

CHAPTER 1

China's Leap into 5G iABCD

- Blockchain with Chinese Characteristics
- AlphaGo, the Historical Match
- AI First—"Second Half Game" of Mobile Internet
- 5G iABCD New Infrastructure
- Digital Transformation in the Cloud
- BaaS Startup Innovation Ecosystem
- Splinternet and the Digital Silk Road

Blockchain with Chinese Characteristics

Since the coronavirus became a pandemic and people dived into remote working in March 2020, video-conferencing services have become vital components of this new way of life. Zoom, an until then little-known online platform, has emerged as the go-to service for not only virtual meetings and classroom lessons, but also church services, costume parties, romantic dates, and even wedding ceremonies. Zoom has quickly become the No. 1 video-conferencing platform in the United States, more popular than similar offerings from Google, Microsoft, and Facebook. Between December 2019 and April 2020, Zoom's daily meeting participants jumped 30-fold to 300 million in a mere five months.

Whereas Zoom is headquartered in the United States and listed on the Nasdaq exchange, the actual Zoom app appears to have been developed by companies in China. In its Securities and Exchange Commission (SEC) filings, Zoom has at least 700 employees who work in research and development out of its affiliated companies in China. The company founder is a native Chinese who had working experience at the US telecom giant Cisco. When Western corporations flocked to Zoom it could well have been their first time to use Chinese enterprise-resolution software in their businesses. In the past, the US and European markets mostly learned about China's booming digital economy from the billion users of WeChat (the WhatsApp of China), mind-boggling e-commerce volume of Alibaba, or the goofy videos of TikTok.

Most of them, however, probably have missed a much bigger technology breakthrough in China in the same month, which further illustrates China's digital economy prowess—in the form of “hard tech” innovation—way more than pure mobile applications connecting online users. After more than six years of preparation, in April 2020 People's Bank of China (PBOC, the central bank) unveiled to the public its new digital currency, the world's first central bank digital currency (CBDC), known as the Digital Currency/Electronic Payment (DCEP), which could replace cash with a blockchain (like)-based solution.

Most likely, DCEP makes China the first major economy to adopt a native digital currency. DCEP is designed to function as the digitalization of physical cash (i.e. paper cash, coins, and banknotes) or just as the substitution of the base money supply (M0)—at least for now. Progress on the DCEP was broadly viewed as a reaction to Facebook's announcement in 2019 that it intended to launch *Lybra*, Facebook's planned blockchain-based digital currency, which is still trying to win approval from regulators. Unlike Bitcoin and other cryptocurrencies, built on the excitement regarding “decentralization”, DCEP is run from a centralized database; nevertheless, DCEP is built with blockchain and cryptography, and it has incorporated blockchain's

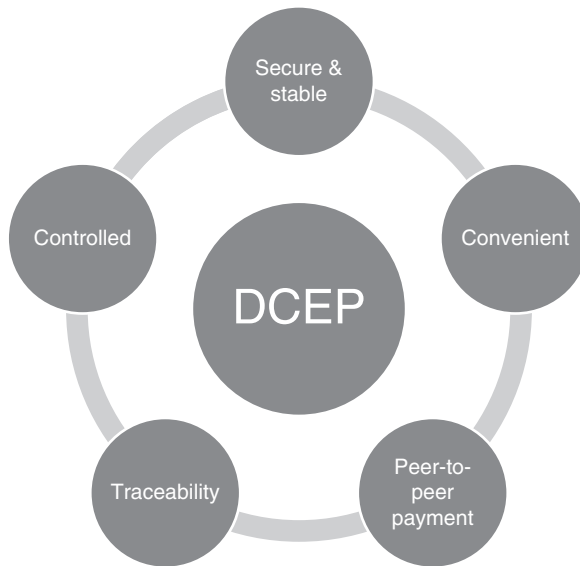


Figure 1.1 How is DCEP designed?

Data Source: Media Reports, April 2020.

key concepts, such as peer-to-peer payment, traceability, and tamper-proof-ness (see Figure 1.1).

Since its April launch, the new digital currency has been piloted in four major cities, Shenzhen, Suzhou, Chengdu, and Xiong'an New Area, the city to replace Beijing as the country's capital. (Leveraging the blockchain technology's strength in data management, the whole city of Xiong'an has a blockchain DNA. **See the "Vice Capital Built on Blockchain" box.**)

In the pilot zones, DCEP has been formally adopted into the cities' monetary systems, with some government employees having started to receive their salaries in the digital currency in May 2020. People can create a DCEP wallet in their commercial bank's mobile app and use the national digital currency for expenses like transportation, education, healthcare, and other consumer goods and services. Starbucks, McDonald's, and Subway chains in China, for example, were named on the central bank list of firms to test DCEP. In July, Chinese ride-hailing giant

Didi Chuxing entered a strategic partnership with the PBOC to test DCEP on its transport platform of over 500 million users. In August, China expanded DCEP trials to Beijing and several major cities—getting even closer to its official launch.

Vice Capital Built on Blockchain

Billed as “a strategy crucial for the millennium to come,” the Xiong’an New Area is a new area of “national significance” launched by China on April 1, 2017, following the Shenzhen Special Economic Zone in the 1980s and Shanghai Pudong New Area in the 1990s. Designed for taking over “non-capital functions” from the hyper-crowding of Beijing, Xiong’an (meaning “brave and peace”), located about 100 km southwest of Beijing, will be a new home—a “vice capital”—for Beijing’s colleges, hospitals, financial institutions, and state-owned enterprises’ headquarters.

As China’s “city of the future”, Xiong’an has been designed to become a smart city zone for innovation. In this context, the integration and application of the Internet of Things (IoT) technologies, artificial intelligence, Big Data, and cloud computing has been strongly encouraged in the city planning. In particular, the new city is set to become the blockchain hub in China and has taken a lead in rolling out blockchain-based services.

The blockchain DNA of the megacity had started even before its construction. To build the vice capital over swampland, the government purchased land from local farmers. Those transactions are made via blockchain to keep them transparent and organized. The so-called Blockchain Land Compensation Distribution Platform distributes financial subsidies for relocated residents in the area. Since April 2020, DCEP, the blockchain-based digital currency, has been tested at hotels and convenience stores in the New Area.

In order to create a “beautiful forest to last a thousand years”, every tree in Xiong’an will have its unique identification after being planted. The Xiong’an project team has built a system powered by blockchain, Big Data, and cloud computing technology to track the whole process for quality control, including seedling selection, excavation, packaging unloading, planting, and irrigation. Based on this system, each tree has a digital ID. After being encoded, all of its information, including its species, place of origin, planting location, and growth status, can be found in the database.

In parallel, as a model of “transparent Xiong’an”, a blockchain-powered funding management platform is used to monitor the flow of cash and ensure the funds will be used exclusively for the digital forest project. The blockchain platform also tracks each worker’s activities and directly pays salaries to their bank accounts. By the end of 2019, Xiong’an had planted 14 million trees—on the blockchain.

China's DCEP has set off a global debate for its future potential to challenge the US dollar for primacy. To some, DCEP—the world's first central bank digital currency (CBDC) for a major country—may provide a functional alternative to the dollar settlement system that reigns supreme in the global economy for decades. For example, China could use DCEP to manage funding and transactions for its Belt and Road Initiative (BRI) of overseas infrastructure investments, extending its monetary sphere of influence.

This national digital currency push does not come as a surprise. In an October 2019 speech, Chinese President Xi Jinping declared blockchain “an important breakthrough,” that would play “an important role in the next round of technological innovation and industrial transformation.” President Xi urged that China should accelerate the development of blockchain to “seize the opportunity”, in remarks that marked the first major world leader to issue such a strong endorsement of the widely hyped—but still unproven—distributed ledger technology (DLT). (By contrast, most governments in the West have been far more cautious.)

Calling for blockchain to become a focus of national innovation, President Xi's speech detailed the ways the Chinese government would support blockchain research, development, and standardization. To global policymakers, China's blockchain push seems to serve two of its strategic goals: ending the hegemony of the dollar and reducing dependence on the United States for foundational technologies. The central government's support for blockchain projects in China puts any initiatives or standards that emerge on the front foot, potentially hastening the mainstream application and use of the technology.

To be clear, President Xi's speech and DCEP is entirely about blockchain, far from a vote of confidence in Bitcoin or other cryptocurrencies. Blockchain is a form of distributed ledger that creates an online database where every participant can share and synchronize information. The data,

maintained in chained records called “blocks”, is not owned by any single authority (hence, the notion of “decentralization”). Such a decentralized, cryptography-based network mechanism enables immutable data retention and secure transmission. As a matter of fact, Chinese entrepreneurs have been on the crest of the blockchain wave since Bitcoin first gained traction.

The concept first emerged in the 1990s, but did not become reality until 2008, when Satoshi Nakamoto—a pseudonym whose true identity still remains unknown—reportedly launched Bitcoin, a digital currency that used blockchain to realize and store its value. China’s startup ecosystem had aggregated enormous experience in building digital blocks before the release of the Ethereum platform in 2015, which marked a milestone in the second-generation blockchain system that embodied “smart contracts”. The blockchain field was revolutionized by the implementation of layered smart contracts in the Ethereum platform to create applications other than money exchanges.

Along the way, China has become home to some of the world’s largest cryptocurrency “mining farms”—data centers hosting the high-powered computers where the so-called miners (companies or passionate individuals) compete against others in the blockchain network to solve complex math puzzles and earn new coins. According to CoinShare’s estimate in December 2019, approximately two-thirds of global Bitcoin mining (65%) happens in China: Sichuan province alone produces more than half (54%) of global hashrate (the parameter for mining capacity). Moreover, China manufactures most of the world’s mining equipment. Chinese companies, such as Bitmain, Canaan, and MicroBT, are among the world’s biggest manufacturers of Bitcoin mining gear.

Furthermore, the Chinese exchanges for cryptocurrencies (Bitcoins and other tokens) used to lead the world in terms of volume. The “coin” rush was interrupted by Chinese

authorities in September 2017, which effectively banned all Initial Coin Offering (ICO) activity within China as “unauthorized and illegal public fundraising” and “unauthorized public sales of securities”. The Chinese government also made illegal all cryptocurrency exchanges within the country. As a result, the market saw cryptocurrency trading and other related activities in China moving abroad due to tightened regulation.

Although China has cracked down on cryptocurrencies, shutting down all domestic crypto exchanges and banning all ICOs, blockchain technology itself is recognized as a revolutionary development by the government. After all the noise, hype, and speculation died down, the blockchain technology reached its third phase and has been integrated with the real economy since 2018 (see Figure 1.2). Real companies have come to the field to focus on application of the technology in solving real business problems to create solid values.

For enterprises, blockchain is expected to apply broadly in the business world to revolutionize how data is managed and shared. Blockchain can offer an excellent solution to synchronize data, especially sensitive information, across companies, industries and geographical boundaries. It can facilitate a trusted network that enables multiple parties to exchange data, information, and assets directly, as in the case of supply chain finance (see the details in Chapter 5 relating to fintech discussions) in the manufacturing sector. The technology is used widely across a range of industries in China: for banking, financial services, public services, healthcare, logistics, and

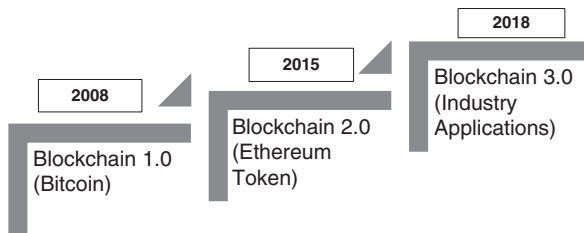


Figure 1.2 Blockchain from 1.0 to 3.0

smart manufacturing. If blockchain is mainstream anywhere, it's in China.

No doubt, the launch of DCEP and the ongoing rollout of blockchain applications should further support China's global technology ascent. Whereas blockchain technology is newly embraced by China as a frontier of innovation, the country is also making giant strides in advancing the 5G network, artificial intelligence (AI), and more emerging technologies—a digital rush started from a chess game in 2017.

AlphaGo, the Historical Match

In May 2017, the Chinese media was abuzz with reports about a historical match of the Go chess game (*weiqi*). It was a best-of-three match between Chinese player Ke Jie, the world's No.1 ranked player and world champion, and the AI-enabled computer Go program called AlphaGo, designed by the DeepMind Lab of the US internet giant Google. The match turned out to be one of China's most talked-about news events in 2017, attracting hundreds of millions of views on social media.

For many, the Wuzhen showdown was ripe with suspense and symbolism: uman versus machine; tradition versus modern; intuition versus algorithm; East versus West. Who would prevail? **(See the “Match Impossible” box.)**

In the end, a tearful Ke Jie became the hallmark image of this historic match. After losing 0–3 to AlphaGo, Ke Jie took off his glasses and wiped his eyes, the sound of his distress filled the room in which he had fought and lost. Subsequently, AlphaGo went on to defeat a team of five top Chinese professionals in a demonstration game in which they were allowed to lay down variations on a board and discuss among themselves, showing that even collective human minds couldn't beat the machine.

Match Impossible

China is the birthplace of *weiqi* (*Go* chess), an ancient board game played on a 19x19 grid. In *Go*, two players place black or white stones on the grid, each seeking to seal off the most territory. Historical records show it was played as early as the Zhou dynasty (1046 BC–256 BC). The match took place in Wuzhen, Zhejiang province, where there is a canal more than 1300 years old—a fitting venue for a game that dates back thousands of years. Wuzhen also hosted China's annual World Internet Conference, creating a parallel link to the digital power of AlphaGo.

In contrast to the long history of *Go* within Chinese culture, the development of AlphaGo was only three years old at the 2018 match. *Go* is seen as an extremely difficult game for computers to master because there are more possible board configurations in *Go* than there are atoms in the visible universe. Furthermore, human players believe that winning multiple battles across the board relies heavily on intuition and strategic thinking and that a software algorithm cannot simply memorize all combinations of board pieces, assess the situation by calculating all possible moves, and select a strategy to win, like in chess.

As such, *Go* has been a benchmark for measuring the human mind against artificial intelligence after IBM's Deep Blue beat chess grand master Garry Kasparov in 1997. For many years, there was little progress. More recently, the AlphaGo program developed by Google's DeepMind managed to analyze the game in a different way. AlphaGo used two sets of "deep neural networks" containing millions of connections similar to neurons in the brain—one that selects its next move while the other evaluates the decision.

The Google programmers provided AlphaGo with a database of 30 million board positions drawn from 160 000 real-life games to analyze, and the program was also partly self-taught, having played millions of games against itself following its initial programming ("machine learning"), all the while learning and improving. AlphaGo's success was considered the most significant yet for AI, due to the complexity of *Go* game, which has an incomputable number of possible scenarios, and in particular emphasizes the importance of "intuition" or "instinct" that is thought to be reserved for humans only.

After AlphaGo beat the best human player, Google developed a more advanced version, AlphaGo Zero, which was not trained by historical data of games between humans at all. Instead, AlphaGo Zero was only taught of the *Go* chess game rules before it started self-training by playing games against itself. Within a few days, AlphaGo Zero easily beat AlphaGo. Clearly, in addition to the quantity of data, other factors, like new algorithms, computing power, and the kinds of data available, may be just as valuable for AI training.

As if to respond to the humans' confusion, fear, and depression, at the end of the match the DeepMind Lab team announced that AlphaGo would retire from competing against human players. Instead, the team would largely shift toward using AI to solve problems in health, energy, and other fields. There was no doubt about AI's overwhelming superiority, at least in the game of Go.

First, the AI program showed more understanding of Go than humans, even to the extent of perfection. From time to time, AlphaGo put down seemingly randomly placed stones to set up winning positions. Those surprises kept coming in all three games, with the AI program making "unconventional" and "interesting" moves against Ke Jie. In a later interview, Ke Jie vowed never again to subject himself to the "horrible experience" because "he had had enough".

"For human beings", a visibly flummoxed Ke Jie commented with a resigned expression, "our understanding of the Go game is really very limited". Meanwhile, "AlphaGo to me is 100% perfection", he added, showing feelings of helplessness and depression. Even for the world's No.1 player, confronting an enemy that never makes mistakes and always picks the best possible moves ahead of its rival was no longer a competition, but torture.

Second, the AI program had no emotions or feelings, which seemed to be another advantage over humans. In close games, that may have given AlphaGo an edge. Toward the end of the second match, Ke Jie was visibly agitated, tugging his hair, rubbing his chest, and laying his head on the table from time to time. After the game he confessed that, when he thought he might have had a chance at winning in the middle of the game, he got too keyed up to keep calm. "I was very excited. I could feel my heart bumping", he said. "Maybe because I was so excited I made some stupid moves".

Third, the AI program made the Go game more interesting. One-time world champion Shi Yue commented that, in games between human players he had never seen moves like AlphaGo's and was unlikely to in the future. The question to follow

Table 1.1 The speedy ascent (and retirement) of AlphaGo

November 2015	DeepMind organized a secret match with Fan Hui, Chinese 2-dan pro and winner of several European championships. AlphaGo won 3–2 in unofficial training games, and won 5–0 in the official match
January 2016	DeepMind published a paper in the journal <i>Nature</i> describing the AI system behind the AlphaGo version that beat Fan Hui. The team also announced a five-game match against Lee Sedol, the top player of the previous 10 years
March 2016	The upgraded version of AlphaGo played a best-of-five match against 9-dan Lee Sedol, the multiple world champion from South Korea, and won 4–1
January 2017	A new, upgraded version of AlphaGo (called “Master”) won 60–0 against most top professionals from China, Korea and Japan in fast-move games (mostly 30 seconds per move)
May 2017	AlphaGo defeated 9-dan Ke Jie, the reigning top-ranked player from China, 3–0 in a best-of-three match
May 2017	DeepMind team announced that Alphago would “retire” from competing against human players

Note: For the Go chess, professional ranks in China, Japan, and Korea all start at 1-dan and go up to 9-dan, the best players being 9-dan.

is whether there is still value in human-versus-human games? If games between AI programs become more interesting and unpredictable, the existential value of professional Go players could be questioned.

Most strikingly, the leaps in AI power happened in a short period of time. The ascent of AlphaGo to the top of the Go world was distinct from the trajectory of machines playing chess games. Because of its vast number of possible scenarios (in the order of magnitude numbering 10 to the power of 360!), many professional players estimated that it may take AI at least another 10 years before it could outperform top human players. However, the development and perfection of AlphaGo spanned less than three years (see Table 1.1). “Last year, I think the way AlphaGo played [against Lee Sedol of South Korea] was still quite human-like, but today I think he plays like the God of Go”, Ke Jie said after the game.

As such, AlphaGo’s superior calculation power stripped Chinese audiences of their initial curiosity about AI and threw

them into confusion. Almost overnight, the internet business community in China started discussing about “the second half game” of the mobile internet economy which, in 2013–2016, led a boom in e-commerce and online entertainment. Since 2017, the new key words have become *data* and *intelligence*, and the resolve to close the gap with—and quickly surpass—Silicon Valley in deploying AI is prevalent across the country.

AI First—“Second Half Game” of Mobile Internet

The image of the world’s top player crying at his loss to AI has triggered a great sense of determination and urgency among Chinese businesses and companies about AI: either adapt the fast-evolving technology of AI, Big Data analysis, and computer chips (for AlphaGo, Google designed a special-purpose chip specifically for machine learning) to upgrade—or be destroyed.

As such, the largest internet companies, such as Alibaba (the e-commerce giant like Amazon) and Tencent (best known for its billion-user social messaging service WeChat) jumped on the AI wave to transform themselves into “intelligence first” companies. During the recent “mobile first” era (which feels like ages ago), their mobile platforms had accumulated vast amounts of user and transaction data; such data is now being leveraged, using AI, to solve practical operational challenges and drive new business models. (Hence, the notion of the “second half game”.)

Tencent—the highest-valued Chinese internet company, which has roots in gaming and online services—made dramatic changes in response to the new trend. In 2018, for the first time in six years, Tencent announced a major restructuring to move from a consumer business toward one that caters for industry as well. The restructuring included the creation of a new Cloud and Smart Industries Group, focusing on AI, cloud services, Big Data and security; and another new group combining its social media, mobile internet, and online media operations for the purpose of strengthening internal coordination to compete

with emerging competitors like Toutiao (the short video platform that owns the world-famous app TikTok).

Furthermore, Tencent formed a new technology committee that better coordinates fundamental technology research in different parts of the company. Tencent's restructuring marks a "significant strategic upgrade" for the company and comes as its main business of gaming and online services began to grow at a slower pace. As publicly stated by Pony Ma, Tencent's founder and chairman, "the next era of the internet is the industrial internet", and Tencent will, in reaction, develop new industry-facing services to "connect industries and consumers to build a more open ecosystem".

Meanwhile, technically savvy and internationally educated entrepreneurs, with compelling technologies, have easily attracted venture capital for startups that bring niche AI applications to a broader market. Computer vision (CV), for example, is the science for computers or robots to duplicate the way humans perceive and visually sense the world around them. Facial recognition technology, in particular, has been widely used in public security applications, with public security authorities using the technology to spot suspected criminals and even jaywalkers.

In the computer vision sector, Megvii, SenseTime, Yitu Technology, and CloudWalk are collectively referred to as China's "Four CV Dragons". The Four Dragons' growth coincides with China's full embrace of facial recognition technology and its integration into the daily lives of the Chinese population. In recent years, CV companies have also used the AI technologies to transform a variety of industries from finance to entertainment, transport to healthcare, and more.

Megvii focuses on face detection, recognition, and analysis across different platforms. Its core product Face++ is a cloud-based face recognition technology platform, and it has been widely applied in various industries. Through a partnership with Alibaba, Face++ has been integrated into Alipay (the widely used mobile payment platform) to support facial scan

logging in and Smile to Pay, a payment method that allows users to make a purchase by scanning their faces. Face++ is also integrated into smart city applications, where it's deployed to optimize traffic flows and "see" incidents that require police or medical attention. In line with the AI product's name, the Megvii technology is similarly used by Meitu, the popular beauty-enhancing photo editing application. (The Meitu, which means "beautify pictures" in Chinese, app offers features that can remove wrinkles, smooth pores, and lengthen legs in photos.)

SenseTime specializes in deep learning-enabled computer vision technologies, such as facial recognition technology that can be applied to payment and picture analysis for bank card verification and security systems. SenseTime has supplied automatic face scanning systems to many railway stations and airports across China, with a near perfect accuracy rate. For example, it has signed agreements with China's largest subway operator, Shanghai Shentong Metro Group, to use AI to monitor metro traffic. At US\$7.5 billion (according to media reports in late 2019, following a recent round from investors, including SoftBank Group), SenseTime is the world's highest-valued AI startup. According to *South China Morning Post's* 2019 internet report, SenseTime and Megvii are major exporters of AI solutions for security and surveillance in government and commercial markets across Southeast Asia, Latin America, and Africa.

Yitu Technology operates a cloud-based visual recognition engine that enables computers to detect and recognize faces and cars. The system has been mostly used in surveillance and crowd-tracking, and the company's clients include state authorities such as China Customs and China Immigration Inspection. **Cloudwalk** has also been the leading AI tech supplier for China's banking industry.

Natural language processing (NLP) technology is another example. **iFlytek**, China's leading speech-recognition company that creates voice recognition software, has changed the way

doctors write up medical records, thus giving them more time to spend with patients. Traditionally, doctors have to spend much of their time writing up patients' medical records every day. They usually write them between surgeries and very often stay in the office after working hours to finish the paperwork. iFlytek's speech-recognition application was tested at hospitals, where doctors could record their diagnoses vocally at "considerably high accuracy".

iFlytek has also developed more than 10 voice-based mobile products covering education, communication, music, and intelligent toys. It has won a series of worldwide speech and AI competitions, including the Blizzard Challenge, reportedly the most authoritative international competition in speech synthesis. As such, iFlytek was named by China's MOST (Ministry of Science and Technology) to be the national AI champion for speech recognition, along with **Alibaba** Group (smart city initiatives), **Baidu** (autonomous driving), Tencent (computer vision in medical diagnosis), and SenseTime (intelligent vision).

Collectively, the established internet firms and tech startups are investing billions in building new research centers, hiring experienced AI experts and young data scientists, and even setting up labs in the US' Silicon Valley to work on the latest algorithms, smart robotics, and self-driving cars. Tencent even created its own version of a Go-playing AI program called *Jueyi* (or FineArt in English), but only after AlphaGo had already retired; hence, there was no chance for the two AI programs to meet in a direct contest. Nevertheless, the AI race between Chinese and US tech companies is on.

5G iABCD New Infrastructure

If Chinese companies' embrace of AI has been resolute and aggressive, the decisive commitment from the Chinese government, which has announced a sweeping vision for AI and digital economy excellence through a series of policies and initiatives (see Table 1.2), is truly extraordinary. Perhaps it was a

Table 1.2 Major Chinese national and local government strategy and policy initiatives relating to AI and the smart internet (2013–2020)

Name	Issuer	Date	Focus
Promote “ Information Consumption ” to Increase Domestic Consumption	State Council	August 2015	To use information technology to promote more domestic consumption (such as e-commerce)
“ Broadband China ” strategy	State Council	August 2015	To significantly improve the country’s information infrastructure, including 4G network coverage to cover all the cities
“ Internet+ ” Action Plan	State Council	May 2015	To develop internet access for industries, and leverage AI to create new services and applications
“ Internet+ ” and AI Three-year Action Plan	NRDC	May 2016	To develop a fundamental AI ecosystem and produce world-class AI enterprises
Next Generation Artificial Intelligence Development Plan	State Council	July 2017	Setting out roadmap for China to reach global AI leadership position by 2030
Three-year Plan for Next Generation AI Development (2018–2020)	MIIT	December 2017	Setting near-term guidelines based on the national AI Strategy
Artificial Intelligence Innovation Action Plan at Higher Education Institutions	MOE	April 2018	To establish at least 50 AI academic and research institutes by 2020
“ Intelligence Plus ” Initiative	State Council	March 2019	To implement AI to transform and upgrade manufacturing industries
Guidelines for Market-based Allocation of Production Factors	Communist Party of China Central Committee and the State Council	March 2020	Defining data as a new type of production factor, on par with land, labor, capital and technology
New Infrastructure Initiative	State Council	May 2020	Calling for quickening the pace of new infrastructure investment for digital economy

Note: **State Council** – China’s Central Government; **NDIC**—National Development and Reform Commission; **MIIT**—Ministry of Industry and Information Technology; **MOE**—Ministry of Education.

coincidence of timing, but soon after the Wuzhen Go match, China's central government released "A Next Generation Artificial Intelligence Development Plan" in July 2017.

The plan calls for: (a) a homegrown AI to match that of Western developed countries within three years (by 2010), (b) China's researchers to make "major breakthroughs" in AI theory by 2025, and (c) Chinese AI to be the world's undisputed leader ("occupy the commanding heights") by 2030. This plan probably is the first in the world and by far the most ambitious move to react to the AI revolution.

To solve the shortage of AI talent, China's Ministry of Education in April 2018 released the "Artificial Intelligence Innovation Action Plan at Higher Education Institutions", which envisions that by 2020 China would establish at least 50 AI academic and research institutes for 100 interdisciplinary majors that combine AI with traditional subjects, such as mathematics, statistics, physics, biology, psychology, and sociology, among other disciplines. Governments across the world are rushing to support innovation in AI, but none has published as concrete a plan as China and—more importantly—to execute on.

It should be highlighted that China's digital economy push started much earlier than the ambitious AI plan. It started in August 2013, when China's State Council issued a blueprint to officially promote "**Information Consumption**". At the beginning, the term was mostly related to "consumption-based on information technology", with e-commerce based on internet channels as the focus. Soon the concept was expanded into "quality information products for consumption", such as movies and online videos, which led to a boom of online entertainment. In 2015, the "internet plus (+)" strategy was unveiled in the annual government work report, encouraging traditional industries to use the internet to run key aspects of their business and find new business models.

As a result, China's mobile infrastructure has developed with remarkable speed (see Figure 1.3). According to China internet Network Information Center (CNNIC)'s most recent

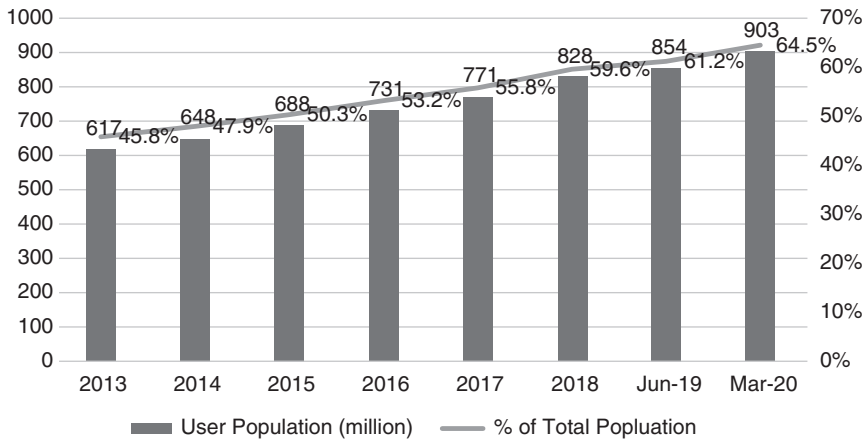


Figure 1.3 China’s internet population jump with mobile internet

Data Source: CNNIC, March 2020.

annual report, March 2020, China had the world’s largest internet user population of 903 million, representing a penetration rate of 64.5% (of a 1.4 billion population) and a 50% increase from the internet user number of 2013. The percentage of those using mobile phones to go online exceeded 99% (897 million). Since 2013, China has been the largest e-commerce market in the world. (For the mobile economy’s early development, refer to the author’s 2016 book *China’s Mobile Economy – Opportunities in the Largest and Fastest Information Consumption Boom.*)

In recent years, new policies have a much broader goal of digitalizing the whole economy (instead of only the internet sectors) with the latest digital and data-driven technologies (beyond internet connectivity). In 2017, “**Digital Economy**” as China’s future economic model was put into the government work report for the first time (also referred to as “Digital China”), and the AI flavor was soon added in 2019 with the notion of “**Intelligence Plus**”. The market expects far more profound transformation of China’s economy to come from “intelligence +” than from earlier years of “internet +”, and

that's also why the next phase of development is referred to as the “second half game” of the mobile internet economy.

The State Council's 2019 work report highlighted the importance to “create **industrial internet** platforms and expand Intelligence Plus initiatives to facilitate transformation and upgrading in manufacturing”. The industrial internet concept involves the broader adoption of advanced consumer and industrial applications that are powered by digital infrastructure and data analytics, which is in line with China's wider ambitions to lift its industries up the value chain and better compete globally in emerging technologies, dubbed the Fourth Industrial Revolution by the World Economic Forum (WEF).

Further, in 2020, China's central government issued an economic policy guideline to include “data” in “factors of production”, joining the traditional elements of land, labor, capital, and technology, for which the government will take key measures to accelerate the cultivation of the “**data market**”. Under this framework, personal data management and protection, unified industry data standards, public and private data sharing, among other key issues of the digital economy, are seeing accelerating development. (Data law developments are discussed in Chapter 8.)

Eventually, all these concepts are summarized by the “**New Infrastructure**” initiative in the Government Work Report, delivered by Premier Li Keqiang in May 2020, which aims to vastly enhance internet infrastructure to spur digital consumption and encourage the development of apps for online working, distance learning, telemedicine, vehicle networking, and smart cities (see Figure 1.4). “We will step up the construction of new types of infrastructure. We will develop

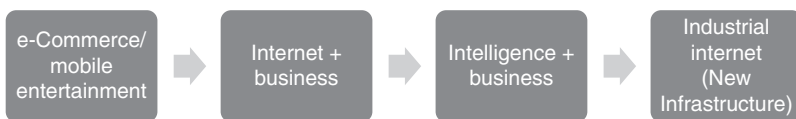


Figure 1.4 From “information consumption” to “digital economy”

next-generation information networks and expand 5G applications. We will build more charging facilities and promote the wider use of new energy automobiles. We will stimulate new consumer demand and promote industrial upgrading," said Premier Li.

This new infrastructure push comes from the central government, local provinces, and related ministries like MIIT (Ministry of Industry and Information Technology). In total, China is expecting, over the next five years, to top more than 27 trillion RMB (close to US\$4 trillion) in new infrastructure construction and related investments, according to Haitong Securities. Compared to traditional infrastructure, such as roads, railways, and bridges (which were the main form of investment stimulus in China during the previous global financial crisis in 2008–2009), the “new” represents infrastructure built on advanced digital technology—it’s infrastructure that’s data driven.

At the center of new infrastructure is the next-generation (5G) wireless networks for data transmission. The 5G technology’s most visible advantage is its data transfer speed, which is expected to be 1000 times more powerful than 4G technology. The high-speed and highly stable 5G services are expected to encompass wireless applications far beyond basic internet communication to include smart cars and advanced manufacturing. Ultimately, 5G is for the “Internet of Things” (IoT), a loose term used to describe a network of mobile internet, smart devices, home appliances, and any physical objects through cloud technology. For example, the faster data transmission by the 5G technology is expected to provide a constant and reliable stream of real-time street data for driverless cars to function effectively and safely.

Based on the superfast cellular 5G networks, advanced applications of AI, blockchain, cloud computing, and Big Data analytics are expected to make major breakthroughs. Together, they form the tech infrastructure of China’s digital economy, which can be summarized as 5G iABCD (see

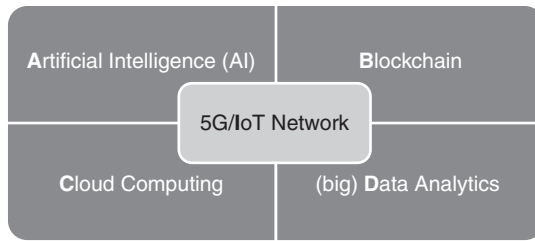


Figure 1.5 New infrastructure – 5G iABCD

Figure 1.5). Companies from every sector of the economy are set to embrace this “full suite” of information technologies for enterprise purposes.

Just like AI and blockchain, China’s Big Data and cloud computing market is growing at a rapid clip. In recent years, data centers—secure facilities that house large-capacity servers and data storage systems—have been built at a breathtaking pace to catch up with the explosive demand of data services. The latest from the Chinese government is to build “industrial big data” centers nationwide, such that massive amounts of “industrial big data”—mostly manufacturing and production data—can be utilized to advance the capabilities of traditional industries.

These data facilities are used by enterprises to remotely store large amounts of data, manage their business applications, and host cloud computing operations. Thanks to the cloud units of internet companies like Alibaba and Tencent, China has emerged as a global leader in data-intensive computing. Alibaba Cloud, for example, was formed to provide cloud services to Alibaba’s business network, and increasingly external enterprise customers. As the following two sections show, the digital platforms not only help industrial companies’ digital transformation, but also provide an important infrastructure for tech startups’ innovation. In short, the Chinese internet companies that emerged from the mobile internet boom are becoming the technology infrastructure of China’s digital economy.

Digital Transformation in the Cloud

Regarding China's new infrastructure and enterprises' digital transformation, Alibaba Group and its Alibaba Cloud are a perfect example. During the mobile revolution, all Chinese companies started to digitalize their business data and internal systems, and they are increasingly migrating operations and data to the cloud infrastructure (until recently, most of them still rely on local computing in their own data centers). Though Alibaba is mostly known for its e-commerce empire and Singles Day, it has become the first company in the world to run all core business systems on its own public cloud platform. Moreover, its fast-growing cloud computing business further supports other Chinese businesses' cloud-migration journey.

For background, Cloud technology (also known as "cloud computing") means that servers, data storage, databases, networking, software, and analytics are hosted on the internet and stored on large, privately owned data centers. The cloud provider enables end users to "rent" and remotely access IT resources from cloud providers on a pay-per-use basis, which provides an efficient alternative to the local hosting and operation of IT resources. Businesses subscribe to cloud services and pay either a monthly or annual fee, just like buying electricity from a power grid. This fee is determined by the amount of data and number of users a business requires – making it easier for a company to scale its operations up and down. Overall, cloud computing provides both improved system scalability and cost savings over traditional IT infrastructure.

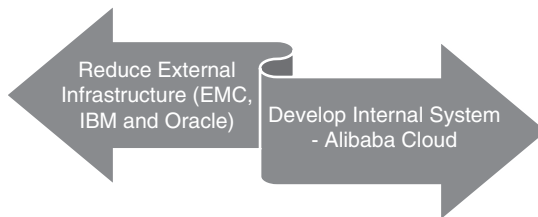


Figure 1.6 Alibaba's IT infrastructure goes internal

As Alibaba's e-commerce businesses have enjoyed explosive growth in recent years, an upgrade of its own internal systems was much needed. Rather than continuing to procure expensive equipment and services from **Oracle**, **IBM**, and **EMC**, Alibaba began replacing its existing IT infrastructure with in-house systems and migration to the cloud. Consequently, Alibaba Cloud was formed to provide cloud services to Alibaba's business network. Today, Alibaba Cloud is also Alibaba Group's cloud computing business for external corporate customers, offering a complete suite of services such as database, storage, network virtualization services, Big Data analytics, elastic computing, large scale computing, machine learning, and IoT services.

Alibaba Cloud has played a major role in educating the domestic market about the benefits of cloud computing, and it maintains its leadership position by developing solutions that enable the digital transformation of businesses across industries. During the last quarter of 2019, it reached two important milestones. First, the cloud computing business for the first time generated over 10 billion RMB of revenue (about US\$1.5 billion) in a single quarter. Second, ahead of the 11.11 global Shopping Festival in 2019 (see the details in Chapter 2), Alibaba Cloud enabled the migration of the core systems of Alibaba e-commerce businesses onto the public cloud. This internal migration is a major milestone that not only generates greater operating efficiencies for Alibaba, but also encourages more companies to adopt its public cloud infrastructure.

According to Alibaba, the performance, reliability, and agility of the core ecommerce platform increased drastically after completely moving onto its public cloud. ("Alibaba is like a high-speed jet that is capable of upgrading its engine during the course of flight", one Alibaba executive said.) The next step for the company is to share Alibaba experience with its customers. As such, the investment and adoption of the cloud in China are growing rapidly. According to Canalys' statistics in March 2020, Alibaba Group is China's largest provider of public cloud services, taking almost half of the market.

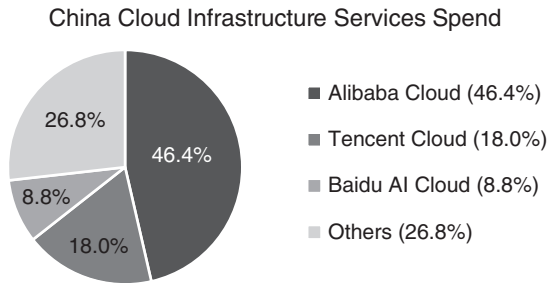


Figure 1.7 Alibaba Cloud leads the Chinese market

Data Source: Canalys, March 2020.

(See Figure 1.7. Tencent and Baidu, two major internet companies, are also sizable cloud service providers.) According to Gartner’s April 2020 report, Alibaba Group is the world’s third largest and Asia Pacific’s largest Infrastructure as a service provider by revenue in 2019.

As the Alibaba Cloud case illustrates, Chinese internet companies have turned themselves into tech companies, and they subsequently help companies from all sectors of the economy to digitally transform. Across just about every industry sector, Chinese companies are investing heavily in research and development of the latest digital technology. The consensus is that digital revolution is more than simply advancing e-commerce through mobile platforms. The more profound value creation is to find incremental consumption demand and new business models, where traditional industries use new set of digital tools to run key aspects of their business.

In other words, digital transformation is more about “digital thinking” than “internet adding”. The companies will become “smarter” by fusing institutional human knowledge with machine learning, and their increased efficiencies, faster decision making, and cost savings will all lead to better customer experiences.

For example, the traditional retail industry has been completely remodeled, thanks to the largest mobile e-retailing market in the world. Retailers are forced to move away from

the out-of-date perception that e-commerce is merely another sales channel for their products, as it is critical for customers to get the same products, services, and shopping experience in every channel where they choose to make purchases. To meet the demand of tech-savvy customers, retailers must provide a “seamless omni-channel shopping experience” by integrating their online and offline channels, instead of having separate systems to sell products online and offline. Hence, the trend of “new retail”, where the boundaries between online and offline are disappearing.

During the 2020 coronavirus pandemic, new digital tools have proven to be a lifeline for China’s small retailers as the pandemic disrupts business models and consumer behavior. Small merchants—including many with little or no previous online presence—have flocked to live-streaming to boost sales at a time when consumer habits are changing faster than ever. The video streaming has the advantage of enabling live interaction—consumers can send questions and comments that appear on the screen in real time, and sellers can explain and showcase their products in a personal way. In this context, new retail is more about generating demand by exciting people and creating an experience. (The detailed “new retail” cases are discussed in related chapters in Part Two.)

For instance, Chinese shoe retailer **Red Dragonfly** – which closed almost all of its 4000 physical stores due to the coronavirus pandemic—has leveraged video streaming platforms to move its operations online. The store clerks are trained to run regular live streams to reach, virtually, shoppers still wary of confined spaces and to answer customers’ queries online much as they would deal with in-store visitors. Foreign brands too have joined in the scramble to engage homebound Chinese consumers. Luxury product maker **Louis Vuitton** hosted a live-streaming sale in March 2020—the first time since the brand entered the Chinese market 30 years ago. Global automakers such as **BMW** have hired professional livestream hosts to introduce their various car models.

For every business sector, the transition from an industrial economy that favored mass production and scale (which is “product driven”) to a digital economy that favors user connectivity, data, and their personal preferences (which is “user driven”) is challenging the very nature of the “core competence” long held by the sector and its leading companies. What’s promising is that the tremendous revolution in e-commerce and retailing could be similarly applied to other industries when they embrace the digital transformation:

- **Responsive to market demands.** New applications are driven by the needs of the market, aiming to solve the “pain points” of existing services and practices.
- **Keeping agile for new product development.** Companies adapt their offerings quickly based on the “local needs” of Chinese consumers.
- **Deep integration of online to offline businesses.** Online experience is not enough (a shocking concept after many years of mobile e-commerce boom) and must be complemented with offline services.
- **Emphasize a platform instead of single product offering or a specific vertical business.** An ecosystem offering multiple connected products and services is more resilient.

For example, the Chinese insurance market is witnessing a remarkable pace of innovation, which started with the basic “internet +” before undergoing a shakeup of the industry. The insurance companies have moved through four phases in their digital evolution (see Figure 1.8), resulting in more direct engagement with customers and more tailored products for



Figure 1.8 From “Internet +” to data-driven digital economy

them. Furthermore, smart technologies are now revolutionizing the core operations of insurers, such as damage assessment for car accidents. The four phases are as follows:

The first phase involves setting up online channels to reach both customers and insurance agents and automating back-end processes, including underwriting and claim processing. **The second phase** involves creating digital services to help customers with related offline activities, such as making a doctor's appointment through a mobile app. Through the first two steps, companies increase the number of customer interactions and strengthen their connection to customers. **The third phase** then involves consolidating customers' online and offline data to provide more personalized solutions based on the improved understanding of customers.

The rewards are significant for issuers with successful digital implementations. Not only can they engage directly with customers to provide seamless interactions on products and services, but also gain access to comprehensive customer profiling information to win in long-term competitions on customization. According to Tencent's statistics in 2018, the online insurance purchase in China had an 18-fold increase in the past five years, covering a total number of 220 million insurers.

The fourth and latest phase is the most exciting, which involves using smart technology and data analytics to revolutionize the core insurance business. For example, AI has been successfully put into vehicle insurance. Alibaba's financial arm, Ant Group, has developed Ding Sun Bao (Damage Assessment Tool), which aims to standardize damage assessment and make it more objective, reducing the potential for human adjusters on the scene to be influenced by the drivers involved. This digital tool is already adopted by large insurers, including China Taiping, China Continent Insurance, Sunshine Insurance Group, and AXA Tianping.

Ding Sun Bao can remotely collect photos of external vehicle damage, analyze them using AI-driven, deep-learning

image recognition technology, reconstruct the scene of the accident, and assess the damage. One advantage is it makes damage assessment more objective, reducing the risk that claim handlers on the scene could be influenced by drivers involved in an accident; hence, there is a higher degree of accuracy in damage assessment. Another advantage is that through machine learning, it can process claims within a few seconds, much faster than human adjusters alone could handle.

At the first launch of DingSunBao in June 2017, Ant Group set up a challenge between “six experienced human claims adjusters” and its AI program. Each team evaluated 12 cases, during which DingSunBao took six seconds to assess the damage and set claim amounts, whereas human adjusters took 6 minutes and 48 seconds to reach their conclusions. Both judged that one of the 12 cases required further investigation. In May 2018, Ant Group launched version 2.0 of its DingSunBao app, which was upgraded into a video-based AI application.

With the upgraded version, car owners can use their smartphones to capture video clips of their cars for submission. Vehicle damage information is displayed automatically, including where and how to repair the vehicle and how much the car owner can claim from insurers, saving time in filing claims and offering transparency on what’s likely to be covered. According to Alibaba, this new version’s secret sauce includes 46 patented technologies, such as simultaneous localization and mapping, a mobile deep-learning model, damage detection with video streaming, a result display with augmented reality, and others. More industry transformation is coming as Ant Group is now using blockchain technology as the new infrastructure of insurance claims processing.

In 2020, the COVID-19 outbreak gave a digital transformation lesson to almost every industry. From a technology perspective, the outbreak has given a push to many new technologies such as drones and robots, as authorities seek to better

detect and respond to the disease. Autonomous robots have replaced human cleaners at segregated wards. In rural areas, local authorities are using drones equipped with loudspeakers to alert citizens seen in open areas without face masks. In particular, it accelerates Chinese companies' shift to the cloud as enterprises try out cloud initiatives to facilitate remote working and remote interactions. For companies managing their internet infrastructures, making adjustments to computing needs on the fly is expensive and complicated. Cloud computing makes it easier.

On the other hand, many pandemic-driven new business practices will remain part of daily life. For example, live-streaming is now an important shopping channel, with or without the "home stay" order, and the digital platforms are developing enhanced services for livestream hosts with new digital technologies, such as 5G and AR- (Augmented Reality-) powered features. With a strong sense of urgency, all companies are rushing to learn how new 5G iABCD digital technologies can be integrated into their businesses to unlock value from nontraditional angles. The digital transformation of China is accelerating.

BaaS Startup Innovation Ecosystem

With government endorsement in the background, a dynamic ecosystem of entrepreneurs and startups is organically being built up and rapidly expanding (see Figure 1.9). The network of established internet firms and their seasoned entrepreneurs, endless eager talents, abundant angel investors and venture capital, and a sophisticated manufacturing system are collectively making China one of the most interesting centers of innovations in the world.

The core of this ecosystem is a network of "graduated Chinese entrepreneurs" from established tech firms at home and abroad. Around their passion for new startups, there seems to be an endless supply of venture capital, young talent, and

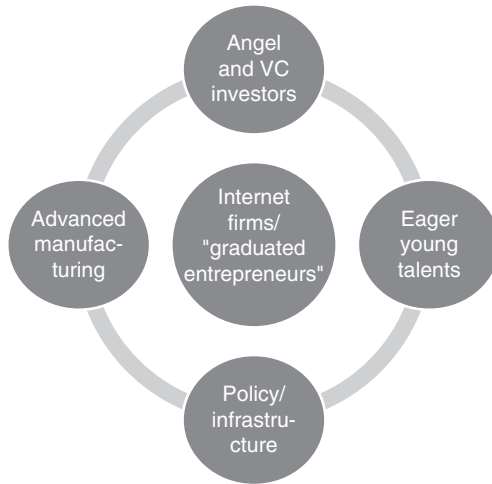


Figure 1.9 China's innovation ecosystem

government support. This development resembles the multiplying effect seen in the Silicon Valley ecosystem in the last few decades, where generations of innovators, from Intel, Netscape, Google, and PayPal, have created waves of startups. Whereas the previous generation of China internet companies was mostly copycat versions of Western sites, the new generation startups are creating a remarkable wave of innovation that challenges the long-held perception of “Made in China” copycatting.

Among 5G iABCD (see Figure 1.5), the blockchain is the latest addition to the startup scene. Thanks to fresh endorsement from China's central government, the blockchain industry is experiencing a boom. According to the China Internet Report 2020 by SCMP (*South China Morning Post*) Research, about 80% of the top tech companies recognized by the SCMP have either run a blockchain project or invested in blockchain technology. Scores of blockchain startups are popping up daily, even the coronavirus hasn't been able to keep them down.

For example, because food scandals—ranging from rice grown in cadmium-tainted soil to infant formula tainted with

melamine—is widespread in China, blockchain is used to support supply chain transparency and auditability to reassure consumers wary of food safety. In June 2019, Walmart China entered into a partnership with consulting firm PricewaterhouseCoopers (PwC) and blockchain firm **VeChain** to create the Walmart China Blockchain Traceability Platform.

VeChain is a Shanghai-based blockchain provider specializing in governance and business ecosystems. They have created a tokenized public chain called VeChainThor. The companies work together to provide real-time traceability throughout the supply chain, which has traditionally been challenging due to fragmented data sharing systems that are often paper-based and can be error-prone. Built on the VeChainThor blockchain, the traceability platform enables shoppers to track consumer goods back to their source, inspection, and shipping.

Amid the coronavirus pandemic, startups like Hyperchain launched a blockchain-based platform to improve donation efficiency. In February 2020, the blockchain startup teamed with China **Xiong'an Group Digital City Corporation** (as the name suggests, it is the company that operates the blockchain city of Xiong'an) to create a donation tracking platform called Shanzong, which means “trace of good deeds” in English. At a time when some traditional charities like the Red Cross have come under fire for poor distribution of resources to people in need, Shanzong tracks what kind of donations are given, from money and masks to medical materials, how they have been matched to areas of need, and when they have been delivered, according to a Hyperchain statement.

In fact, China is shown as dominating in the 2019 Global Blockchain Invention Patent Ranking report from IPRDaily, a Chinese intellectual property news site. It would appear that China is predominantly driving the world in the utilization and development of blockchain technology. According to the report, China accounted for the top three spots, seven of the top 10 and 19 out of 30, and the Chinese companies

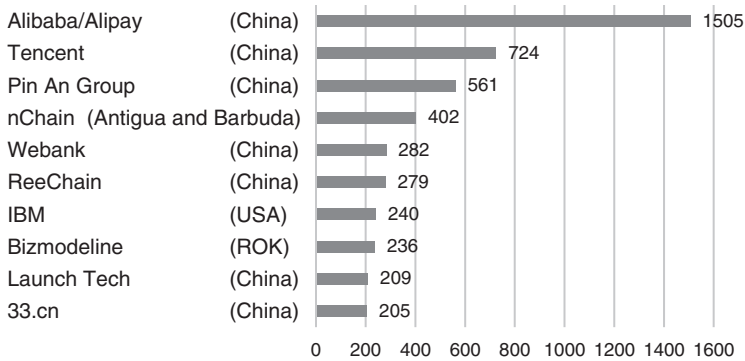


Figure 1.10 Global blockchain patent application 2019 ranking

have represented about 70% of the world’s global blockchain patent applications (see Figure 1.10). Alibaba and its financial arm, the Ant Group, have by a wide margin filed the most patents identified with blockchain on the planet.

With an initial public offering (IPO) announced in August 2020 and targeting a valuation of more than \$200bn, the Ant Group is the world’s highest valued financial technology (or fintech) company—and most valuable private tech startup globally. Its Alipay is China’s largest mobile-payment network, spanning 900 million users, and it also operates one of the country’s largest investment products platforms, lends to individuals and small businesses, and operates a credit-scoring system based on customer data analytics. (See the detailed case study in Chapter 5. The company was known as Ant Financial until June 2020, when its official Chinese name was changed to “**Ant Technology.**” A spokesperson said the company wants to be referred to in English as “**Ant Group Co.**”, better reflecting its role as “an innovative global technology provider” to businesses.)

Of course, most blockchain protocols are open source. Therefore, the ranking of blockchain patent applications is not directly equivalent to blockchain technology innovation power. Nevertheless, the increase in the number of blockchain patents demonstrates a developing interest by China and

business organizations like Alibaba, which has been on the top since 2017. Furthermore, Alibaba, Tencent (ranked No. 2), and other firms also provide blockchain platform infrastructures for the market (BaaS – blockchain as a service). Their BaaS services provide an important link between blockchain architecture and the enterprise-level blockchain projects.

These BaaS services enable blockchain entrepreneurs to focus on building new applications, leading to a wave of young blockchain companies in China. For example, Tencent is collaborating with Waterdrop, a crowdfunded health insurance firm, to develop a medical and insurance solution leveraging blockchain technology. Tencent plans to integrate the solution into its WeChat messenger, which will help more than one billion Chinese users to access their medical bills conveniently and securely. The solution will also benefit medical institutions and insurance firms by facilitating an efficient billing system to prevent claims from fraudulent invoices.

In the coming years, the pace of innovation will continue accelerating. For one thing, established tech firms, as well as up-and-coming companies, serve as useful infrastructure for next generation tech startups. For another, the synergies of 5G iABCD are gradually taking shape. The different technologies can feed into each other and create an ecosystem of automation—IoT devices collect data on millions of criteria, which is then collated in the cloud and managed by Blockchain, analyzed by Big Data, and used to train and improve AI algorithms for real life applications. As 5G iABCD technologies interact and improve each other, the huge synergies will spur more innovation in China (see Figure 1.5).

Splinternet and the Digital Silk Road

China's rapid digital transformation has had profound implications for global stakeholders dealing with the China market. Foreign investors are richly awarded, and consumer goods companies see an emerging market filled with opportunities

from an expanding middle class. Overseas users are adopting smartphones and mobile apps created in China, but Silicon Valley tech giants are taking notice of new competition arising from Asia. Today, many Chinese companies are looking to expand overseas, and their impact is increasingly felt by foreign investors, consumers, startups, and industry companies across the globe.

Their overseas expansion has accelerated since China started the “Digital Silk Road” (**DSR**) initiative in 2017. The DSR is the new digital dimension of the “Belt and Road Initiative” (**BRI**), which was launched by the Chinese government in 2013 to promote cross-continent trade through major infrastructure investments. Whereas BRI has been commonly associated with physical infrastructure projects, such as roads, railways, energy pipelines, and ports, the DSR will bring advanced IT infrastructure to the BRI country, such as broadband networks, e-commerce hubs, and smart cities.

In DSR, China sees its burgeoning digital economy as a success story that can be shared with emerging markets, and it has also become a partner for other countries’ digital revolution (see the detailed DSR discussion in Chapter 10), including examples such as:

- **Localized solutions.** Baidu has opened a language processing lab in Singapore to improve its search applications for speakers of Southeast Asian languages, and it has launched a localized version of its search engine in Brazil.
- **Smart infrastructure.** Alibaba Cloud has set up data centers in Indonesia, offering a reliable and cost-effective cloud product and services to Indonesian businesses, particularly small to medium-sized enterprises (SMEs) and startups;
- **Education.** Alibaba set up worker training programs in Malaysia to teach small and medium-sized enterprises to sell their products on Alibaba platforms;

- **Investing into new startups.** Tencent and Didi Chuxing, among others, have invested in the ASEAN car sharing apps, including Grab and Go-Jek, which surpassed the global ride-hailing service Uber in Southeast Asia. (Notably, Chinese capital has also actively invested in Silicon Valley, but in recent years, such investments have plummeted due to tightened US CFUIS investment regulations.)
- **Global M&A transactions.** In early 2018, a Chinese investment consortium acquired a majority stake in London-based data center operator Global Switch, in a series of transactions worth more than US\$3 billion. Just like investing into new startups, these M&A deals aim to find synergies between overseas companies and the Chinese market.

Not surprisingly, the latest addition to the DSR is, again, the blockchain. In April 2020, China launched the Blockchain Services Network (**BSN**), which is a critical part of China's national blockchain strategy that was announced by President Xi in late November 2019. The BSN is an ambitious effort to include as many blockchain frameworks as possible and make them accessible under one uniform standard on the BSN platform. As such, it's the largest blockchain ecosystem in China, and in the DSR context, it is rapidly expanding its network overseas.

According to its official announcement, the BSN promotes low-cost development, deployment, and maintenance of consortium blockchain applications. Just like building a simple website on the internet, developers can deploy and operate blockchain applications conveniently and at extremely low cost. So far, no blockchain project has yet found widespread commercial usage globally. By significantly reducing entry barriers for blockchain application developers, the BSN can potentially drive significant innovation in traditional businesses across countries, which would have profound implications for cross-border applications from finance and payments to commerce.

As China's digital economy gains increasing global influence, the global economy sees China in Asia and the United States in the West forming two leading innovation centers of the world. Chinese and US companies represented 90% of the total market value of the top 70 digital business platforms, according to the United Nation's 2019 digital economy report. The two innovation centers have different strengths, but are also highly connected—the United States is the incubator of original technologies, and China is the best market for commercialization. Thanks to its largest user population, China excels at incremental innovation, but still lags the United States in transformational, science-based innovation.

Until recently, the two markets enjoyed a cross-border flow of ideas, capital, and talents. Silicon Valley operated on three key ingredients: code, connections, and cash, and the Chinese link brought in abundant supply (before the recent US–China tech and trade tensions). Chinese engineers churned out plenty of the first, and Chinese venture capital brought an infusion of the second and third (see Figure 1.11). (As a cross-border investor, the author used to focus on US investments that had a strong potential synergy with the Chinese market from a commercial perspective as well as Chinese portfolio companies that sought to globalize in overseas markets.) The two-way bridge

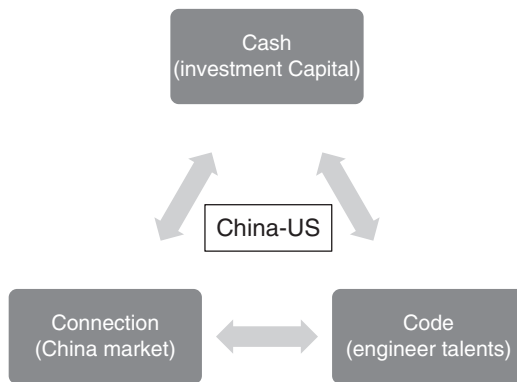


Figure 1.11 The 3C transpacific synergy (of yesterday)

created synergies and speeded up startup launches, innovation, and scale on both sides of the Pacific Ocean.

However, investment from China into US tech companies quickly slowed in August 2018 after the Trump administration stepped up vetting of deals over national security issues in American critical technologies. One key driver is that, with focused policy and substantial investment by its government, and the unrivalled user data pool, original 5G iABCD innovation is advancing in China, which, in more and more fields, is in head-on competition with the United States. Another important factor is, for each country, the data used to train AI models are locally managed and carefully guarded, as tech innovation is now of national security and geopolitical significance.

Even after the US–China phase I trade agreement (“a truce”) was reached in early 2020, the tech war has shown no sign of easing. For example, stoked by the COVID-19 pandemic, the short video app TikTok was second in downloads to the Zoom video-conference app in the first half of 2020, according to market-research firm Sensor Tower. Since 2019, US lawmakers have been calling for an investigation of TikTok’s relationship with its Beijing-based parent company (ByteDance) and the Chinese government. In July 2020, Secretary of State Mike Pompeo suggested that the United States is considering banning TikTok because it views the popular social media app as a security threat – despite the fact that TikTok had spent much of the previous 12 months trying to distance itself from its Chinese roots.

And the blow came more quickly—and broader—than everyone anticipated. Weeks later, on August 6, US President Trump issued sweeping bans against TikTok and fellow Chinese tech app WeChat (the “superapp” owned by Tencent), citing concerns that TikTok and WeChat collect “vast swaths of information from its users”; i.e., from US users. On top of that, Trump issued another executive order within a week, ordering ByteDance to divest the US operations of TikTok within 90 days.

In response, ByteDance and TikTok filed a lawsuit against the US government, challenging the president's executive order that bans US companies from doing business with them on national security grounds. According to a ByteDance statement, that executive order was issued "without any due process". Noteworthy, TikTok's lawsuit did not challenge the order to divest its US assets, and Microsoft and Oracle and other private investors immediately started a bid for TikTok's businesses in the US, Canada, Australia, and New Zealand, in the hope that the TikTok platform could bring significant synergies to their existing consumer-facing businesses.

Regarding the popular messaging app WeChat, the order would bar "any transaction that is related to WeChat". In response, a group of WeChat users formed the US WeChat Alliance Group, a nonprofit group (not affiliated with the app's owner Tencent), which then filed a lawsuit against the Trump administration's executive order, calling the prohibition unconstitutional. Interestingly, because the WeChat app is ubiquitous in China, more than a dozen major US multinational companies raised concerns in a call with White House officials that such a ban could undermine US companies' competitiveness in China, according to *Wall Street Journal* reports.

Compared to mobile apps popular among teens, the advanced tech industry is the big boy version of that. Huawei and ZTE, China's two major telecommunications systems makers, have been banned from buying US microchips for their 5G network push. More recent additions to the trade blacklist are eight Chinese artificial intelligence companies, including AI national champions SenseTime, Megvii, and iFlyTek. (As its New Year's message, Megvii said in the first post on the company's official WeChat account in 2020 that being added to the US "Entity List"—which bars it from buying US-origin technology—had actually turned into a "coming of age gift" that had taught the company how to face a complex and changing international environment.)

As a result, these US actions have firmed up China's resolve to cut reliance on US tech smarts and to grow its own core

technologies. Relating to microchips, for example, in October 2019, China set up a new national semiconductor fund (its second in less than five years) with 204 billion yuan (US\$28.9 billion) – its predecessor was capitalized with US\$20 billion in 2014. The new fund has an ambitious goal to cultivate China’s complete semiconductor supply chain, from chip design to manufacturing and from processors to storage chips.

What’s next for the United States? It’s setting up its own sovereign funds to develop 5G network technology, a field in which Chinese company Huawei is the global leader. The battle for digital tech supremacy is on, and this process of the United States and China “designing out” each other’s technologies will continue. (See more details in Chapter 9. Also, refer to the author’s recent book *The Hunt for Unicorns: How Sovereign Funds Are Reshaping Investment in the Digital Economy*.)

Emblematic of this “decoupling”, nothing so far has been as literal and dramatic as a severed data cable that potentially links the two sides of the Pacific. The Pacific Light Cable Network (PLCN), a high-capacity fiber-optic cable project started before 2018, was a joint venture among Google, Facebook, and a Chinese telecommunications company called Dr. Peng Telecom & Media Group, which is the fourth-largest telecom company in China (see Figure 1.12). The cable would run about 8000 miles (13 000 kilometers) and was intended to be a high-speed trans-Pacific data route between the United States

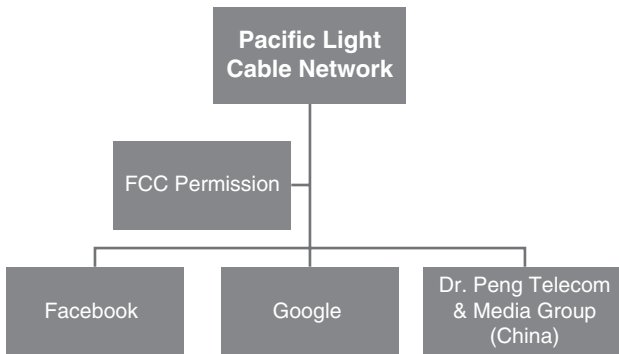


Figure 1.12 The Pacific Light Cable Network

and Hong Kong/China. In 2020, the US government formally denied the Hong Kong link, and Google and Facebook (with Dr. Peng out of the picture) accepted the reality of having to operate just the two fiber pairs owned by the American companies: Google's link to Taiwan and Facebook's to the Philippines.

This is a vivid example of the “splinternet,” or separation of Eastern and Western technology worlds, that is coming, and quickly. In the past decade, companies like Google and Facebook have made significant investments into similar cables to handle ever-growing network traffic between the United States and Asia. Now, the national security considerations are changing the way that Internet connectivity across the Pacific is structured. Because subsea cables form the backbone of the internet, by carrying 99% of the world's data traffic, the rules of internet connectivity between the United States, China, and the whole world is being dangerously rewritten.

All in all, a US–China tech decoupling is real and accelerating. Hence, the digital economy is in a vital conflict and crisis: the global tech world, together with at least part of the world economy, is now fractured into two—and potentially more, considering Europe, Japan, and other regions—spheres of influence, whereas tech entrepreneurs are driving the prospect of a technological singularity, hyper-connected society, and internet of everything. The tech companies are only now waking up to the fact that their platforms in the future are going to be a lot less globalized.

Therefore, it is critical for the United States and China, the two tech superpowers, to reach a new equilibrium to collectively lead the future 5G iABCD innovation with the rest of the world. Otherwise, the cross-border flow of capital, talents, and data, which the global economy has taken for granted, is at risk. That is why the Digital Silk Road—at least its concept of global connectivity—is such an important concept to start a global digital economy dialogue. As the G20 leadership together declared at the G20 2016 Summit in Hangzhou, China: collectively, the digital economy revolution will build an innovative, invigorated, interconnected, and inclusive world economy.