has many hidden dangers.⁴³ He adds that **real-time positioning, tracking, video surveillance, face recognition technology, etc. all expose users to unknown risks, and this high-precision information will seriously endanger public security if they**

35. <http://archive.today/P73i1>

36. Wang Fei, "Smart transportation accompanying the development of autonomous driving (智慧交通护航自动驾驶)", *Economic Information Daily*, 11 June 2021, [html http://archive.today/QVXkJ](http://archive.today/QVXkJ)

37. "Analysis of the current market situation and development prospects of China's smart transportation industry in 2020 - The market will maintain high growth in the next five years (2020年中国智慧交通行业市场现状及发展前景分析 未来五年市场将保持高速增长)", *Guan Bang Fund*, 10 October 2021, <http://archive.today/053Ed>

38. Yu Sinan, "The development of smart transportation, avoiding falling into the trap of 'smart' but not 'capable' (发展智能交通, 要避免'智'而'不能')", *People's Daily*, 2 August 2021, <http://archive.today/pbi8s>

39. "China's autonomous driving enters a strategic opportunity period, how to overcome the data gap with foreign giants (中国自动驾驶进入战略机遇期, 如何克服同国外巨头的的数据差距)", *Guancha*, 29 September 2021, <http://archive.today/n625B>

40. Ibid.

41. "From vehicle-only autonomous driving to V2X, the Chinese way towards autonomous driving (从单车智能到车路协同, 自动驾驶中国方案的用兵之道)", *China Automotive News*, 12 September 2021, <http://archive.today/ivTFp>

42. Ibid.

43. Zhao Pengjun & Zhu Junyi, "The Development and Challenges of Smart Mobility (智慧交通的发展现状及其所面临的挑战)", *Contemporary Architecture*, 2020 No. 12, <http://archive.today/LfrDK>

are maliciously used. In recent years, there has been an international wave of social thinking against AI-led smart technologies. People have begun to doubt whether smart technologies can be relied on and trusted. Moreover, the normal operation of smart connected cars will involve diverse data such as road, traffic, personal and behavioral data. Only by gaining public trust and achieving public oversight will the development of the smart connected car industry have a stable foundation. To address the issue, for instance, China issued "Provisions on the Management of Automobile Data Security (for Trial Implementation) 汽车数据安全管理办法(试行)" in August 2021, which targeted the emerging industry of smart connected vehicles. Some other regulations focusing on the wider data and personal information domain have also been issued or are undergoing reviews, but there is still a long way to go.

China is not the only country encountering such challenges. Privacy, the use of AI and data governance elicit public debates in all countries undergoing digital transformation. These debates go beyond the automotive and transportation sector. As other countries are also actively working on mitigation measures and solutions, Li Xiaodong, Director of Center for Internet Governance at Tsinghua University, emphasizes that China should not "work behind closed doors (闭门造车)".⁴⁴ He adds that the development of data governance rules, including the ones involving auto data, needs to take into account international spillover effects and to be able to align with international standards. Therefore, China needs to embrace international cooperation.

Although there are some attempts to promote global data governance, the general trend in the domain goes towards "divide and conquer (分而治之)".

attempts to promote global data governance, the general trend in the domain goes towards "divide and conquer (分而治之)". As the global digital transformation accelerates and the volume of data continues to expand, the discussion around the concept of "data security" has moved from the initial focus on "personal privacy" and "corporate secrets" to "national security". The autonomous driving and smart transportation race is also a data and power race.

China seems to be moving at full speed towards digitalization and "smartening". The number of pilot projects keeps increasing, covering almost the whole spectrum of economic activity: smart transportation, smart logistics, smart energy, smart medical care, smart agriculture... Their developments are highly interconnected and often overlap, although they fall under different categories of government priorities and plans. While lagging behind in certain technologies, which Chinese experts openly admit, it appears that China's smart transportation and autonomous driving industry will be able to play with an advantage of scale. Chinese analysts also tend to argue that there is a Chinese superiority in terms of governance efficiency. Risks are also acknowledged, but overridden by the benefits if managed accordingly. In the words of Zhao Pengjun and Zhu Junyi, smart transportation should not be given up just because there is a fear of risks (因噎废食).

However, data governance standard setting is a field of international power competition and an inevitable reality. Nan Yang, Assistant Researcher, Institute of American Studies at Chinese Academy of Social Sciences, notes that **with the new technological revolution, acquiring and interpreting data is widely seen as an important way to achieve the "power of control" in international politics.**⁴⁵ Although there are some

44. "Where does data governance for smart connected vehicles go from here? (智能网联汽车数据治理何去何从)", *Fuxi Institution*, 10 June 2021, <http://archive.today/gQbtQ>

45. Yang Nan, "The Prospects of the Great Power «Data Wars» and Global Data Governance (大国“数据战”与全球数据治理的前景)", *Social Science*, 2021 No. 7, <https://archive.ph/NtpTH>



SMART WINDOW DRESSING FOR CHINA'S URBAN LIFE

At the end of 2020, Chinese scholars claimed that more than 600 "Smart City projects" were under construction across the country.⁴⁶ In 2018, this number was lower than 400.⁴⁷ Smart city frenzy in China is not a new phenomenon, with preliminary considerations originating around 2008.⁴⁸ However, as the pandemic further revealed the reliance on information and communication

Smart city frenzy in China is not a new phenomenon, with preliminary considerations originating around 2008.

technology (ICT) for both economic and social activities, **Chinese government planners and local officials are rushing to become the most advanced country in terms of "smart cities"**. This piece delves into China's smart cities drive, starting from policy papers and planners' conceptualization to the materialization of these projects.

In 2013, the Ministry of Housing and Urban-Rural Development released pilot programs for local trials. Smart city construction is also an objective of the 14th Five Year Plan, and an important component of the country's "new type of urbanization plans".⁴⁹ In the last three years, smart city planning, and construction became subject to increasing standardization. As of mid-September 2021, the national standard database includes 84 drafts related to smart city standard building, ranging from sensor networks building to maturity level assessment.⁵⁰

"Smart cities are the future of economy and governance"

"Smart city" projects include different realities, ranging from "smart community" to "smart waste collection projects" or "smart parking area". **A "traditional" definition of smart cities insists on the safety components of smart cities.**⁵¹ For instance, Qiu Baoxing,⁵² Counselor of the State Council, sums up the main functions of a smart city in four "pillars" (四梁):⁵³ "grid management digitalization, government internet website, city security, and resource sharing." Such a model puts a more important emphasis on city security and management, although it is not limited to the aforementioned pillars.

However, other Chinese research papers go beyond the security aspect. Yang Xueshan, Former Deputy Minister of the Ministry of Industry and Information Technology, considers a smart city as *"the path of modernization and information development of the city, the process of combining information technology and government management, business operation, social services, and citizen's life."*⁵⁴ More generally, **Chinese scholars consider "smart cities" as a logical application of the new economic thinking around the digital economy.**⁵⁵ Such thinking is best summarized by Huang Yiping, Deputy Dean of the National School of Development of Peking University.



**PIERRE
SEL**

Pierre Sel graduated from Sciences Po in International Relations. His research focuses on the social credit system, e-government and new information and communications technologies (ICT) in China. He has worked at the French Embassy in Beijing and IRSEM, the Strategic Research Institute of the French Defense Ministry. He is the co-founder of EastIsRed, a French research-service company focusing on China.

⁴⁶ Ding, Zhaowei, "Cities racing to change tracks, smart cities become the main (battleground)" (城市竞速换赛道, 智慧城市成主场), *CPS*, 23 August 2021, <http://smartcity.cps.com.cn/article/202108/940051.html>

⁴⁷ Ekman, Alice "China's Smart Cities: The New Geopolitical Battleground", *Études de l'Ifri*, Ifri, December 2019, <https://www.ifri.org/en/publications/etudes-de-lifri/chinas-smart-cities-new-geopolitical-battleground>

⁴⁸ Shan, Zhiguang - "Smart cities during the epidemic era - Insights on smart cities construction" (疫情时代的智慧城市-智慧城市建设启示录), *National Information Centre*, 15 June 2021 <https://mp.weixin.qq.com/s/tWg7BNV7QHRc9Si0tlmJQ>

⁴⁹ Wu Zhigang et al., "2021 Smart City Development Level Survey and Assessment Report (2021年智慧城市发展水平)", *China Software Evaluation Center*, 19 July 2021, <https://www.smartcity.team/reports/2021年智慧城市发展水平调查评估报告/>

⁵⁰ National Public Service Platform for Standards Information 全国标准信息公共服务平台, <http://std.sam.gov.cn/search/std?tid=&q=%E6%99%BA%E6%85%A7%E5%9F%8E%E5%B8%82>

⁵¹ Ekman, op, cit.

⁵² Qiu Baoxing, Counselor of the State Council, Chairman of the China Society for Urban Science Research, former Vice Minister of the Ministry of Housing and Urban-Rural Development, and a member of the China Regional Economy Forum of 50.

He argues that, in the wider context of digitalization of the economy, smart cities are at the intersection of the Chinese government push for “new (ICT) infrastructures” (ie. data centers, 5G and telecommunication networks); strategies for leveraging and valorizing big data;⁵⁶ the fourth industrial revolution, etc.

A tempting market for tech companies

According to the “White Paper on Digital Twin City” released in 2020, the total market size could reach EUR 17.10 billion in 2023.⁵⁷ These contracts often entail different “packages”. Parts of the contracts go for sensor providers, connectivity specialists, infrastructure specialists, data visualization companies, etc.⁵⁸ Therefore, it is rare that one company can apply for the whole contract, and therefore the subcontracting model is prevalent.

Industry heavyweights like Tencent, Alibaba, or Huawei have obvious advantages as they master many of the key expertise, in particular cloud and computing power, data analytics, and management. According to industry blogger Zhang Xinfang, **Baidu, Alibaba, Tencent, and Huawei landed 117 “smart city projects” between 2015 and 2020, valuating more than EUR 1.29 Bn.**⁵⁹ Among them, more than half went to Alibaba (68), followed by Tencent (33), and Huawei (11). However, Huawei managed to acquire the most value from these tenders; earning EUR 505 million from the 11 projects, relatively more than Tencent (EUR 455M), and Alibaba (EUR 309M). Besides the major companies, others are also competing in the smart city market. Telecom providers (China Mobile, China Telecom, and China Unicom) and surveillance (Dahua, Hikvision) are also solutions providers, built upon a decade of managing complex networks and important volumes of data.⁶⁰

Smart city construction – emblematic case studies

Ningbo is often quoted as a successful smart city implementation case study. Ningbo smart city construction plans also trace back to 2010, with an early implementation plan published in 2011.⁶¹ In a 2018 report, the municipal economic and digitalization committee describes the achievements realized with the help of Tencent in smart city construction.⁶² However, **most of the achievements listed in the report are “e-government” or “e-service” related projects, such as a “one-stop city service app” aimed to better serve citizens’ need for administrative procedures.**

At the core of the realization is the establishment of a Municipal Data Management department that oversees the construction of the databases on the management of data and a large swath of the smart city construction. The first step is infrastructure: broadband access, 5G base station, and Wi-Fi coverage for the connectivity part, and data center centers for storage and computing capacities.⁶³ Another typical example is the “Digital health service” platform which simplifies appointment taking on medical dossier digitalization”.⁶⁴ Similarly, Ningbo municipal council built a platform for education and court services. Another platform deals with transportation systems which includes the integration of transit information data and apps.⁶⁵ These projects might appear very “common”, but they constitute the basic

Smart cities are at the intersection of the Chinese government push for “new (ICT) infrastructures” (ie. data centers, 5G and telecommunication networks); strategies for leveraging and valorizing big data; the fourth industrial revolution, etc.

53. Chou Baoxing, “Design Points of the Basic Framework of Smart City Information System (智慧城市信息系统基本框架的设计要点)”, *The Paper*, 8 August 2021, https://www.thepaper.cn/newsDetail_forward_13955011

54. Ibid.

55. Huang Yiping, “Digital Economy, Smart Cities, Third Wave of Globalization (数字经济、智慧城市、第三波全球化)”, *Ai sixiang*, 23 August 2020, <http://www.aisixiang.com/data/122602.html>

56. Thinking embodied in the qualification of data as a factor of production (2021), the 2020 Big Data white paper and the experimentations around data markets.

57. Yu Xiaohui, Hu Jianbo and Wang Aihua, “Digital Twin Cities White Paper (数字孪生城市白皮书)”, *China Academy of Information and Communications Technology*, Beijing, 17 December 2020, http://m.caict.ac.cn/yjcg/202012/t20201217_366332.html

58. Wang Deqing, “Policy ‘bombing’, the battle for smart cities in 2021, has begun (政策轰炸，2021年的智慧城市争夺战，打响了吗?)”, *Leifeng wang*, 6 January 2021, https://mp.weixin.qq.com/s?__biz=MTM2ODM00-DYyMQ==&mid=2651497088&idx=1&sn=d642ce4e-b6029fc75f4d051f4cdd6a31&ch-ksm=624ea22255392b347ee2e2e9e3ab02d5e5467be-988dbbd4387928199bbb7979cf5aad7b4845c#rd

59. Zhang, Xinfang, “Smart city and city brain market analysis, who can win: Ali, Tencent and Huawei?” (智慧城市和城市大脑市场分析，阿里、腾讯、华为谁能胜出?), *Qianjia*, 2 March, 2020, http://www.qianjia.com/zhike/html/2020-03/2_20255.html#sm=624ea22255392b347ee2e2e9e3ab02d5e5467be-988dbbd4387928199bbb7979cf5aad7b4845c#rd

60. Ding, Zhaowei, “Cities racing to change tracks, smart cities become the main (battleground)” (城市竞速换赛道，智慧城市成主场), *CPS*, 23 August 2021, <http://smartcity.cps.com.cn/article/202108/940051.html>

61. Dai Yun “Special Session on Government Affairs: The Practice of New Types of Smart City Construction in Ningbo (政务专场：新型智慧城市建设的宁波实践)”, *Ningbo City Economic and Information Technology Commission*, May 2018, <https://main.qclouding.com/raw/f37ce0ecba9619e099d867dcfa5a035f/政务专场：新型智慧城市建设的宁波实践.pdf>

62. Ibid.

63. Ibid, slide n°7.

64. Ibid, slide n°9.

65. Ibid, slide n°12.

elements of smart city construction: data digitalization, labeling, and management, database construction, and operation.⁶⁶

66. Note that these projects are often supervised by "one department": the municipal health department overseeing the health information, etc.

Infrastructure building and data processing are the most complex tasks of smart city building. According to a corporate presentation, ZTE charged approximately EUR 65 million for a provincial cloud in Hunan, which includes infrastructure and data management (see slide n. 1 in the annex). In the case of the "Integrated Information System for Grassroots Social Service Management" in Ningbo, it amounts to proper data formatting and building protocols for efficient data exchanges between administrative departments. Such an undertaking is nonetheless very complicated, as it involves building information systems for different districts, all of which with their distinctive local data infrastructure (their databases as well as collections and classification mechanisms).⁶⁷ As a result, it is still difficult to understand the true impact of these programs. It is interesting to note that **local governments seem to be aware of the shortcomings, and efforts are under way to make better use of data.**⁶⁸

67. Ibid, slide n°13.

68. See for example the idea of "data markets" pushed forward in Beijing or Shanghai in the framework of "data factor" plans.

With the 14th Five-Year Plan, the Ningbo government continues to foster enhanced connectivity and sensors' data integration, with large-scale deployment of 5G networks, enabling IoT deployment. Authorities are also looking forward to using satellite coverage to improve connectivity for "maritime operation digitalization".⁶⁹ In 2020, these efforts have led to the finalization of Ningbo "city brain" (城市大脑), which was built with the support of Alibaba and is poised to provide integration and visualization function to city management.⁷⁰

69. This enhanced connectivity program is named "海天地" (Sea Sky and Earth) integration.

70. Ji, Yongjin, "Ningbo City Brain formally operates: new engine, new foundation and new infrastructure for Ningbo's digitalization reform", 宁波城市大脑正式运营: 宁波数字化改革的新基建、新底座、新引擎, *Smart-city.team*, 30 March 2021, <https://www.smartcity.team/cases/smartcitycases/%E5%AE%81%E6%B3%A2%E5%9F%8E%E5%B8%82%E5%A4%A7%E8%B4%91/>

Realities of smart city construction

Smart city construction is heavily debated in China. Many projects are perceived as either unrealistic, useless, or a waste of resources. First, the costs of the projects are often criticized. It is tempting for technology providers to sell overpriced solutions to government customers who are often "naïve" about their usefulness. For instance, some companies provide seemingly attractive data visualization tools for the government for a significant amount. **In reality, those are mostly interface layers that do not necessarily include the fusion of different data.**

Smart city construction is heavily debated in China. Many projects are perceived as either unrealistic, useless, or a waste of resources.

Other criticisms of smart cities pertain to their "techno-centric" nature. Some projects built around specific technological solutions are not necessarily useful or relevant to urban planning. Qiu Baoxiong, Former Deputy Minister of Housing and Urban-Rural Development, warns that **"if we confuse the means and objectives of urban construction and downplay urban governance and the needs of the people, a smart city built from a fictitious top-level design is doomed to failure and will become needless "smart", empty "smart" and false "smart" (白智慧、空智慧、假智慧).**"⁷¹ Both Covid-19 and the more recent Zhengzhou floods provided examples of how flawed designs had serious repercussions on smart city success and effectiveness. In Zhengzhou, for example, a heavy rainstorm damaged Zhengzhou's communication infrastructure, and the network was completely paralyzed last July. The city's "smart tunnel", equipped with a real-time monitoring system, was supposed to be able to "talk and think (会说话 会思考)". The UWB-based

71. Chou Baoxing, "Design Points of the Basic Framework of Smart City Information System (智慧城市信息系统基本框架的设计要点)", *The Paper*, 8 August 2021, https://www.thepaper.cn/newsDetail_forward_13955011

positioning/navigation module enables precise positioning of personnel, equipment and vehicles in the tunnel so that if there is an unexpected accident, the management can quickly search and rescue personnel through the last location recorded in the background. In practice, none of these functions worked when the water was flooding.”⁷²

In a report written by the Ministry of Industry and Information Technology's Software Testing Center conducted a comparative study of smart cities construction in China.⁷³ Their model evaluates smart city construction in five sectors, dubbed as SMART, assigning grades from 0 to 1.⁷⁴ Their results are interesting albeit not surprising: only 7 cities qualify as “leading cities” with a grade above 0.85 (Beijing, Shanghai, Hangzhou, Guangzhou, Qingdao, Shenzhen, Ningbo, Wuxi).⁷⁵ The average score was 0.70.⁷⁶ **Unsurprisingly, the best results are achieved by richer, more technology-savvy cities, with the Pearl River Delta region and the Yangtze Delta River Region being the most advanced.**⁷⁷

The reports underline serious discrepancies between cities in their smart city construction. While cities perform well on internet connectivity or IoT environments, sensor installations (cameras but also heat sensing, gas sensing, etc.) and computing platforms vary greatly.⁷⁸ The same goes with the openness and interoperability of platforms (for example, access to third-party developers to build in tools in government app).⁷⁹ **When it comes to user participation in the e-government services and apps, the report blasting “low participation” and “poor user experience” in many cities.**⁸⁰

Finally, when it comes to data, results are likewise very contrasted. So-called “top-level design and management” (referring to the administrative layout and management of the projects) achieve high grades on average (0.79), but data management in itself only achieves 0.47. According to the authors, the main difficulties come from poor incentives, “information barriers”, and insufficient interoperability and openness between the (different) platforms (which means in effect various databases).⁸¹ It is unclear what are the different measures that can be taken to further correct these issues.

While smart digital platforms in some cities have played a role in facilitating citizens' lives, and improving the efficiency of services involving government services, medical and health care, cultural tourism, and other application services, it is hard to affirm the maturity and reliability of these projects. In

In most cases, the local government considers digital and smart city construction as a “performance project for window dressing”, with superficial projects being done, and short-term benefits being prioritized over long-term, top-level, and fundamental design.

most cases, the local government considers digital and smart city construction as a “performance project for window dressing”,⁸² with superficial projects being done, and short-term benefits being prioritized over long-term, top-level, and fundamental design. Policymakers are at least aware of these issues. Efforts in smart city evaluation and standardization indicate that, **while the drive for smart city construction will continue, efforts are deployed to correct problems in the conception.**

⁷². Liu Qicheng, “Do Not Retreat in the Smart City Construction (智慧城市建设不要务虚)”, *Tongxin Shijie*, 12 August 2021, <https://finance.sina.com.cn/tech/2021-08-12/doc-ikqciyzm1026745.shtml>

⁷³. Wu, Zhigang, “2021 Smart City Development level” (2021年智慧城市发展水平), *China Software Evaluation Center*, July 2021

⁷⁴. Service 30% of the score – city service for the citizens and companies, Management 20% of the score – top level (data) management, Application 25% – accessibility and applications of smart cities capabilities, Resources 15% – data extraction, classification, sharing and analysis, Technology 10% – infrastructures and sensors.

⁷⁵. Ibid, p. 17.

⁷⁶. Ibid, p. 19.

⁷⁷. Ibid, p. 18.

⁷⁸. Ibid, p. 21, fig. 3-5.

⁷⁹. Ibid, p. 26.

⁸⁰. Ibid, p. 25.

⁸¹. Ibid, p. 22.

⁸². Liu Qicheng, “Smart City construction should not be unrealistic” (智慧城市建设不要务虚), *Tongxin shijie*, 12 August 2021, <https://finance.sina.com.cn/tech/2021-08-12/doc-ikqciyzm1026745.shtml>

ANNEX

In a sub-forum of the China High Tech Fair (November 2020, Shenzhen) dedicated to New Infrastructure, a representative from ZTE Smart City Business Unit gave a presentation of their company's smart city portfolio and program. On a slide, he presented the government cloud structure of Hunan province, and detailed how such this project has been implemented in a transparent manner. In his word, "transparent" meant that the cost was kept under the control and the project are sized according to the client's needs, contrary to many projects that are over dimensioned and priced.

The representative explained that the Hunan government cloud project cost roughly 66M EUR. According to the slide, the project help provincial government save up to 40M EUR of administrative expenditures. The infrastructure usage efficiency is currently 70%.

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MEMBERS

FRANÇOIS GODEMENT

Senior Advisor for Asia
fgodement@institutmontaigne.org

MATHIEU DUCHÂTEL

Director of the Asia Program
mduchatel@institutmontaigne.org

CLAIRE LEMOINE

Program Officer - Asia
clemoine@institutmontaigne.org

VIVIANA ZHU

Policy Officer - Asia
vzhu@institutmontaigne.org

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