



U.S. Senate Finance Committee  
Subcommittee on Fiscal Accountability and Economic Growth

Hearing  
on  
Defending and Investing in U.S. Competitiveness

July 14, 2021 – 2:00 p.m.  
Virtual via WebEx

Statement of Yaya J. Fanusie  
Adjunct Senior Fellow  
Center for a New American Security  
Chief Strategist  
Cryptocurrency AML Strategies

### **China's Fintech Strategy: Seeking to Dominate the Next Data Revolution**

Chair Warren, Ranking Member Cassidy, the distinguished members of the subcommittee, and my fellow panelists, it is an honor to participate in today's hearing. Please allow me to add that although I do consulting with the private sector on financial technology issues, my comments today are my personal opinion and are not on behalf of any clients.

Today, I will explain how the Chinese government's recent foray into financial technology (fintech), including by investing heavily in blockchain technology and piloting a central bank digital currency, is a long-term strategy to dominate the digital economy of the future. This strategy is a new financial dimension to the great-power competition between China and the United States. But it is about more than money or currency. It is really about data. Specifically, it is about which country will be most successful at leveraging data for technical innovation, to set the standards for new global financial infrastructure, and become the anchor for the information revolution that is on the horizon. The Chinese Communist Party (CCP) intends to upend the United States' leading economic and geopolitical status by investing in nascent technologies that the United States is not currently prioritizing and building the digital infrastructure that will drive global commerce and shape the evolution of the internet itself. If the United States does not understand China's fintech strategy and how it fits into seismic technological shifts that are emerging, the United States will not be able to develop an appropriate strategic response and could lose the geopolitical leadership position it has held since the end of World War II. In my testimony, I will explain key elements of China's fintech strategy, how they fit into a continuum of innovations in the world's history of



data revolutions, and recommend ways that the United States must adapt and position itself to compete with China in the 21st-century economy. But first, I'd like to start with some historical context.

From the late 1960s and into the early 1980s, a revolution in humankind's transmission of data occurred, slowly. The internet was born. The infrastructure of the internet was constructed over decades. It was a quiet data revolution. It happened largely outside the limelight because building a network for computers to talk to each other across great distances had little practical value for the broader population, most of which had no direct access to computers at the time. So, creating the internet then was not a profit-seeking endeavour at first. Its impetus was military. At the height of the Cold War, the U.S. Department of Defense funded computer science academics and gave them a long innovation leash.<sup>1</sup> However, the DoD funders tethered the research to an ultimate objective: to build computer infrastructure that would support the U.S. military's information and communication needs around the world.<sup>2</sup> The internet protocol that we all engage in today, known as TCP/IP, emerged in 1983.<sup>3</sup> But it was not until mostly American firms built civilian applications on top of it, such as public websites and private email accounts, that the internet offered mainstream value and revolutionized the world.

No one entity or nation technically owns the underlying infrastructure of the internet. However, it cannot be denied that the United States' decades-long investment in building it enabled U.S. companies to lead the technological and business growth that arose out of the internet's information revolution. This position, however, is being challenged, slowly and steadily, by China. The clearest example of China working to upend America's economic dominance on the internet is its Blockchain-based Service Network (BSN), a state-driven project that has partnered with Chinese private tech firms to build what the Chinese Communist Party believes is the next generation of internet infrastructure. The BSN, like the United States' endeavour to build the original internet, is a decades-long campaign. The BSN vision is an internet environment where data transmits through distributed broadcasting, in which separate applications and business systems can simultaneously access and operate on agreed-upon, authenticated data.<sup>4</sup> This contrasts with current internet processes, where data is siloed between different systems and moves through the internet in a linear fashion. In theory, this upgraded internet would enable an internet of things where all digital things can communicate and transact with each other, enabling a new era of digital

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<sup>1</sup> Ben Tarnoff, "How the Internet was Invented," *The Guardian*, July 15, 2016, <https://www.theguardian.com/technology/2016/jul/15/how-the-internet-was-invented-1976-arpa-kahn-cerf>.

<sup>2</sup> Defense Advanced Research Projects Agency, *ARPANET: Advancing National Security Through Fundamental Research*, [https://www.darpa.mil/attachments/ARPANET\\_final.pdf](https://www.darpa.mil/attachments/ARPANET_final.pdf).

<sup>3</sup> Justin Jaffe, "Happy Birthday, Dear Internet," *Wired*, December 31, 2002, <https://www.wired.com/2002/12/happy-birthday-dear-internet/>.

<sup>4</sup> Yifan He, "Consensus 2021: Rebuilding the Internet with Blockchain Broadcasting," *Coindesk*, May 6, 2021, <https://www.coindesk.com/consensus-2021-rebuilding-internet-blockchain-broadcasting>.



innovation and economic possibilities. But it would be an internet where China owns the underlying infrastructure.

Since blockchain technology emerged with the Bitcoin protocol in 2009, many technologists and entrepreneurs have argued that its distributed architecture model could eliminate long-lasting inefficiencies in data management and dissemination. In theory, this new way of recording and conveying data can revolutionize financial services, supply chain management, media, and government recordkeeping.<sup>5</sup> In practice, these and other industries have yet to be disrupted by the new technology. So blockchain, also known as distributed ledger technology (DLT), today remains an experimental computer science niche with no single private or public sector entity dominating its development. Yet, it is interesting that, instead of dismissing blockchain as over-hyped and underperforming, China is doubling down on it. To understand why, let's look at China's overall approach to new technologies and the state of global blockchain development over the past few years.

### **Building Infrastructure Instead of Applications**

China's research and development (R&D) strategy has two prongs, as described by Yifan He, the BSN's executive director.<sup>6</sup> One approach is to invest in critical technologies that have evident benefits and established applications.<sup>7</sup> Some examples are robotics, semiconductors, and artificial intelligence. However, China faces stiff competition with the United States, which is also prioritizing R&D in these areas. The second approach is to pursue nascent technologies that no country has yet to dominate (and that perhaps most countries ignore). Such technologies may have fewer current applications, but would offer great potential first-mover advantage. Developing blockchain infrastructure is an example of this second approach. Executive Director He also explained that China increasingly prefers to build new underlying technology, rather than develop applications on top of Western-dominated infrastructure. This approach seeks to capture market share at the outset of a relevant new technology. According to He, China's approach is to look 50 to 100 years ahead and then work toward the technological future.<sup>8</sup>

There are reasons why many outside China would ignore or dismiss the BSN. For example, although blockchain technology has received excessive media attention in the past few years, there

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<sup>5</sup> Sam Wood, "Technology vs. Trust: Why this Wharton Professor Thinks Blockchain's Time is Yet to Come," *The Philadelphia Inquirer*, March 11, 2019, <https://www.inquirer.com/business/weed/blockchain-kevin-werbach-wharton-school-mit-press-20190311.html>.

<sup>6</sup> BSN, "Understand China's Pursuit in Emerging Technologies," Medium, June 10, 2021, <https://medium.com/bsnbase/understand-chinas-pursuit-in-emerging-technologies-af2104958a4a>.

<sup>7</sup> Arjun Kharpal, "In Battle with U.S., China to Focus on 7 'Frontier' Technologies from Chips to Brain-Computer Fusion," CNBC, March 5, 2021, <https://www.cnbc.com/2021/03/05/china-to-focus-on-frontier-tech-from-chips-to-quantum-computing.html>.

<sup>8</sup> BSN, "Understand China's Pursuit in Emerging Technologies."



are no blockchain use-cases that have wide adoption except for cryptocurrency trading and speculation. And the largest U.S. software companies that trumpeted the potential benefits of distributed ledger technology in early 2016<sup>9</sup> have mostly shuttered their blockchain service offerings by mid-2021.<sup>10</sup> Blockchain has not led to a massively popular software application that is central to daily life and dominates a consumer market. There's no blockchain killer app yet.

However, this failure to achieve blockchain mass adoption and private sector profitability is similar to what would have happened if U.S. firms had launched internet service business divisions in the 1970s. Computer networking was a niche technology space with infrastructure that was too immature to support any profitable business applications. IBM was producing computers at that time, but the internet likely would not have arisen by IBM or any other private firm trying to build global networking infrastructure single-handedly. The internet arose through computer scientist collaboration where academic researchers iterated upon their protocols, seeking to build common infrastructure for all networked computers. In contrast, in the blockchain space, a wide variety of startups and developer groups around the world have been launching their own blockchain protocols, each one competing with the others and touting its architecture as the best system to eventually deploy new, decentralized applications on the internet.

The Chinese Communist Party views blockchain technology as strategically important, but its assessment appears separate from the blockchain hype of five years ago. It was only in late 2019 that China's President Xi Jinping called on the country to excel in blockchain research and development.<sup>11</sup> In one interview, BSN Executive Director He said that he personally only started looking at DLT in 2018.<sup>12</sup> But much of the global hype around blockchain had already started to fade by this time.<sup>13</sup>

No blockchain killer app has emerged due to the regulatory uncertainty around the technology, the lack of interoperability between blockchain protocols, and the unsustainable costs for startups unable to find product-market fit with unproven tech. However, a cursory study of how the United States developed the internet through government-funded R&D has likely given the Chinese government a more promising blueprint for leveraging blockchain technology, which is to play the

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<sup>9</sup> Jamie Redman, "Microsoft & IBM Declare Blockchain Open for Business," Bitcoin.com, February 17, 2016, <https://news.bitcoin.com/microsoft-ibm-declare-blockchain-open-business/>.

<sup>10</sup> Ian Allison, "IBM Blockchain is a Shell of Its Former Self After Revenue Misses, Job Cuts: Sources," Coindesk, February 1, 2021, <https://www.coindesk.com/ibm-blockchain-revenue-misses-job-cuts-sources>; Joshua Mapperson, "Microsoft Quietly Closing Down Azure Blockchain in September," Cointelegraph, May 14, 2021, <https://cointelegraph.com/news/microsoft-quietly-closing-down-azure-blockchain-in-september>.

<sup>11</sup> "China's Xi Urges Acceleration of Development of Blockchain Technology," Reuters, October 25, 2019, <https://www.reuters.com/article/us-china-economy-xi/chinas-xi-urges-acceleration-of-development-of-blockchain-technology-idUSKBN1X419Y>.

<sup>12</sup> A. J. Cortese, "Red Date is Lowering the Entry Point to the Blockchain Network for SMEs," KrASIA, April 24, 2021, <https://kr-asia.com/red-date-is-lowering-the-entry-point-to-the-blockchain-network-for-smes-inside-chinas-startups>.

<sup>13</sup> Yaya Fanusie, "The Crypto Space is Void," Forbes, December 18, 2018, <https://www.forbes.com/sites/yayafanusie/2018/12/18/the-crypto-space-is-a-void/?sh=3cad8fad70ad>.



long game and pursue decades-long computer science experimentation and collaboration until universal architecture emerges that can support practical applications. But instead of developing internet plumbing that no one owns like the World Wide Web,<sup>14</sup> China's vision of an upgraded internet is more proprietary. The BSN secretary-general commented in late 2020 that the BSN is constructing an online environment where China has "independent intellectual property rights and China controls the rights to internet access."<sup>15</sup>

## Data is the New Electricity

The BSN, as well as China's central bank digital currency, must be understood as part of the Chinese Communist Party's broader fintech strategy. In late 2019, China unveiled a three-year fintech development plan.<sup>16</sup> That strategy focuses more on data than money. The plan calls for China's financial system to get more nimble at acquiring and leveraging data, and to develop a "nationwide integrated big data center."<sup>17</sup> The fintech plan is intertwined with similar CCP directives in recent years promoting the national development of big data analysis and artificial intelligence.<sup>18</sup> The Chinese government aims to collect and centralize as much data as possible for the state's monitoring and management, whether for economic aims or other party priorities.

China's aspirations to lead the internet's evolution rely on data innovation. Digitization, intelligentization, and informatization are terms promoted in recent CCP national strategy documents.<sup>19</sup> While these terms differ slightly in meaning, each is a political directive that involves edifying state knowledge with internet-derived data. Although it is commonly said that "data is the new oil," it is more accurate to say that the Chinese government sees data as the new electricity. Like electricity, data in China is becoming a force to power all applications and economic processes in the country, with individual users (and their devices) connected to national infrastructure.

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<sup>14</sup> "History of the Web," World Wide Web Foundation, <https://webfoundation.org/about/vision/history-of-the-web/>.

<sup>15</sup> See 24-minute mark, "How Blockchain Technology and BSN Support Fintech Development," Youtube, November 4, 2020, [https://www.youtube.com/watch?v=k9Gtg-j\\_3U](https://www.youtube.com/watch?v=k9Gtg-j_3U).

<sup>16</sup> "Chinese Central Bank Releases Fintech Development Plan for 2019-2021," China Banking News, August 23, 2019, <https://www.chinabankingnews.com/2019/08/23/chinese-central-bank-releases-fintech-development-plan-for-2019-2021/>.

<sup>17</sup> "The Central Bank Issued the 'FinTech Development Plan': Strengthening the Development and Application of Distributed Databases," Blocking.net, <https://blocking.net/14752/the-central-bank-issued-the-fintech-development-plan-strengthening-the-development-and-application-of-distributed-databases/>.

<sup>18</sup> Derek Grossman, Christian Curriden, Logan Ma, Lindsey Polley, J.D. Williams, and Cortez A. Cooper III, "Chinese Views of Big Data Analytics," (RAND Corporation, 2020), [https://www.rand.org/content/dam/rand/pubs/research\\_reports/RRA100/RRA176-1/RAND\\_RRA176-1.pdf](https://www.rand.org/content/dam/rand/pubs/research_reports/RRA100/RRA176-1/RAND_RRA176-1.pdf).

<sup>19</sup> Elsa B. Kania, Adjunct Senior Fellow in the Technology and National Security Program at the Center for a New American Security, "Chinese Military Innovation in Artificial Intelligence," testimony to the U.S.-China Economic and Security Review Commission Hearing on Trade, Technology, and Military-Civil Fusion, June 7, 2019, [https://www.uscc.gov/sites/default/files/June%207%20Hearing\\_Panel%201\\_Elsa%20Kania\\_Chinese%20Military%20Innovation%20in%20Artificial%20Intelligence\\_0.pdf](https://www.uscc.gov/sites/default/files/June%207%20Hearing_Panel%201_Elsa%20Kania_Chinese%20Military%20Innovation%20in%20Artificial%20Intelligence_0.pdf); Katja Drinhausen and John Lee, "The CCP in 2021: Smart Governance, Cyber Sovereignty and Tech Supremacy," (MERICS, June 15, 2021), <https://merics.org/en/ccp-2021-smart-governance-cyber-sovereignty-and-tech-supremacy>.



Data also is the lens through which the United States must judge the geopolitical and economic implications of China’s fintech advancement. The best way to do so is to consider what China’s fintech architects say about the data architecture they are building. Again, the planning around BSN exemplifies China’s wide-reaching data strategy.

For example, throughout the world, most discussion on safety systems for self-driving cars proposes capabilities like simple vehicle-to-vehicle communication to allow cars to check nearby vehicles’ current and anticipated movements.<sup>20</sup> Each vehicle would acquire and analyze data emitted from other cars directly, but in piecemeal fashion, through linear transmissions. However, the BSN’s designers propose that blockchain-based broadcast transmission would allow all self-driving cars within a set vicinity to exchange and synchronize data simultaneously, allowing for more efficient and comprehensive analysis of road activity.<sup>21</sup> Assuming transportation and safety authorities also access such broadcast data, these ongoing streams of information could feed hazard monitoring, and help emergency response vehicles map quicker routes to crash sites and medical facilities. In China, such data would be distributed to approved parties, but would likely be centralized for government big data analysis. This constant feed of data would also inform machine learning and lead to greater artificial intelligence capabilities for the government and possibly private entities (like Chinese car manufacturers), if given permissions to the data.

The implications for China’s transportation system and its automobile manufacturing sector would be straightforward: potentially safer roads and more intelligent vehicles and infrastructure. But these enhancements would likely catalyze adjacent innovation in China’s food delivery sector, ride sharing, car insurance, mapping and geolocation software, and countless other areas.

The international implications would arise from the response to one question: Will other nations choose to implement this type of transportation intelligence system, run on capable and tested BSN infrastructure? It should not be assumed that such a complex system could be built outside China without years of R&D. If many major cities around the world plug their transportation networks into the BSN, car manufacturers would be incentivized to either make their vehicles compatible with BSN applications or to develop apps run on the BSN themselves. What would start as a domestic transportation sector innovation in China could transform into a significant hurdle for U.S. automobile industry competitiveness, especially if U.S. regulators prohibit U.S. firms from building BSN compatibility due to national security concerns around data. And as other nations seek the adjacent innovations for other industries operating on BSN’s transportation apps, U.S. firms in those industries could also find themselves at a competitive disadvantage. Even if the BSN is somehow constructed in a way where U.S. data is protected from Chinese government

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<sup>20</sup> National Highway Traffic Safety Administration, *Vehicle-to-Vehicle Communication*, <https://www.nhtsa.gov/technology-innovation/vehicle-vehicle-communication>.

<sup>21</sup> He, “Consensus 2021: Rebuilding the Internet with Blockchain Broadcasting.”



acquisition and regulators allow U.S. engagement, American firms would be forced to develop important business applications on underlying infrastructure run by the Chinese tech sector. This would be the inverse of the relationship between U.S. and Chinese technology firms today.

## **The Digital Yuan is a Long-Term Concern for the United States**

The disruptive potential of the BSN is similar to the risks to the United States around China's Digital Currency/Electronic Payment, which is digitized central bank money known popularly as the eCNY. This new project is better understood more as a new Chinese government-owned data network rather than just as a currency.<sup>22</sup> Like the BSN, the eCNY's implications for economic and geopolitical competition are long term. This central bank digital currency (CBDC) also exemplifies the Chinese government's pursuit of first-mover advantage in nascent technologies.

The eCNY is unlikely to displace the U.S. dollar as the top international reserve currency in the short term or to give China an immediate buffer against U.S. sanctions power.<sup>23</sup> The U.S. dollar is too central to international trade and China's restrictive monetary policies make the yuan, digitized or not, less attractive for global users.<sup>24</sup>

The risk for U.S. displacement comes from the upper hand that China might gain in the long term by developing cross-border financial transaction infrastructure that a significant group of other countries eventually adopt. The eCNY is only in a pilot stage and its monetary and economic benefits for China are uncertain. What is clear is that China is seeking through the eCNY to build a more data-driven financial environment that would enable more technological innovation in its financial sector. For example, in early 2021, the People's Bank of China announced a domestic call for academic research relating to the implementation of its digital currency.<sup>25</sup> In particular, the PBOC sought input on how smart contracts<sup>26</sup> could be integrated with the eCNY, including what legal frameworks would be needed. The central bank also requested research work on

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<sup>22</sup> Matthew D. Johnson, "China's Digital Renminbi Initiative is a Network, Not a Currency," *The Strategist*, Australian Strategic Policy Institute, June 16, 2021, <https://www.aspistrategist.org.au/chinas-digital-renminbi-initiative-is-a-network-not-a-currency/>.

<sup>23</sup> "Digital Yuan Gives China a New Tool to Strike Back at Critics," *Bloomberg*, April 20, 2021, <https://www.bloomberg.com/news/articles/2021-04-20/digital-yuan-gives-china-a-new-tool-to-strike-back-at-critics>.

<sup>24</sup> Yaya J. Fanusie and Emily Jin, "China's Digital Currency: Adding Financial Data to Digital Authoritarianism," (Center for a New American Security, January 26, 2021), <https://www.cnas.org/publications/reports/chinas-digital-currency>.

<sup>25</sup> "Fading shuzi huobi chuangxin yanjiu kaifang keti shengqing zhinan (2021 niandu) [Application Guidelines for the Open Project of Legal Digital Currency Innovation Research (2021)]," The People's Bank of China, March 26, 2021, <http://archive.today/t84QT>.

<sup>26</sup> A smart contract is computer code that executes an agreement programmed within a blockchain platform. See: Stuart D. Levi and Alex B. Lipton, "An Introduction to Smart Contracts and Their Potential and Inherent Limitations," Harvard Law School Forum on Corporate Governance, May 26, 2018, <https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/>.



incorporating the state's digital currency with 5G and internet of things systems in order to spur more innovative payment applications.<sup>27</sup>

Such research and experimentation is likely to give China leading expertise in the global pursuit of CBDCs. This knowledge advantage would put the Chinese government in position to drive the CBDC technical design and policy standards that other nations adopt. Signs of this are visible now. For instance, China is part of a Bank for International Settlements pilot project with the central banks of Hong Kong, Thailand, and the United Arab Emirates.<sup>28</sup> The project, known as the Multiple CBDC or mCBDC Bridge, is testing cross-border transactions between those central banks using a DLT platform. The United States does not appear to be closely involved with the pilot project.

Because China is the largest economy with the most progress in CBDC development, it is likely to have an outsized influence in the multilateral organizations that will recommend CBDC prototypes and standardization. This fits squarely with the CCP's strategic approach: gain the first foothold in a nascent technology and dominate its proliferation as the rest of the world adopts it.

The long-term risk for an alternative cross-border payment system to arise should not be dismissed. U.S. adversaries are not the only nation-states seeking to remove the centrality of the dollar to the global economy. Even central banks in U.S. ally countries are looking to lessen the world's dependence on the dollar. In 2019, the governor of the Bank of England suggested that the international community should construct a new "synthetic hegemonic currency" through a network of CBDCs to facilitate international trade in the long run.<sup>29</sup> The mCBDC bridge seems to be piloting that idea.

If the future global financial system is built on the backbone of CBDC infrastructure, then the nation with the most CBDC expertise is likely to influence how the system is run. And although the U.S. Federal Reserve is conducting some initial CBDC research and plans to release a discussion paper on the topic soon,<sup>30</sup> China is clearly leading in this arena. The People's Bank of China has been researching digital currency since 2014<sup>31</sup> and has released over \$300 million worth

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<sup>27</sup> "Application Guidelines for the Open Project of Legal Digital Currency Innovation Research (2021)," The People's Bank of China.

<sup>28</sup> "Multiple CBDC (mCBDC) Bridge." *The Bank for International Settlements*, 19 February 2021, [www.bis.org/about/bisih/topics/cbdc/mcbdc\\_bridge.htm](https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm).

<sup>29</sup> Mary Carney, "The Growing Challenges of Monetary Policy in the Current International Monetary and Financial System" (Jackson Hole Symposium, Jackson Hole, Wyoming, August 23, 2019), <https://www.bankofengland.co.uk/-/media/boe/files/speech/2019/the-growing-challenges-for-monetary-policy-speech-by-mark-carney.pdf>.

<sup>30</sup> Lael Brainard, "Private Money and Central Bank Money as Payments Go Digital: an Update on CBDCs" (Consensus by CoinDesk 2021 Conference, Washington, D.C., May 24, 2021), <https://www.federalreserve.gov/newsevents/speech/brainard20210524a.htm>.

<sup>31</sup> Fanusie and Jin, "China's Digital Currency: Adding Financial Data to Digital Authoritarianism."





of eCNY to the public in pilots around the country.<sup>32</sup> Those pilot transactions are likely generating immense data for the Chinese government to analyze and learn from.

## **The Oneness of Data**

Data certainly is becoming the new electricity, but not just in China. Big data, machine learning, artificial intelligence, and the internet of things are driving technological innovation in most advanced economies. The world is becoming more, not less, dependent on data moving through the internet. This trend is leading to a oneness of data that would appear to power almost every aspect of our public and private lives.

The prospect of living in a world plugged into ubiquitous and seemingly omniscient data can seem scary, and for good reason. The risks of undermining privacy, strengthening authoritarianism, and increasing digital financial crime are great as more of our life activity operates online. There are also various social spillover effects from our culture getting more fixated and dependent on our devices, screens, and data feeds.

But at a time when advanced economies appear to be near the precipice of a fully digitized existence, now may be the best time for the United States to assert rules of the road for the increasing role of data in our lives. The first step is to accept the inevitability of this technological advancement in data transmission, while managing its societal shape. China's preemptive strategy to gain prominence in blockchain-based broadcast transmission of data is a wake-up call for U.S. innovation. In order to chart a way forward that is consistent with American values, it is essential to understand the long history of data revolutions.

Data is simply information recorded and conveyed in written form. One of the world's first data revolutions occurred around 3000 BCE when the ancient Egyptians began writing on papyrus. That plant-based papyrus technology allowed for ink to be retained more easily on a portable writing surface compared to writing on walls, stone, and clay. Later, the Egyptians began using parchment made from animal skins as a writing tool. Parchment was more durable than papyrus and it became the medium that members of the early Jewish, Christian, and Islamic traditions used to record and spread the Abrahamic message.<sup>33</sup> The Chinese are credited with inventing paper from plant fibers and cloth around the second century CE, but for hundreds of years, it was used very selectively and the art of papermaking was a closely-guarded skill.<sup>34</sup> It wasn't until the rising

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<sup>32</sup> "Spending with China's Digital Yuan Around \$300 Million, PBOC Says," *Reuters*, November 2, 2020, <https://www.reuters.com/article/china-currency-digital/spending-with-chinas-digital-yuan-around-300-million-pbo-c-says-idUSL1N2H00B1>.

<sup>33</sup> Keith Houston, "Hidebound: The Grisly Invention of Parchment," *Longreads*, December 1, 2016, <https://longreads.com/2016/12/01/hidebound-the-grisly-invention-of-parchment/>.

<sup>34</sup> Neathery Batsell Fuller, "A Brief History of Paper," *St. Louis Community College*, July 2002, <http://users.stlcc.edu/nfuller/paper/>.



Islamic civilization in the eighth century CE learned of paper from the Chinese that papermaking received assembly-line-like production. Thus, the scholars of the Golden Age of Islam wrote and reproduced hand-copied manuscripts on paper to transmit the leading scientific and literary knowledge of their time.<sup>35</sup> However, interestingly, the Chinese were the first to invent paper money during the Tang Dynasty between the 7th and 10th centuries CE.<sup>36</sup> Papermaking spread throughout areas under Muslim control and to Europe by the 11th century through the Moorish influence in Spain.<sup>37</sup> Within a few hundred years, paper mills were common throughout Europe. It is important to note that initially, some European rulers resisted paper, seeing it as an unworthy, heathen-derived form of data transmission, especially unsuitable for Christian religious texts, which continued to use parchment.<sup>38</sup> The civilizational tables turned with Johannes Gutenberg's printing press, invented in Germany in 1440. European church leaders initially rejected the new technology, with clergy in France claiming that books duplicated with movable type were "work of the Devil."<sup>39</sup> However, soon, printing press technology spread throughout Europe. It can be argued that the printing press was the most revolutionary technology the world has seen, perhaps rivaled by the steam engine. More books were printed in the 50 years after the printing press than in the previous 1,000 years.<sup>40</sup> It enabled a flourishing of scientific, religious, and philosophical knowledge. Data transmitted through the printing press eventually sparked the Protestant Reformation and seeded the Renaissance. But it was banned by the Ottoman Empire for hundreds of years, which some say accounted for much of Islamic civilization's scientific and economic decline.<sup>41</sup>

Elements within societies often initially rejected a new technology of data transmission due to the concern that it was associated with unworthy individuals or subversive activity. Special interests typically focused on the new technology's downsides, especially the displacement it could cause to established institutions. Many scribes, for example, were disintermediated by the printing press. Today, many people criticize the proliferation of Bitcoin and other cryptocurrencies due to their easy exploitation by criminal elements. But the broadcast data capability of blockchain is not an easy function to dismiss.

Historically, new data transmission technology, when it was better at recording, preserving and spreading information, and in the long run, more cost efficient, has always won out over legacy

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<sup>35</sup> Holland Cotter, "SHELF LIFE; The Story of Islam's Gift of Paper to the West," *The New York Times*, December 29 2001, <https://www.nytimes.com/2001/12/29/books/shelf-life-the-story-of-islam-s-gift-of-paper-to-the-west.html>.

<sup>36</sup> Szczepanski, Kallie. "The Invention of Paper Money in China." *ThoughtCo*, [www.thoughtco.com/the-invention-of-paper-money-195167](http://www.thoughtco.com/the-invention-of-paper-money-195167).

<sup>37</sup> Fuller, "A Brief History of Paper."

<sup>38</sup> Fuller, "A Brief History of Paper."

<sup>39</sup> Tom Wheeler, *From Gutenberg to Google: The History of Our Future* (Washington, D.C.:Brookings Institution Press, 2019), 42.

<sup>40</sup> Keith Houston, *The Book: A Cover-to-Cover Exploration of the Most Powerful Object of Our Time* (New York: W.W. Norton & Company, 2016), 128.

<sup>41</sup> Benjy Cannon, "A Brief History of Disruptive Innovation, Part I," Disruptive Competition Project, August 7, 2013, <https://www.project-disco.org/competition/080713-a-brief-history-of-disruptive-innovation-part-i/#.V081avkrLcs>.



systems. Blockchain technology has similar potential. The “broadcast transmission” of the internet is likely to be the world’s next data revolution. This new capability, if it scales up for mass use, would allow for different parties and different technical systems to operate off of the same data, simultaneously. The ability to harness data in unprecedented ways will likely spur new inventions and new occupations, just as the original internet did. And it eventually would eliminate certain applications, jobs, and business lines. But this data revolution is in its infancy. The United States has time to compete in this technology and influence its development in an American way.

### **American Values and the Oneness of Data**

The oneness of data does not have to become a tool of tyranny and dehumanization if it is molded by the principles of America’s founding. U.S. policymakers, businesspeople, and other stakeholders must consider a framework for participating in this data revolution in a way that fits with the U.S. Constitution. Rising data ubiquity should be anchored with the Bill of Rights. For example, many former U.S. officials are arguing for a digital dollar.<sup>42</sup> If the United States is to develop its own central bank digital currency system, it must be constructed so that the government’s access to data does not violate the Fourth Amendment’s protection against unreasonable search and seizure of one’s “person, houses, papers, and effects.”<sup>43</sup>

Fourth Amendment protection can be threatened by transactions involving digital assets due to their “always on,”<sup>44</sup> trackable nature. Complete access to real-time financial transaction data is not possible in the current banking system where there is no single database (government or otherwise) of everyone’s digital transactions. If the United States launches a CBDC, permission to access CBDC data would need to be strictly controlled and compartmentalized so that the government cannot search one’s digital person without legal probable cause. And CBDC architects would need to design the system so that personal data discovered even under subpoena power is expunged from monitoring and analysis when an individual is no longer considered a legitimate suspect in wrongdoing. This requires smarter information systems than we have in financial regulatory infrastructure today, but, in principle, could borrow from practices in the intelligence community that mask identities of U.S. persons when disseminating FISA-derived intelligence reporting.<sup>45</sup>

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<sup>42</sup> Michael B. Greenwald and Michael A. Margolis, “Why a Digital Dollar is Good for the World,” (Harvard Kennedy School Belfer Center, June 4, 2021), <https://www.belfercenter.org/publication/why-digital-dollar-good-world>; Hon. J. Christopher Giancarlo, “Building a Stronger Financial System: Opportunities of a Central Bank Digital Currency,” Statement to the Subcommittee on Economic Policy, Committee on Banking, Housing and Urban Affairs, U.S. Senate, June 9, 2021, <https://www.banking.senate.gov/imo/media/doc/Giancarlo%20Testimony%206-9-21.pdf>.

<sup>43</sup> “Fourth Amendment: Search and Seizure,” Constitution Center, <https://constitutioncenter.org/interactive-constitution/amendment/amendment-iv>.

<sup>44</sup> Tony McLaughlin, “The Regulated Internet of Value,” Citibank, June 2021, <https://www.citibank.com/tts/insights/articles/article191.html>.

<sup>45</sup> Office of Civil Liberties, Privacy, and Transparency, Office of the Director of National Intelligence, *Protecting U.S. Person Identities in Dissemination under the Foreign Intelligence Surveillance Act*, (November 2017), <https://www.dni.gov/files/documents/icotr/CLPT-USP-Dissemination-Paper---FINAL-clean-11.17.17.pdf>.



As the U.S. government and private sector seek to develop decentralized applications powered by broadcast transmission data, both must think through potential scenarios where new technological capabilities would infringe upon key constitutional rights. It will be challenging to build forward-looking guidelines to manage data ubiquity when most innovations are unforeseen. But this is why the United States must advance in blockchain technology research and experimentation. The way to anticipate the risks from a new technology's spread is to pilot its deployment and learn from it slowly, just as the United States did in developing the internet in the 1970s and 80s. Below are recommendations for how the United States can lead the next data revolution.

- **The National Science Foundation (NSF) should fund a Decentralized Internet Sandbox for Colleges and Universities (DISCU).** The NSF should fund the development of an interoperable blockchain ecosystem where university students and faculty in the United States can build decentralized applications. This would require two phases. The first would be to develop a common architecture across institutions for programmers to build blockchain protocols that talk to one another. The second would be to create and test applications in this academic-only sandbox environment. I found the practical need for such an environment when I taught a college course on blockchain technology at Morgan State University's business school in 2018.<sup>46</sup> My students developed and pitched ideas for decentralized applications to solve long standing business efficiency problems on campus. The class came up with several intriguing business propositions. However, there was no easily accessible platform for students to test out and deploy their ideas, especially since they were not trained blockchain programmers. A nation-wide, academic-only sandbox would provide a low-risk environment for blockchain-related research and collaboration. It would enable students and professors from around the country to work in an interoperable programming environment, share best practices, and iterate on projects. As the functionality of projects on the DISCU system matures, universities could propose to move elements of the sandbox into the open internet. The aim should be to create open-architecture for the world to use, just like the internet, and not infrastructure wholly owned or controlled by one nation or any other entity. This process would take several years, but would be a critical investment in digital infrastructure for future generations.
- **The Small Business Administration, through its Small Business Innovation Research (SBIR) program, should offer grants to U.S. businesses for fintech R&D that supports both privacy and national security concerns.** The scope of U.S. digital finance innovation is likely to correlate to the extent to which transactions can conform to global

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<sup>46</sup> Morgan State's First Blockchain Course Finds Use Cases on Campus, Stephen Babcock, Technical.ly, December 5, 2018, <https://technical.ly/baltimore/2018/12/05/morgan-state-blockchain-course/>.

regulatory standards for anti-money laundering and counter-terrorist financing. Financial platforms that operate fully pseudonymously are unlikely to scale to mass use due to the regulatory considerations of financial crime risks that come from pseudonymous transactions. And at the same time, as digital transactions attached to personal identification grow in volume and in their relevance to the economy, data privacy is likely to become more vulnerable to exploitation and abuse. Recently, the U.S. Treasury's Financial Crime Enforcement Network (FinCEN) announced it would host an innovation workshop for tech firms to present privacy-preserving technologies that could secure privacy and deter illicit financing.<sup>47</sup> This is a good step to help inform financial regulators about the current innovations available to preserve privacy, but more investment is actually needed to develop such solutions. The SBIR's competitive, private-sector-focused award system would be a fitting way to incentivize small businesses to take on this important digital challenge.<sup>48</sup>

- **The United States Federal Reserve should expand its research of central bank digital currencies.** Digital currency experts working on the Fed's CBDC research have spoken to Congress about a variety of CBDC models and called for more multidisciplinary research.<sup>49</sup> Cybersecurity is likely to be a key concern. But evaluating the appropriateness of a digital dollar should not just be a technical affair. The United States must also consider many complex public policy and social questions relating to privacy, financial crime, and financial access. Instead of just one Fed study, it would make sense for various branches to conduct CBDC research, each focusing on a specific policy or technical dimension of digital currencies. More extensive Fed research will help U.S. public and private sector stakeholders gain expertise needed to navigate the rise of CBDCs, whether the United States creates a digital dollar or not.
- **The Securities and Exchanges Commission (SEC) should give more regulatory clarity around digital assets and blockchain technology.** While U.S. anti-money laundering requirements for cryptocurrency exchanges have been clear since FinCEN issued guidance in 2013,<sup>50</sup> securities regulation has been murky to many U.S. blockchain innovators. The threat of SEC enforcement actions<sup>51</sup> has lessened much of the fraudulent and unregistered

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<sup>47</sup> "FinCEN to Host Innovation Hours Program Workshop on Privacy Enhancing Technologies," FinCEN, press release, May 26, 2021, <https://www.fincen.gov/news/news-releases/fincen-host-innovation-hours-program-workshop-privacy-enhancing-technologies>.

<sup>48</sup> Small Business Innovation Research and Small Business Technology Transfer Programs, *About: The SBIR and STTR Programs*, <https://www.sbir.gov/about>.

<sup>49</sup> Dr. Neha Narula, "Building a Stronger Financial System: Opportunities of a Central Bank Digital Currency," Statement to the Subcommittee on Economic Policy, Committee on Banking, Housing and Urban Affairs, U.S. Senate, June 9, 2021, <https://www.banking.senate.gov/imo/media/doc/Narula%20Testimony%2006-9-21.pdf>.

<sup>50</sup> "FinCEN Issues Guidance on Virtual Currencies and Regulatory Responsibilities," FinCEN, press release, March 18, 2013, <https://www.fincen.gov/news/news-releases/fincen-issues-guidance-virtual-currencies-and-regulatory-responsibilities>.

<sup>51</sup> Tom Robinson, "Crypto Enforcement Actions by U.S. Regulators Reach \$2.5 Billion," Elliptic, June 21, 2021, <https://www.elliptic.co/blog/https://www.elliptic.co/blog/crypto-enforcement-actions-by-us-regulators-reach-2.5-billion>.



securities activity that has been rampant in the crypto space, but it also has likely discouraged many legitimate innovative U.S. fintech projects and encouraged some American blockchain entrepreneurs to relocate abroad. To compete in the digital economy race with China, the United States must foster a more innovative fintech environment. It might even be possible to transfer the technical benefits of blockchain technology into conventional finance by tokenizing the regulated securities market.<sup>52</sup> If U.S. securities regulation does not evolve to account for the new technical and entrepreneurial capabilities offered by blockchain technology and broadcast data transmission, the United States could be hamstrung in a data revolution that is only just beginning.

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<sup>52</sup> McLaughlin, *The Regulated Internet of Value*.