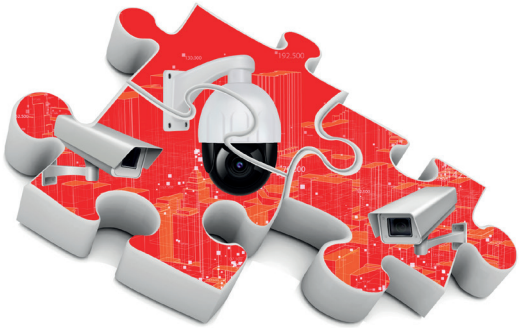

China's smart cities and the future of geopolitics

VALENTIN WEBER

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STRATEGIC UPDATE
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In 1863 Samuel Butler wrote a seminal piece titled "Darwin among the Machines". It is one of the first to recognize that machines might become sentient one day. About 100 years later, George Dyson took Butler's idea further in his book "The Evolution of Global Intelligence".[1] By that time the internet emerged and so had artificial intelligence. Dyson takes this evolution as an occasion to see the internet as a living being and posits that it contains a form of intelligence that we cannot yet comprehend.

The builders of China's surveillance architecture—the Ministry of Public Security and private companies—have also been fascinated by the intelligence of interconnected devices. They started off constructing intelligent buildings and later morphed them into smart cities.[2] They then upgraded smart cities—urban environments with a lot of sensors—to include a command center: the city brain, a concept conceived by Alibaba chief technology officer Wang Jian.[3]

The city brain aggregates and analyses all data through AI-assisted cloud computing and presents it in a visually appealing way for city management staff, who are located in the digital cockpit (a room with large screens).[4] The city brain could finally provide more intelligence to cities, but not anywhere close to the artificial general intelligence envisioned by Butler and Dyson.

> "With the city brain, the community of common destiny will be transformed into a technological community of common destiny"

The city brain follows the OODA loop concept created by John Boyd, a U.S. Air Force colonel who developed it to aid with decision-making during combat situations.[5] Huawei cites the OODA loop in its smart city concept and adjusts it to city level decision-making, which consists of the following features:

1. Observe: the system gathers traffic, healthcare, video information;
2. Orient: information is transformed into valuable information;
3. Decide: warning, prediction and prevention alerts are shown;
4. Act: the city brain suggests implementation options.

Feedback is continuously fed into the cycle to shorten the decision-making time and improve the process.

> “City authorities will want to know which ships are coming into their port and receive alerts of incoming vehicles that cross mountainous border controls.”

The vision for the city brain has been influenced by party leaders, academics and industry. Xi Jinping visited the Hangzhou city brain and noted that it is the key way to make cities smarter by using AI, big data and cloud computing.[6] State-led research institutions are also ardently developing this concept. Liu Feng—dean of Yuanwang Think Tank Digital Brain Research Institute and deputy director and secretary-general of the Urban Brain Special Committee of the Chinese Society of Command and Control—has been one of the key people behind this concept.[7] Liu lays out a very geopolitical vision for the digital brain:

> *The digital brain will gradually expand from the city brain, to the provincial brain, national brain, and finally the [world digital brain (世界数字大脑) or a world digital nervous system]. The construction of the world's digital brain will be the third important opportunity to establish the world's technological ecological standards and systems after TCP/IP and the World Wide Web.*[8]

In other words, the first step for government and industry is to connect various city brains into megalopolis brains, such as in the Guangdong-Hong Kong-Macao Greater Bay Area and the Yangtze River Delta urban agglomerations.[9] The next step would be to have all city brains in China connected.

Although the vast majority of urban brains lie in China (500 cities have announced that they are building city brains) the aim is also to expand regionally and globally.[10] Alibaba's city brain has already been exported to Kuala Lumpur, Malaysia.[11] Its prime purpose is to raise the efficiency of the traffic management in the Southeast Asian city. The municipal, national, regional and world digital brain are and will be powered by the Beidou geospatial system, China's alternative to GPS.[12] Chinese initiatives to push Beidou in Southeast Asia and in the Middle East along the Silk Road are in line with this goal.[13] The world digital brain will most probably be made up of thousands of city brains, but it does not stop there. Smart oceans and mountain ranges will likely feature just as importantly in the world digital brain.[14] Data from underwater or mountain peaks will feed into city brains. City authorities will want to know which ships are coming into their port and receive alerts of incoming vehicles that cross mountainous border controls.

The primary goal of the world digital brain is to serve as the technological support structure for the community of common destiny, which is a key Chinese foreign policy concept.[15] It posits that Chinese wisdom can modernise the globe and that China ought to play a central role in such an international order. With the city brain, the community of common destiny will be transformed into a technological community of common destiny.

Liu, one of the key thought leaders on the city brain, estimates that the world digital brain will be built by 2045.[16] A major challenge to this vision will be to interconnect technological standards present in different world regions. National security considerations will likely hamper Chinese city brain deployments in Europe and the United States. Not to deploy Chinese city brains is a marker of local agency. But even other countries and municipalities that do acquire city brains have a moderate amount of agency: they do make the conscious decision to buy Chinese gear.[17] One of the primary motivations for Nairobi and Mombasa (both located in Kenya) to acquire Huawei's Safe City technologies was to reduce crime rates in the city; whether this has been achieved is disputed.[18] If local actors are unhappy with certain equipment they can replace the it with the non-Chinese equivalent.[19]

“Smart city systems are highly complex, which makes it difficult for importing countries to scrutinise them. City brains are even more complex, potentially incomprehensible, because of their extensive deployment of artificial intelligence.”

However, local agency is curtailed no matter who the supplier is. This is because most countries do not have the ability to secure systems properly. Smart city systems are highly complex, which makes it difficult for importing countries to scrutinise them. City brains—the next evolutionary step of smart cities—are even more complex, potentially incomprehensible, because of their extensive deployment of artificial intelligence. Little appears to be done to increase the auditability of those system. Therefore, it is difficult to know exactly what the system is doing; municipalities might sometimes not be aware where data relating to their city resides or who has access to it.[20] With this lack of transparency, local agency over the confidentiality and integrity of data is hampered.

Local agency over systems acquired is even more important if it pertains to military systems, as those are at the core of national security. Brain-like intelligence is not only being conceptualised in the context of urban environments. The Chinese Institute of Command and Control, a state-led organisation under the auspices of the Ministry of Civil Affairs, emphasises the Military Command Brain (军事指挥大脑) in addition to the Urban Governance Brain (城市治理大脑).[21]

The Institute—which focuses on eclectic subjects like intelligent wargaming, swarm intelligence, aerospace security and the city brain—explains the urban brain’s value for the military brain:

> *It can be said that the confrontation of wars between countries in the future will be reflected in … [confrontations] between several military brains. Based on the research progress of the urban brain, we can combine various military elements into a brain-like combination to form the structural diagram of the military brain[.]*[22]

While the larger strategy of civil-military fusion in China is not yet fully accomplished, due to a historical separation of the defence sector from the private sector, civil-military overlap is visible in the smart city private sector.[23] For example, Digihail creates high resolution digital renderings of cities for Huawei as well as for the military,[24] and has worked on visualisations of aerospace battlefields.[25] To do this, Digihail fuses large-scale geographic information data: it visualises attack surfaces, travel routes, and deployment area of combatants; it creates a virtual display of the 3D battlefield that covers land, air sea, and electronic warfare; and it synchronises information flows from the different branches of the military. Digihail provides a visual decision-making system that integrates key personnel and vehicle monitoring. The company also visualizes space attack and defence operations for the Chinese military.[26]

As the digital twin products—being digital representations of systems, cities, and geographical features—of Digihail show, the military brain is about more than the ground level in urban environments. It is about all domains of warfighting. Aerial maps, nautical maps, space, and land maps feed into the digital brain. They speak of one map command on the battlefield.[27] This is similar to social governance in one screen that is hailed in China.[28] 'One screen social governance' (一块屏里的社会治理) or 'one map command' (一张图指挥) will require a lot of interlinking of systems. It will be interesting to see how the various city brains will be interconnected in China and for what purpose. As it currently stands, it appears that the interaction of various city brains ensures that dwellers of one city can take advantage of the same services in a neighbouring city as if it were their own. Interlinking city brains might also allow for cross-regional decision-making of municipal authorities. It might help to better control flows of people or goods.

On a global scale, what would a world digital brain do? Where would decisions be made and how would they be taken: in the municipal city brains or national brains, or one that is being operated from China? Whose interest would the world digital brain pursue? Whose technological standards and algorithms will it be built on? What does it mean if various military brains face each other? Will there ever be a world military brain? Would it be based on the world's city brains, the world's military brains, or both?

One question that underlies most of the above questions is: What is the value for China of Chinese companies operating city brains abroad? Presently a major benefit may be that it helps with spying. The smarter the exported surveillance infrastructure becomes; the easier spying becomes. In the early 2000s, Chinese as well as international

companies exported 'dumb' surveillance equipment.[29] CCTV cameras could record but not analyse images. With time the equipment has become smarter; exported cameras can now potentially identify a Chinese dissident through facial recognition and track their daily commutes, which might help the Chinese authorities with the abduction of that person.[30] The more insight local authorities in Thailand have, the more situational awareness China, or any other foreign power, has if it taps into those data streams. In other words, the smarter its exported surveillance infrastructure, the more influence it can wield in those regions, since it has a privileged but not exclusive capability to control its technology within a given territory.[31]

In the medium-term, if Chinese territorial tensions with Malaysia, or other regional states, ever led into open hostilities, the mapped infrastructure and data streams of Alibaba's city brain in Kuala Lumpur could potentially be integrated into the warfighting map of Chinese fighter jets: pilots may find it easier to identify convoys of cars that have been marked by the local city brain as important and deserving protection, e.g. government officials' cars.[32] This may give them an advantage in urban warfare. What is more, if a territory were conquered, it might be more easily governable, as Chinese firms and officials are already familiar with the urban governance management systems in place.

Smart cities in vital geographical locations

While deploying safe city solutions in Lahore, Pakistan (over 10 million inhabitants) or Kampala (Uganda's capital) could provide useful intelligence insights for China, building smart cities in coastal regions might be even more crucial for Beijing.[33] This is because these smart cities are often located close to submarine cable landing stations and vital naval channels. In addition to this, in coastal and less developed locations it might be easier for China to covertly project its power: through mobile maritime assets (fishing vessels) or by gradually transforming newly built civilian (digital) infrastructures into military ones.[34]

A few Chinese-planned coastal smart cities have come under special scrutiny: Mauritius, Fuga Island (Philippines), and Daru (Papua New Guinea). Due to security concerns and a fear of Chinese influence only one out of three smart cities (Mauritius) has been built.[35]

In Mauritius India's external intelligence agency, the Research and Analysis Wing (RAW), voiced concern.[36] India's fear related to the Huawei-built Mauritius-Rodrigues Submarine Cable, landing in Baie Jacotet (Mauritius).[37] This could allow China to tap into Indian and Western communications going through the Indian Ocean.[38] France has military bases on neighbouring Réunion, for instance.[39] Réunion is connected

to Mauritius through the SAFE undersea cable, which lands in Baie Jacotet. In other words, Huawei did not only build what one day may become the local digital brain—the Mauritius smart city—it also built the world neural pathways (submarine cables) leading to it.[40] This combination of infrastructure projects raised major concerns, although it neither prevented Huawei from building a safe city in Mauritius nor hampered its construction of the submarine sea cables.[41]

Fuga island is yet another case of a Chinese smart city that has stirred national security concerns.[42] The project proposed by Xiamen Hongji Yongye Investment would cost $2bn. Secretary Raul Lambino, chief executive officer of the Philippine government-owned corporation that manages Fuga Island, said of the proposed 'One Belt One Road Fuga Island Smart City' that it does not pose any security threat.[43] Captain Jonathan Zata of the Philippine Navy counterargued that the adjacent strait and the nearby subsea cables are of strategic importance to the Philippines.[44]

In addition to this, Fuga is located adjacent to the channel that connects Taiwan and the Philippines. This channel is frequented by both the People's Liberation Army (PLA) and US, as well as US-allied navy ships that make their way from the Pacific into the South China Sea. This maritime channel is also part of the first island chain, extending from the Japanese archipelago, the Ryukyu Islands, down to the Philippine and Indonesian Islands.[45] The concept of the first island chain was conceived by John Foster Dulles, US Secretary of State (1953-59).[46] It was later adapted by the PLA and features in Chinese writing as a geographical location that the PLA ought to control in order to assert its power regionally.[47] The first island chain is also important in terms of submarine warfare, as the entity that controls the adjacent islands knows when submarines enter or exit the Pacific Ocean.[48]

> "The smarter [China's] exported surveillance infrastructure, the more influence it can wield in those regions, since it has a privileged but not exclusive capability to control its technology within a given territory."

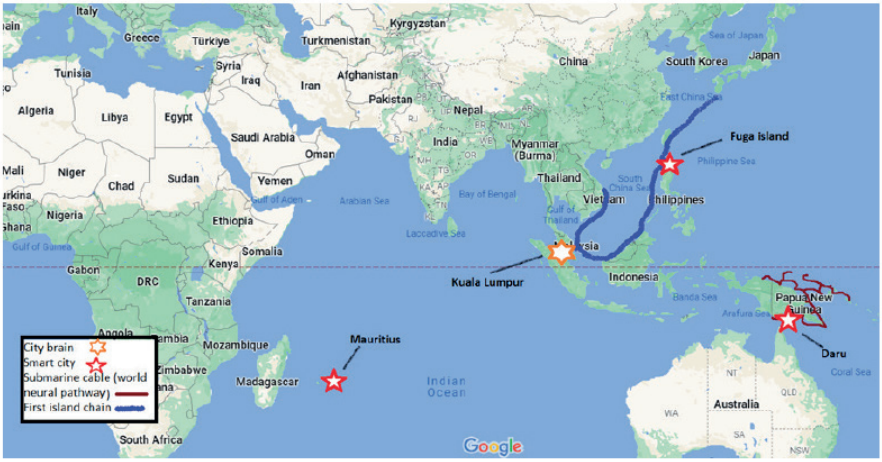

Figure 1. Selected foundations of the emerging world digital brain within the geostrategic context.

Yet another smart city that Chinese developers aimed to build in a critical location is Daru, Papua New Guinea.[49] The plans promised an investment of $39bn for commercial, industrial, residential and resort purposes.[50] Additionally, China's Ministry of Commerce backed a $204m heavy 'comprehensive multi-functional fishery industrial park' on Daru.[51] While this project may appear benign, Chinese fishing vessels have been suspected of carrying intelligence collection equipment, engaging in projects relating to national security and manned with militiamen.[52] In addition to this, Daru hosts one of the landing stations of one of Papua New Guinea's submarine cable networks: 'Kumul Domestic Submarine Cable System'.[53] Tianjin-based HMN Tech laid the cables. In turn, the prospect of a major Chinese-built city, which is wired with the latest surveillance technologies, combined with the submarine cables that had already been built by HMN Tech, raised major security concerns in Australia. These concerns might have led to the Daru smart city project being shelved.[54]

Conclusion

In most of the world a bifurcation of the internet infrastructure will not occur. Even if the US and the EU, as well as their allies are more wary in acquiring Chinese smart city products. This can be seen in India, which strongly relies on US suppliers: Bangalore (IBM) and Vijayawada (Cisco) or in Valenciennes, France, where Huawei withdrew its safe city engagement due to difficulties of operating in the French

market.[55] In Germany, Duisburg paused its smart city cooperation with Huawei due to new security assessments by the German federal government.[56]

In other countries, municipalities embrace Huawei safe cities and deploy theirs alongisde Western suppliers' products. In Jakarta (Indonesia), IBM is deploying its smart city solutions.[57] At the same time, Indonesian authorities are exploring cooperation with Huawei whose products could power the new smart capital, Nusantara.[58] Also in Indonesia, Chinese company Inspur is providing around one hundred servers to Pekalongan for its smart city construction; in Bandung, Huawei has been key in building safe city solutions.[59] This means that one city in a certain country could rely on Chinese suppliers, while another decides to use alternative non-Chinese suppliers. More considerable bifurcations of the technological infrastructure may occur in Europe, the US, India and other countries which take a harsher stance towards Chinese technologies being built into their critical infrastructure. In many countries outside of this grouping, however, such a bifurcation of suppliers relating to smart cities or digital brains will likely not occur.

As of 2023 we are far away from an extensive bifurcation of the internet or a world digital brain. But policymakers in democracies should nevertheless take note of the thinking that is emerging in the Chinese research community, industry, and party circles, as well as the geostrategic nature of Chinese smart city construction projects abroad. Democracies should also work toward drawing up initiatives that promote privacy-friendly smart urban turnkey solutions that can compete globally.[60] This will mean expanding research on privacy enhancing technologies that can preserve individual privacy, while simultaneously giving law enforcement tools to combat threats. As the future of geopolitics lies in the smart city, so should strategic thinking be focused on them. ■

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The Author

Dr. Valentin Weber is Associate at LSE IDEAS. He is a Research Fellow at the German Council on Foreign Relations. He holds a PhD in cyber security from the University of Oxford.

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China's smart cities and the future of geopolitics

VALENTIN WEBER

In this latest Strategic Update, Valentin Weber explores Chinese scientific research and industry application of smart cities, with 'city brains'. The geostrategic implications for these complex Chinese smart city construction projects outside of China—particularly surrounding surveillance and artificial intelligence—and a potential future 'world digital brain' must be considered by policymakers, even if we are far away from an eventual bifurcation of the global internet.

LSE IDEAS
Floor 9, Pankhurst House
1 Clement's Inn, London
WC2A 2AZ

+44 (0)20 7107 5619
ideas@lse.ac.uk
lse.ac.uk/ideas

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