



Crypto Rogues

U.S. State Adversaries Seeking Blockchain Sanctions Resistance

Yaya J. Fanusie & Trevor Logan

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Center on Economic
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Technology Innovation

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Executive Summary

In the 1800s, few economists imagined that the U.S. dollar would eclipse the British pound sterling as the world's leading currency in the next century. Nor could most foresee how American banks, businesses, and U.S. foreign policy itself would drive much of the global economic order well into the next millennium. The primacy of the dollar has enabled U.S. policymakers to deploy tools of financial coercion and economic sanctions to promote U.S. national security interests without relying solely on diplomacy and military action. For decades, U.S. adversaries have been trying to evade and undermine this power, but there has been no way to conduct significant international commerce without moving through the pipes of the U.S.-led global financial system.¹ Now, however, new pipelines are being built.²

“At the moment, blockchain platforms are experimental and small in scale compared to the conventional financial system, but they are evolving quickly. Blockchain technology may be the innovation that enables U.S. adversaries for the first time to operate entire economies outside the U.S.-led financial system. These governments, therefore, are prioritizing blockchain technology as a key component of their efforts to counter U.S. financial power.”

Efforts are underway around the world to build new systems for transferring value that work outside of conventional banking infrastructure. The Bitcoin

software code enables users to send non-copyable digital assets, known as cryptocurrency or digital currency, to another person without an intermediary, removing the role of the traditional banking sector. The transaction history is stored on an immutable, distributed ledger known as a blockchain, with software code that typically is openly sourced and free. Blockchain is gaining popularity in the U.S., with cryptocurrency startups growing and some large financial institutions piloting elements of the innovative software to increase payment efficiencies. While cryptocurrencies and blockchain technology may benefit millions of consumers by reducing the role of intermediaries and increasing transparency, U.S. adversaries see this development as an opportunity to reduce Washington's ability to impose economic sanctions, which depend on intermediaries like traditional banks to monitor compliance.

At the moment, blockchain platforms are experimental and small in scale compared to the conventional financial system, but they are evolving quickly. Blockchain technology may be the innovation that enables U.S. adversaries for the first time to operate entire economies outside the U.S.-led financial system. These governments, therefore, are prioritizing blockchain technology as a key component of their efforts to counter U.S. financial power. Russia, Iran, and Venezuela have initiated blockchain technology experiments that their leaders paint as tools to offset U.S. financial coercive power and increase sanctions resistance. China is also wary of U.S. financial power and the ever-present threat of sanctions against Chinese officials.³ The efforts of these four nations go beyond mere sanctions evasion, typically characterized by sanctioned entities hiding or disguising business and financial operations in order to continue operating within the global financial system. Instead, these nations

1. Peter Harrell and Elizabeth Rosenberg, “Economic Dominance, Financial Technology, and the Future of U.S. Economic Coercion,” *Center For a New American Security*, April 2019. (<https://s3.amazonaws.com/files.cnas.org/documents/CNAS-Report-Economic-Dominance-final.pdf?mtime=20190423154936>)

2. We chose to focus on these four nations because they have active blockchain development projects, discernible through official government statements and other open sources.

3. Josh Chin and Eva Dou, “American Lawmakers Push to Sanction Chinese Officials Over Xinjiang Camps,” *The Wall Street Journal*, August 29, 2018. (<https://www.wsj.com/articles/lawmakers-push-to-sanction-chinese-officials-over-xinjiang-camps-1535554800?ns=prod/accounts-wsj>)

seek to reduce the potency of unilateral and multilateral sanctions by developing alternative payment systems for global commerce. It is also notable that China, Iran, and Venezuela, in particular, have restricted their citizens' access to existing cryptocurrencies as they explore developing a state-backed digital currency.

“Because blockchain ventures currently depend on real-world fiat currency and conventional bank accounts, U.S. sanctions pressure for now can reach businesses in the cryptocurrency and blockchain tech space.”

Blockchain sanctions resistance is a long-term strategy for U.S. adversaries. None of the blockchain platforms currently operational could support the volume and speed of financial transactions moving through the conventional banking system. And most importantly, because blockchain ventures currently depend on real-world fiat currency and conventional bank accounts, U.S. sanctions pressure for now can reach businesses in the cryptocurrency and blockchain tech space.

However, the U.S. position of influence is not necessarily permanent. Technology has created a potential pathway to alternative financial value transfer systems outside of U.S. control. The target timeline may be two to three decades, but these actors are developing the building blocks now. They envision a world in which cryptocurrency technology helps them eclipse U.S. financial power, much the way that the dollar once eclipsed the British pound. Washington, therefore, must understand the benefits and threats posed by new financial technologies, maintain the integrity of global finance, and cultivate the expertise and influence to lead in what is becoming an international crypto race. The U.S. has the opportunity to harmonize digital currency technology with the law-based financial order if it stays ahead of its adversaries' attempts at building the financial system of the future.

Overview of Findings

- Venezuela's national cryptocurrency experiment under the Maduro regime has been a debacle. The petro coin was more of a propaganda effort than a technical or financial accomplishment. The Maduro regime did not build the economic or technical infrastructure to make the petro useful to citizens and international trading partners. The impact of U.S. sanctions and the Maduro regime's own illegitimacy ensured the coin's failure. However, the petro experiment served as a case study for other regimes to learn what not to do in deploying a blockchain sanctions resistance plan.
- Russian financial institutions are launching multiple blockchain technology projects to float corporate bonds and hold digital assets in new depository platforms. A crypto-ruble is unlikely in the short term given legislative and regulatory hurdles, but the Kremlin is looking to develop a digital currency that could be used for trade with regional partners and like-minded governments outside the SWIFT financial messaging system.
- Iran's central bank is highly motivated to develop an alternative to SWIFT, especially after Washington withdrew from the Iran nuclear deal in 2018. Tehran is investing in blockchain pilot projects and promoting blockchain technology education at the university level. Russia has been a strong ally in the plan for blockchain resistance. Iran's approach is gradual, with several blockchain pilots in partnership with Iran's private tech sector in the works.
- China is less threatened by U.S. sanctions than other adversaries, but displacing U.S. influence in the global financial system is a national priority. China's central bank is devoting significant resources and expertise to blockchain research and digital currency development. China's engagement in blockchain payment systems may be the biggest variable in sanctions resistance efforts. China's buy-in, if it involved moving its trade onto a blockchain platform outside the conventional system, would be a game-changer.



Signposts: Possible Scenarios That Would Make Blockchain Sanctions Resistance a Larger Threat

- A U.S. adversary convinces other nations to use a state-based digital currency to conduct trade in the adversary's major commodity export, such as oil.
- An independent cryptocurrency such as Bitcoin gains wide adoption in commerce and becomes more relevant to the global financial system. Then, a U.S. adversary begins to build significant reserves in the cryptocurrency. The state thus uses its holdings to gain more influence in the global financial system.
- While planning to create a state-based digital currency, a U.S. adversary makes progress in developing digital currency wallet infrastructure. The nation develops a state-based digital wallet system where citizens and foreigners can hold and trade the digital currency and use it for transactions with domestic companies.
- A U.S. adversary has enough success with blockchain technology in its domestic banking system that it exports its platform to other nations to integrate into their financial sectors. Less democratic governments – who have fewer regulatory and legislative hurdles – may be the most likely to accept new financial platforms.

Definitions and Scope of Research

Digital currency or virtual currency, terms this paper uses interchangeably, refer to digital representations of value that can be or transferred electronically and used for payment or investment purposes. A cryptocurrency is a type of digital currency created from software in which a network of independent computer nodes confirms transactions through a decentralized consensus mechanism. Those transactions are secured using proven public and private key cryptography protocols that both secure the digital accounts and the individual transactions posted to the distributed ledger, also known as a blockchain. Cryptocurrencies are sometimes referred to as tokens.

Blockchains can be public and permissionless, which means any computer node can connect to the network to confirm and validate transactions. The Bitcoin and Ethereum protocols are well-known public blockchains, for example. There also are private, permissioned blockchains where a central authority or a consortium determines the nodes in the network. Permissioned blockchains may use aspects of permissionless blockchain software and adapt it to make a private blockchain network. Most permissionless blockchains have cryptocurrency tokens to incentivize participation in the network. Private blockchains often do not require tokens.

This report looks at a spectrum of digital currency technology employed by key U.S. adversaries.⁴ For example, while the Maduro regime in Venezuela attempted to launch a public cryptocurrency, sanctioned Russian banks are developing permissioned blockchain networks while some Russian politicians also advocate for a crypto-ruble. Iran is investing in multiple blockchain projects, including using permissionless blockchain software that it is adapting for an eventual state digital token. China aims to develop its own digital currency and is researching and investing in blockchain and cryptography as it assesses ways to incorporate the technology in its future central bank-based digital currency.

4. We did not include North Korea in this study. Although North Korea is also trying to obtain cryptocurrencies to offset sanctions mostly through cyber theft, there is little information available about the Kim regime's internal progress in blockchain technology development.

Venezuela: A Failure to Launch Provides Lessons for Others

President Nicolas Maduro’s attempt to create a sovereign cryptocurrency was a highly publicized, but failed, experiment to mount blockchain sanctions resistance. From the outset, the U.S. Treasury Department noted that President Maduro hoped that “the Petro would allow Venezuela to circumvent U.S. financial sanctions.”⁵

The petro’s shoddy implementation provided little more than a vehicle for regime propaganda rather than any technical or economic utility. And yet, Iran, Russia, and even China are likely to learn from Venezuela’s missteps. While the ultimate fate of the petro is tied up with Maduro’s effort to cling to power in the face of ongoing humanitarian crises and international pressure, the launch failure is a case study in what countries need in order to create viable national cryptocurrencies.

Facing U.S. sanctions for corruption and human rights abuses⁶ and experiencing debilitating hyperinflation⁷ from years of toxic economic policies,⁸ Venezuela’s socialist regime introduced a national cryptocurrency to remedy its economic plight. Maduro first announced the petro during a television broadcast in early December 2017, characterizing it as a cryptocurrency priced against a basket of commodity reserves including oil, gas, gold, and diamonds.⁹ In January 2018, the Maduro regime produced a white paper claiming the petro would have an initial valuation of \$60 per coin, derived from estimated oil prices at the time. Ahead of the planned token launch on March 20, 2018, Maduro claimed the government had raised billions of dollars as part of the initial coin offering.¹⁰ This amount, however, did not match the value of initial coins in circulation, suggesting the tokens never went into commercial circulation.¹¹ Six months behind schedule, the government supposedly launched the petro coin on October 1, 2018.¹² The regime created a block explorer website¹³ to show the record of petro transactions, but it is unclear where the underlying data originated. There were no transactions recorded before October 13, 2018.¹⁴

5. U.S. Department of the Treasury, Press Release, “Treasury Sanctions Russia-based Bank Attempting to Circumvent U.S. Sanctions on Venezuela,” March 11, 2019. (<https://www.state.gov/countries-areas/venezuela/>)

6. U.S. Department of State, “Countries & Areas: Venezuela,” accessed March 6, 2019. (<https://www.state.gov/e/eb/tfs/spi/venezuela/>)

7. Andrew Rosati, “Venezuela’s Inflation to Reach 1 Million Percent, IMF Forecasts,” *Bloomberg*, July 23, 2018. (www.bloomberg.com/news/articles/2018-07-23/venezuela-s-inflation-to-reach-1-million-percent-imf-forecasts)

8. Anatoly Kurmanaev, “The Tragedy of Venezuela,” *The Wall Street Journal*, May 24, 2018. (www.wsj.com/articles/the-tragedy-of-venezuela-1527177202?ns=prod%2Faccounts-wsj)

9. Alexandra Ulmer and Deisy Buitrago, “Enter the ‘petro’: Venezuela to launch oil-backed cryptocurrency,” *Reuters*, December 3, 2017. (www.reuters.com/article/us-venezuela-economy/enter-the-petro-venezuela-to-launch-oil-backed-cryptocurrency-idUSKBN1DX0SQ)

10. Francisco Memoria, “Venezuelan President Claims Petro Pre-Sale Raked in \$5 Billion,” *Yahoo Finance*, March 10, 2018. (<https://finance.yahoo.com/news/venezuelan-president-claims-petro-pre-214303742.html>)

11. Brian Ellsworth, “Special Report: In Venezuela, new cryptocurrency is nowhere to be found,” *Reuters*, August 30, 2018. (www.reuters.com/article/us-cryptocurrency-venezuela-specialreport/special-report-in-venezuela-new-cryptocurrency-is-nowhere-to-be-found-idUSKCN1LF15U)

12. Sead Fadilpašić, “‘Invisible’ Petro Launches, Maduro Promises Tradeability,” *Cryptonews*, October 2, 2018. (www.cryptonews.com/news/invisible-petro-launches-maduro-promises-tradeability-2703.htm)

13. A block explorer is a website designed to display the contents of individual transactions, transaction histories, and wallet balances for individual digital wallets transacting on a particular digital currency. In most cases, the raw public blockchain data is available for anyone to build the explorer, but in the case of the petro, the regime has not made the raw data available.

14. Brenna Smith, “Blockchain Technology Gone Wrong: The Petro,” *Medium*, November 15, 2018. (www.medium.com/humanrightscenter/blockchain-technology-gone-wrong-the-petro-9462420d6724?fbclid=IwAR0ZgzuuKJJaaccdCtV91b e4i93-JyxDeh6ylJ3fg1HmyAgB-RnM_nK9pE)

Maduro’s original announcement said the petro would be based on the Ethereum blockchain,¹⁵ an open software protocol widely used for creating new digital tokens.¹⁶ However, in February 2018, the petro white paper said the token had been built on the NEM blockchain,¹⁷ another open source protocol popular in East Asia. The white paper¹⁸ was completely revised in October 2018 and outlined an entirely different software protocol, which appears to be a clone of another blockchain protocol called Dash. A diagram explaining the token’s architecture was an exact copy¹⁹ of a diagram found in the Dash open source developer guide.²⁰ At the time, Dash had growing popularity in Venezuela and was increasingly accepted by merchants there.²¹

Despite the petro’s fanfare, the government failed to integrate the token into any of its domestic fiscal operations. During 2018, the regime proclaimed numerous times that the petro would be used to pay for various domestic transactions, such as real estate, airline tickets, and tourism.²² None of these promises panned out.

In typical fashion for rushed initial coin offerings, the Maduro regime launched a global promotional campaign without building any supporting business infrastructure that would give its token any value. The petro had no apparent pilot testing, and there were no public agreements with business entities to accept the petro as a form of payment.

Venezuela also failed to convince its trading partners to accept the petro. The foreign trade minister said in April 2018 that Venezuela would possibly purchase Russian-made, heavy-duty trucks using the petro,²³ but in December 2018, the Russian deputy finance minister said Russia had no plans to use the token in trade with Venezuela.²⁴ He added that while Russian finance officials had learned how the petro works, using the token would be discussed later.

Apparent overtures to India and Turkey also failed to produce results. An Indian news outlet reported in April 2018 that Venezuela offered a 30 percent discount if India would purchase Venezuelan oil using petro tokens.²⁵ India’s foreign affairs minister told reporters a

15. Nikhilesh De, “What We’ve Learned About Venezuela’s Cryptocurrency,” *CoinDesk*, February 20, 2018. (www.coindesk.com/petro-debut-learned-venezuelas-cryptocurrency-today)

16. Maxwell William, “ERC-20 Tokens, Explained,” *Cointelegraph*, May 12, 2018. (<https://cointelegraph.com/explained/erc-20-tokens-explained>)

17. Yaya Fanusie and Michaela Frai, “To Evade U.S. Sanctions, Venezuela Launches the World’s First National Cryptocurrency,” *Foundation for Defense of Democracies*, October 24, 2018. (www.fdd.org/analysis/2018/02/23/to-evade-u-s-sanctions-venezuela-launches-the-worlds-first-national-cryptocurrency/)

18. Venezuelan Government, “Petro, Hacia la Revolución Digital Económica (Petro: Towards the Digital Economic Revolution),” accessed February 6, 2019. (https://www.petro.gob.ve/descargas/Petro_whitepaper_eng.pdf)

19. Ana Berman, “Venezuela’s Petro White Paper ‘Blatantly’ Copied Dash, Ethereum Developer Says,” *Cointelegraph*, October 4, 2018. (<https://cointelegraph.com/news/venezuelas-petro-white-paper-blatantly-copied-dash-ethereum-developer-says>)

20. “Dash Developer Guide,” *Dash*, accessed February 6, 2019. (<https://dash-docs.github.io/en/developer-guide#block-chain>)

21. Oscar Williams-Grut, “A cryptocurrency is making huge inroads in Venezuela as inflation runs wild — and it’s not bitcoin or the petro,” *Business Insider*, August 22, 2018. (www.businessinsider.com.au/dash-cryptocurrency-surges-in-venezuela-as-hyperinflation-explodes-2018-8?r=UK&IR=T)

22. Laura Rojas, “¿Qué Busca El Gobierno Con El ‘Nuevo’ Petro? (What is the government looking for with the ‘new’ petro?),” *ProDavinci* (Venezuela), October 27, 2018. (www.prodavinci.com/que-busca-el-gobierno-con-el-nuevo-petro-b/)

23. Adam Reese, “Venezuela In Talks To Purchase Russian Auto Parts Using Petro Cryptocurrency,” *ETHNews*, April 4, 2018. (www.ethnews.com/venezuela-in-talks-to-purchase-russian-auto-parts-using-petro-cryptocurrency)

24. “Россия не обсуждала с Венесуэлой использование петро, рассказал Сторчак (Russia Did Not Discuss the Use of Petro with Venezuela, Storchak Said),” РИА Новости (Russia), December 13, 2018. (www.ria.ru/20181213/1547930868.html)

25. Molly Jane Zuckerman, “India To Get 30% Discount On Venezuelan Crude Oil If Paid For In Petro, Says Local Source,” *Cointelegraph*, April 30, 2018, (<https://cointelegraph.com/news/india-to-get-30-discount-on-venezuelan-crude-oil-if-paid-for-in-petro-says-local-source>)

few weeks later, however, that India's central bank had prohibited any trade using the petro.²⁶

Turkey's foreign affairs minister told reporters in September 2018 that Ankara recognized the petro as a legitimate method of payment, noting, "We can use the petro, and we would be very pleased to do so."²⁷ However, the Turkish government and its economic agencies have not indicated a willingness to trade in petros since then.

Meanwhile, there appear to be no cryptocurrency exchanges outside of Venezuela listing the token. The threat of U.S. sanctions is not the only deterrent. In one reported case, the head of a Colombian exchange rejected the idea of listing the petro because the Maduro regime stipulated that the Venezuelan government must have total access and control of user data.²⁸ The regime's authoritarianism and untrustworthiness are incompatible with exchanges that prioritize customer privacy and data integrity.

Russia: A Perfect Storm for Seeking Blockchain Sanctions Resistance

Moscow is prioritizing blockchain technology advancement as a long-term economic and national security goal to lessen the impact of U.S. sanctions

and diversify its foreign currency reserves. Russia's political leadership is motivated to facilitate trade and investment outside the U.S.-led global financial system.

Russia has a highly active and relatively mature blockchain tech business community, and a central bank that encourages distributed ledger technology experimentation among its financial institutions. Russian financial institutions are piloting multiple blockchain projects, seeking to develop a strategic advantage. As a Russian intelligence officer told an international blockchain standards conference in 2017, "The internet belongs to the Americans — but blockchain will belong to us."²⁹

Russia's focus on blockchain is a change from its disinterest just a few years prior. Talk of a Russian national cryptocurrency dates back as far as 2015 but was confined to the private sector. In 2015, Russian payment companies Qiwi and Webmoney approached the Central Bank of Russia with a proposal for a state-controlled digital currency,³⁰ but the bank rejected the proposal. The following year, however, Andrei Lugovi, a member of the Duma, noted that cryptocurrencies could help Russia avoid U.S. and EU sanctions.³¹ In the three years since, other Kremlin officials have thrown their support behind Russia building a national cryptocurrency or blockchain-based financial system. While President Vladimir Putin initially argued against a national

26. Nidhi Verma, "India says no plans for oil trade with Venezuela using 'petro' cryptocurrency," *Reuters*, May 28, 2018. (<https://in.reuters.com/article/india-venezuela/india-says-no-plans-for-oil-trade-with-venezuela-using-petro-cryptocurrency-idINKCN1IT0ZV>)

27. "Turkey willing to use Venezuela's cryptocurrency Petro," *MENAFN* (Jordan), September 23, 2018. (www.menafn.com/1097472947/Turkey-willing-to-use-Venezuelas-cryptocurrency-Petro); Yamei, "Turkey open to Venezuelan cryptocurrency as trade tender," *Xinhua News* (China), September 22, 2018. (www.xinhuanet.com/english/2018-09/22/c_137486471.htm)

28. Rob Marvin, "In Venezuela, Cryptocurrency Is an Oppressor and a Lifeline," *PC Magazine*, August 9, 2018. (www.pcmag.com/feature/362486/in-venezuela-cryptocurrency-is-an-oppressor-and-a-lifeline)

29. Nathaniel Popper, "Blockchain Will Be Theirs, Russian Spy Boasted at Conference," *The New York Times*, April 29, 2018. (<https://www.nytimes.com/2018/04/29/technology/blockchain-iso-russian-spies.html>)

30. Stephen O'Neal, "CryptoRuble: How Stable Could Russian National Stablecoin Be?" *Cointelegraph*, November 17, 2018. (<https://cointelegraph.com/news/cryptoruble-how-stable-could-russian-national-stablecoin-be>)

31. Damien Sharkov, "Bitcoin Technology Can Help Russia Dodge Sanctions: MP" *Newsweek*, June 2, 2016. (<https://www.newsweek.com/bitcoin-technology-can-help-russia-dodge-sanctions-mp-465901>); U.S. Executive Order 13662, "Blocking Property of Additional Persons Contributing to the Situation in Ukraine," March 24, 2014. (https://www.treasury.gov/resource-center/sanctions/Programs/Documents/ukraine_eo3.pdf)

cryptocurrency, he eventually conceded the need to better understand the technology to “avoid various limitations in global finance trade.”³²

Blockchain’s transformation of the financial sector will likely take decades,³³ but Russia’s National Security Depository (NSD) is laying the groundwork for it now. The NSD provides securities and cash settlement services for the country.³⁴ In mid-2018, the NSD ran a pilot project where a large Russian property management firm issued shares in the form of digital tokens to Sberbank, the country’s largest bank.³⁵ Sberbank is currently under U.S. and EU sanctions, limiting its ability to raise capital internationally.³⁶ The NSD a few months later issued a separate \$12 million corporate bond for Russia’s largest telecom firm MTS through a blockchain platform, in collaboration with Sberbank. A Sberbank executive remarked, “Our joint blockchain project with NSD and MTS is just the beginning, and in

the next 5-10 years, blockchain-based products and services, including smart contracts³⁷ on the basis of blockchain, will become a standard thing.”³⁸

The NSD has also formed a consortium³⁹ with Japanese and Swiss blockchain firms and Slovenia’s central security depository to create a distributed digital depository platform called D3 Ledger.⁴⁰ The platform reportedly offers custody and settlement of digital assets for banks, asset managers, and other central security depositories. In essence, it provides a way to store and trade cryptocurrencies, as well as a way to track ownership of traditional assets by “tokenizing” them on a permissioned distributed ledger. The D3 Ledger software also is based on a form of Hyperledger,⁴¹ a free open-source blockchain platform.⁴²

Meanwhile, state financial institutions are conducting tests with Hyperledger, Masterchain (another open-source, Ethereum-based blockchain),⁴³ and other

32. Anna Baydakova, “Putin: Russia Should Explore Blockchain to Avoid Finance ‘Limitations,’” *CoinDesk*, June 7, 2018. (<https://www.coindesk.com/putin-russia-explore-blockchain-avoid-finance-limitations>)

33. Russia’s National Settlement Depository, Press Release, “National Settlement Depository Presents Its Vision of the Future of Crypto Assets at Sibos,” October 25, 2018. (<https://www.nsd.ru/en/press/ndcnews/index.php?id36=634084>)

34. Russia’s National Settlement Depository, “Services,” accessed January 29, 2019. (<https://www.nsd.ru/en/services/>)

35. Russia’s National Settlement Depository, Press Release, “National Settlement Depository and Sberbank Sum Up the Results of ICO Conducted Using the Bank of Russia’s Regulatory Sandbox,” October 22, 2018. (<https://www.nsd.ru/en/press/ndcnews/index.php?id36=634079>)

36. “How far do EU-US sanctions on Russia go?” *BBC* (UK), September 15, 2014. (<https://www.bbc.com/news/world-europe-28400218>)

37. A smart contract is an electronic program capable of facilitating, executing, and enforcing the negotiation or performance of an agreement between two parties. Once added to a blockchain, the contract serves as a binding agreement with the ability to self-enforce if programmed to do so. For more information, visit Blockchain’s website on smart contracts: <https://www.blockchaintechnologies.com/smart-contracts/>.

38. Russia’s National Settlement Depository, Press Release, “NSD, Sberbank, and MTS Complete the Commercial Bond Transaction Based on Blockchain,” November 23, 2018. (<https://www.nsd.ru/en/press/ndcnews/index.php?id36=634116>)

39. “D3 Ledger Tests Safekeeping of Cryptoassets for Institutional Investors Through Distributed Digital Depository,” *D3ledger*, October 18, 2018. (<https://www.prnewswire.com/news-releases/d3ledger-tests-safekeeping-of-cryptoassets-for-institutional-investors-through-distributed-digital-depository-300733895.html>)

40. Michael del Castillo, “D3 Unveiled: Russian Platform Would Turn Legacy CSDs into Crypto Custodians,” *CoinDesk*, October 27, 2017. (<https://www.coindesk.com/d3-unveiled-russian-depository-seeks-big-money-investors-crypto-tokens>)

41. “A Decentralized Financial Infrastructure for Crypto Assets,” *D3 Ledger*, October 16, 2018. (http://files.d3ledger.com/D3ledger_WP2018.pdf)

42. “Hyperledger IROHA,” *The Linux Foundation*, accessed January 30, 2019. (<https://www.hyperledger.org/projects/iroha>); “The Linux Foundation Helps Hyperledger Build the Fastest Growing Open Source Ecosystem for Business Blockchain Technology,” *The Linux Foundation*, accessed January 29, 2019. (<https://www.linuxfoundation.jp/projects/case-studies/hyperledger/>)

43. “Мастерчейн - первый юридически чистый блокчейн в России (Masterchain - The First Legally Clean Blockchain in Russia),” *RBC* (Russia), accessed January 30, 2019. (<http://masterchain.rbc.ru/>)

blockchain protocols for broader commercial use.⁴⁴ The tests use blockchain applications to deliver existing financial services more efficiently. Most of the banks piloting these projects are under U.S. and EU sanctions. Appendix 1 describes some noteworthy pilots in Russia, as well as China and Iran. Appendix 2 highlights key institutions influencing blockchain development by U.S. adversaries.

The Bank of Russia, meanwhile, expresses strong support for developing blockchain systems for the banking industry.⁴⁵ Currently, however, Russia lacks the legislative framework, regulatory authorities, and technical requirements to immediately “combine its financial system with cryptocurrencies,” according to Elina Sidorenko, chair of the Russian Duma cryptocurrency working group.⁴⁶

In addition to its domestic blockchain initiatives, Russia has become a facilitator for other nations looking to experiment with blockchain technology, especially those seeking to lessen the impact of U.S. sanctions. Since sanctions have hampered the Russian banking sector’s ability to transact in new debt and attract foreign direct investment, it needs new means of cooperation with foreign partners.⁴⁷ To achieve this, Moscow needs the ability to transfer value across borders with parties who also use digital currencies or blockchain technology platforms.

The deputy head of Russia’s central bank announced in April 2018 that she was considering Masterchain

for a new system to transmit the payment messages from the SWIFT global financial messaging system.⁴⁸ The new system is meant specifically for use with countries in the Eurasian Economic Union (EAEU).⁴⁹ Separately, in December 2018, the Russian Ministry of Finance announced that because sanctions were hindering the business of local companies, it planned to develop a regional digital currency in coordination with other members of the EAEU.⁵⁰ The ministry claimed that other unnamed countries supported the plan. However, it said that the digital currency would likely be developed without blockchain technology, possibly due to questions regarding blockchain’s capacity to handle a high volume of transactions in the near term.

“The deputy head of Russia’s central bank announced in April 2018 that she was considering Masterchain for a new system to transmit the payment messages from the SWIFT global financial messaging system. The new system is meant specifically for use with countries in the Eurasian Economic Union (EAEU).”

Russia is also exploring blockchain technology’s potential via joint efforts with members of the BRICS association.⁵¹ In 2016, the NSD signed a memorandum of understanding (MOU) with China’s Securities and

44. Pete Rizzo, “Russian Central Bank Group Prepares ‘Masterchain’ Ethereum Fork for Testing,” *CoinDesk*, June 13, 2017. (<https://www.coindesk.com/russian-central-bank-group-prepares-masterchain-ethereum-fork-testing>)

45. Daniel Palmer, “Russia’s Central Bank to Study Blockchain Tech,” *CoinDesk*, February 29, 2016. (<https://www.coindesk.com/bank-of-russia-blockchain-working-group>)

46. Samantha Chang, “Russia Denies Buying \$10 Billion in Bitcoin, Telegraph Story Fake News,” *CryptoCoinsNews*, January 17, 2019. (<https://www.ccn.com/russia-denies-buying-10-billion-in-bitcoin-telegraph-story-fake-news/>)

47. Max Seddon, “Calvey’s arrest sends chill through Russia’s foreign investors,” *Financial Times* (UK), February 19, 2019. (<https://www.ft.com/content/fc2f021a-32ae-11e9-bd3a-8b2a211d90d5>)

48. “Bank of Russia suggests FinTech’s ethereum blockchain as single system for EAEU,” *TASS* (Russia), April 3, 2018. (<http://tass.com/economy/997474>)

49. The Eurasian Economic Union is comprised of five member states: Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia.

50. Helen Partz, “Russian Finance Ministry Considers EAEU Digital Currency ‘Inevitable’ Due to US Sanctions,” *Cointelegraph*, December 21, 2018. (<https://cointelegraph.com/news/russian-finance-ministry-considers-eaeu-digital-currency-inevitable-due-to-us-sanctions>)

51. The BRICS association is comprised of Brazil, Russia, India, China, and South Africa.

Depository Clearing Corporation to collaborate on financial technology research, including ways to use blockchain technology.⁵² In August 2018, the major development banks from each BRICS nation signed a MOU to cooperate in studying distributed ledger technology.⁵³ Elina Sidorenko said in January 2019 that the BRICS initiative has made more progress than the EAEU plan. Sidorenko emphasized the importance of this initiative to Russia, adding that “if a cryptocurrency unit had been invented that allowed making payments only for energy, the Russian Federation could have made long-term advancements in the economy.”⁵⁴ Russian officials are particularly interested in creating a system that ensures the quick billing and receipt of funds for the energy industry.

When Venezuela announced its attempted launch of the petro in February 2018, details emerged indicating that Russian tech entrepreneurs, possibly directed by Putin advisors, were helping the Maduro regime develop its state-backed digital token.⁵⁵ When the Maduro regime announced the rollout of the petro, it asserted that two relatively unknown tech companies,⁵⁶ whose founders

had Russian roots,⁵⁷ would be helping with the project’s execution. But after the Russian government publicly denied involvement,⁵⁸ the Russian tech companies seem to have been sidelined.⁵⁹

Meanwhile, Russia-based Evrofinance Mosnarbank emerged as a primary foreign financial institution behind the petro as an accepted currency. In March 2019, the Treasury Department sanctioned Evrofinance for using its offices in Russia and Venezuela to engage in a sanctions evasion scheme to enable foreign investors to acquire petro coins.⁶⁰

Iran also seeks to partner with Russia and others to use blockchain technology as an alternative to SWIFT. In May 2018, the head of Iran’s Parliamentary Commission on Economic Affairs met in Moscow with the chair of the Russian Federation Council of Economic Policy to discuss using digital currencies to avoid sanctions and exchange goods.⁶¹ The officials planned future meetings to discuss interbank cooperation.⁶² The Iranian official told the press, “If we manage to move

52. Stan Higgins, “Russian, Chinese Central Securities Depositories Partner on Blockchain,” *CoinDesk*, October 25, 2016. (www.coindesk.com/russian-chinese-central-securities-depositaries-partner-blockchain); Russia’s National Settlement Depository, Press Release, “NSD and China Securities Depository and Clearing Corporation Limited Sign MoU,” October 25, 2016. (www.nsd.ru/en/press/ndcnews/index.php?id36=632354)

53. Angelica Mari, “BRICs sign blockchain agreement,” *ZDNet*, August 28, 2018. (<https://www.zdnet.com/article/brics-sign-blockchain-agreement/>)

54. Samantha Chang, “Russia Denies Buying \$10 Billion in Bitcoin, Telegraph Story Fake News,” *CryptoCoinsNews*, January 17, 2019. (<https://www.ccn.com/russia-denies-buying-10-billion-in-bitcoin-telegraph-story-fake-news/>)

55. Yaya Fanusie and Michaela Frai, “Crypto Investors Should Stay Away from Venezuela’s Petro,” *CoinDesk*, March 25, 2018. (<https://www.coindesk.com/crypto-investors-stay-away-venezuelas-petro>)

56. Stan Higgins, “Venezuela’s Cryptocurrency Is Here, But Who’s Involved Isn’t Clear,” *CoinDesk*, February 21, 2018. (<https://www.coindesk.com/whos-working-venezuelas-cryptocurrency>)

57. “Посол РФ в Венесуэле опроверг участие российских компаний в запуске криптовалюты ‘петро’ (Russian ambassador to Venezuela denied the participation of Russian companies in the launch of the cryptocurrency ‘petro’),” *Россиясегодня* (Russia), March 21, 2018. (<https://1prime.ru/News/20180321/828629453.html>)

58. “Diplomat slams claims of Russia’s involvement in Venezuelan cryptocurrency as ‘fake news,’” *TASS* (Russia), March 23, 2018. (<http://tass.com/economy/995808>)

59. Ana Berman, “Venezuela’s Controversial Petro Sale Starting November, Maduro Claims,” *Cointelegraph*, October 2, 2018. (<https://cointelegraph.com/news/venezuelas-controversial-petro-sale-starting-november-maduro-claims>)

60. U.S. Department of the Treasury, Press Release, “Treasury Sanctions Russia-based Bank Attempting to Circumvent U.S. Sanctions on Venezuela,” March 11, 2019. (<https://home.treasury.gov/news/press-releases/sm622>)

61. “Iran, Russia eyeing digital money to dodge sanctions,” *Press TV* (Iran), May 19, 2018. (<https://www.presstv.com/Detail/2018/05/19/562244/Iran-Russia-eyeing-digital-money-to-dodge-sanctions->)

62. “Иран и Россия могут начать использовать криптовалюты для обхода санкций (Iran and Russia can start using cryptocurrencies to circumvent sanctions),” *RBC* (Russia), May 17, 2018. (<https://www.rbc.ru/crypto/news/5afd4fb69a794757df44fa3a>)

this work forward, then we will be the first countries that use digital currencies in the exchange of goods.”

In mid-November 2018, Iran Blockchain Labs personnel participated in a meeting in Armenia with the Russia Association of Crypto-Industry and Blockchain (RACIB) and the Armenian Blockchain Association. All parties signed an agreement to cooperate on distributed ledger technology.⁶³ A RACIB press release said it would provide advisory services for implementing blockchain in Iran and developing a regulatory framework for Iran’s cryptocurrency industry. The president of RACIB vowed to help Iran address its sanctions challenges.⁶⁴

Iran: A Veteran Sanctions Evader Adds Blockchain to Its Toolkit

Facing U.S. sanctions for 40 years, Iran has developed extensive evasion networks and methods.⁶⁵ Even so, the U.S. has demonstrated that it can still impose

substantial costs on Iran by cutting it off from the global financial system. SWIFT disconnected more than two dozen Iranian banks in early November 2018,⁶⁶ just days after the U.S. Treasury threatened to impose sanctions on the Brussels-based messaging service if it continued servicing designated Iranian financial institutions.⁶⁷ Sanctions have impacted Iran’s ability to export crude oil, leading to a historic low of less than 500,000 exported barrels per day.⁶⁸ Iran has also faced a persistent inflation challenge, peaking at 51.4 percent in March of 2019.⁶⁹ Threatening a deep recession, Iran’s record-high inflation is pushing Iranian citizens to trade in their rial for less volatile currencies.⁷⁰

Blockchain technology provides Tehran an opportunity to build new financial infrastructure that is immune from Washington’s most effective sanctions.⁷¹ While acknowledging that it was “immature and farfetched” to suggest that blockchain technology could help Iran evade sanctions immediately, Ali Divandari, the head of the Central Bank of Iran’s Monetary and Banking Research Institute and himself a target of U.S. sanctions,⁷² said in January 2019, “Blockchain can truly

63. Lubomir Tassev, “Russian Developers to Help Iran Build Its Crypto-Economy,” *Bitcoin*, November 14, 2018. (<https://news.bitcoin.com/russian-developers-to-help-iran-build-its-crypto-economy/>)

64. Mikhail Tetkin, “Россия и Иран разработают аналог банковской системы SWIFT (Russia and Iran Will Develop an Analogue of the Banking System SWIFT),” *RBC (Russia)*, November 14, 2018. (www.rbc.ru/crypto/news/5bec0e349a7947d73928470c)

65. Jonathan Schanzer, “The Biggest Sanctions-Evasion Scheme in Recent History: And the swashbuckling gold trader at its center,” *The Atlantic*, January 4, 2018. (<https://www.theatlantic.com/international/archive/2018/01/iran-turkey-gold-sanctions-nuclear-zarrab-atilla/549665/>); Emanuele Ottolenghi, “Snap-back: A Journey Through Iranian Sanctions Evasion in Georgia,” *Tablet*, July 1, 2015. (<https://www.tabletmag.com/jewish-news-and-politics/191903/iranian-sanctions-evasion>)

66. Arshad Mohommed, “SWIFT says suspending some Iranian banks’ access to messaging system,” *Reuters*, November 5, 2018. (<https://www.reuters.com/article/us-usa-iran-sanctions-swift/swift-says-suspending-some-iranian-banks-access-to-messaging-system-idUSKCN1NA1PN>)

67. U.S. Secretary of State Michael R. Pompeo and U.S. Treasury Secretary Steven T. Mnuchin, “Briefing on Iran Sanctions,” *U.S. Department of State*, November 2, 2018. (<https://www.state.gov/briefing-on-iran-sanctions/>)

68. David Adesnik, “Sanctions Drive Iranian Oil Exports to Historic Lows,” *Foundation for Defense of Democracies*, June 4, 2019. (<https://www.fdd.org/analysis/2019/06/04/sanctions-drive-iranian-oil-exports-to-historic-lows/>)

69. Saeed Ghasseminejad, “Inflation in Iran is on the Rise,” *Foundation for Defense of Democracies*, April 30, 2019. (<https://www.fdd.org/analysis/2019/04/30/inflation-in-iran-is-on-the-rise/>)

70. Tzvi Kahn, “Defying Predictions, Iran Sanctions Exert Unprecedented Impact,” *Foundation for Defense of Democracies*, May 22, 2019. (<https://www.fdd.org/analysis/2019/05/22/defying-predictions-iran-sanctions-exert-unprecedented-impact/>)

71. Yaya Fanusie, “Blockchain Authoritarianism: The Regime In Iran Goes Crypto,” *Forbes*, August 15, 2018. (<https://www.forbes.com/sites/yayafanusie/2018/08/15/blockchain-authoritarianism-the-regime-in-iran-goes-crypto/#4d9785ec3dc6>)

72. U.S. Department of the Treasury, Press Release, “Treasury Designates Bank Mellat Subsidiary and Chairman Under Proliferation Authority,” November 5, 2009. (www.treasury.gov/press-center/press-releases/pages/tg355.aspx)

revolutionize the concept of money.”⁷³ Divandari also asserted that blockchain’s technical separation from banks’ conventional payment systems theoretically would shield them from U.S. sanctions pressure.

Hints of how Iran could use blockchain technology to circumvent U.S. sanctions emerged in early 2017 when Swedish blockchain startup Brave New World Investments⁷⁴ was formed to facilitate European investment in Iran via Bitcoin.⁷⁵ The company received bitcoins from investors and planned to convert them into Iranian rial to purchase shares of local companies on the Tehran Stock Exchange. Swedish banks, however, refused to allow Brave New World to open accounts because of fears of secondary sanctions from U.S. financial authorities. So the firm began operations purely off of its digital currency holdings.⁷⁶ A year later, Brave New World suspended its Iranian investment plans after the Central Bank of Iran (CBI) banned cryptocurrency trading for a time. According to the firm, even before the official ban, it had not made investments because the company was uncertain on whether or not cryptocurrency use would be banned in the country.⁷⁷ It is noteworthy that uncertainty concerning the Iranian government’s regulation of blockchain technology at the time was a bigger hurdle to Brave New World’s business than the lack of a Swedish bank account.

CBI is investing in blockchain technology infrastructure. With CBI’s support, Sharif University of Technology established Iran Blockchain Labs (IBL) in 2017.⁷⁸

Sharif appears to be the hub for blockchain education in the country. Its lab does research, consulting, and education on blockchain technology and includes several European blockchain experts as external associates.⁷⁹ IBL has hosted periodic workshops about cryptocurrencies and blockchain technology. The speakers often include professors and graduate students from other Iranian universities, covering topics ranging from the basics of cryptocurrency mining to how blockchain can enhance Iran’s payment systems.⁸⁰

“Central Bank of Iran (CBI) is investing in blockchain technology infrastructure. With CBI’s support, Sharif University of Technology established Iran Blockchain Labs (IBL) in 2017. Sharif appears to be the hub for blockchain education in the country.”

CBI also reportedly signed a 2018 agreement with Iran’s vice-presidency for science and technology affairs and with Iran’s governing body for over-the-counter securities exchange, Fara Bourse, to develop financial technology (fintech) and a cryptocurrency. An accompanying announcement said that the government would assemble experts and financiers to guide Iran’s progress on blockchain developments and that cryptocurrencies could facilitate international trade.⁸¹ A few months earlier, the vice-presidency had announced support for private cryptocurrency

73. “Central Bank of Iran Official: Blockchain No Solution for Sanctions,” *Eghtesad Online* (Iran), January 22, 2019. (www.eghtesadonline.com/Section-economy-4/27918-central-bank-of-iran-official-blockchain-no-solution-for-sanctions)

74. “Brave New World Investments,” *Brave New World Investments* (Sweden), accessed January 30, 2019. (<http://www.bnw.investments/>)

75. Michael del Castillo, “Sweden Incorporates Iran Investment Firm Using Only Bitcoin,” *CoinDesk*, April 12, 2017. (<https://www.coindesk.com/sweden-incorporates-iran-investment-firm-using-only-bitcoin>)

76. “Brave New World Investments,” *Brave New World Investments* (Sweden), accessed January 30, 2019. (<http://www.bnw.investments/>)

77. Mikael, “BNW Investments suspends Iran ambitions after cryptocurrency ban,” *Brave New World Investments* (Sweden), April 23, 2018. (<http://www.bnw.investments/index.php/2018/04/23/bnw-investments-abandons-iran-ambitions-after-cryptocurrency-ban/>)

78. Iran Blockchain Labs, *LinkedIn*, accessed March 6, 2019. (<https://www.linkedin.com/company/iranblockchainlabs/about/>)

79. “Iran Blockchain Labs,” *Iran Blockchain Labs*, accessed January 30, 2019. (<http://blockchainlabs.ir/#about>)

80. “Collaboration in Activities,” *Iran Blockchain Labs*, accessed January 30, 2019. (<http://blockchainlabs.ir/#collaboration>)

81. “Being active in financial technologies will affect the economy of the country,” *ISTI* (Iran), June 3, 2018. (<http://en.isti.ir/index.asp?fkeyid=&siteid=30&pageid=6588&newsview=35724>)

development, noting that there should be “at least one Iranian product” in the digital currency realm.⁸²

Tehran also announced in late July 2018 that it was developing a national cryptocurrency to offset the impact of impending U.S. financial sanctions. Iranian state media reported that the nation had already built the main elements of a cryptocurrency token that would be used for domestic banks to settle transactions. At the time, several Iranian technology companies were working with the central bank to iron out the kinks.⁸³

In August 2018, CBI announced it would issue Iran’s sovereign cryptocurrency token. The implementation plan would involve two phases: In the first phase, the token would be used solely for domestic bank-to-bank payments; in the second, it would be available for broader retail payments.⁸⁴ Other Iranian government statements about cryptocurrency show that Tehran’s ultimate aim with blockchain technology is to help facilitate international trade outside of the conventional banking system.

There are several projects underway related to foreign trade, and building new pipelines for Iran’s banking sector

appears to be the focus.⁸⁵ One initiative called Borna features a partnership between CBI and the Informatics Services Corporation, which develops banking payment systems for Iran.⁸⁶ CBI provides the funding through its partnership with Informatics to Iranian blockchain startup Areatak.⁸⁷ Media reporting indicates that a team from Areatak is working inside the Informatics office to develop an identity verification system as part of the Borna project. The Borna project uses Hyperledger to create a private blockchain platform that operates without cryptocurrency mining.⁸⁸ Indeed, because the central bank would control and disburse this cryptocurrency, mining is unnecessary.⁸⁹

A separate project is led by the Iranian startup Kuknos (Persian for “Phoenix”). Kuknos is developing a gold-backed cryptocurrency called the Peyman, which would be used initially by four Iranian banks to allow for digitally tokenizing real-world assets. Three of the four banks are under U.S. sanctions.⁹⁰

The Peyman token is built on the Stellar blockchain protocol.⁹¹ The Stellar system is an open-source blockchain for creating payment infrastructure. Although

82. “Entrance of the country into digital currency field is significantly difficult due to lack of presence of any specific law in this area,” *ISTI* (Iran), April 22, 2018. (<http://en.isti.ir/index.aspx?fkeyid=&siteid=30&pageid=6588&newsview=33690>)

83. “Iran closer to own digital money as sanctions loom,” *Press TV* (Iran), July 25, 2018. (<https://www.presstv.com/Detail/2018/07/25/569249/Iran-closer-to-own-digital-money-as-sanctions-loom>)

84. “Iranian Cryptocurrency’s Features Revealed,” *IBENA* (Iran), August 27, 2018. (<http://en.ibena.ir/news/90482/Iranian-Cryptocurrency-s-Features-Revealed>)

85. “Implementation of 5 Cryptocurrency Test Models / Central Bank Positive View on Blockchain,” *8th Annual Conference on Electronic Banking and Payment Systems* (Iran), accessed March 6, 2019. (http://conf.mbri.ac.ir/ebps8/Mobile/News_en/294135)

86. “Company Overview,” *Informatics Services Corporation* (Iran), accessed January 30, 2019. (<https://www.isc.co.ir/portal/home/?67337/About-Us>)

87. Leigh Cuen, “Blockchain Startups Are Modernizing Iran’s Financial Infrastructure,” *CoinDesk*, February 12, 2019. (<https://www.coindesk.com/iran-blockchain-bank-bitcoin-crypto-token>)

88. “Iranian Cryptocurrency’s Features Revealed,” *IBENA* (Iran), August 27, 2018. (<http://en.ibena.ir/news/90482/Iranian-Cryptocurrency-s-Features-Revealed>)

89. Cryptocurrency mining is the process of authenticating transactions on the blockchain. Miners, or users validating transactions in a block, use computer components to both validate transactions and solve a math puzzle unique to each block that denotes that the miner has successfully authenticated all of the transactions for a given block. Other miners verify the miner has correctly solved the block’s math puzzle, and the block reward, a small amount of the cryptocurrency, is given to the winning miner. Miners compete with other miners to receive block rewards, as the miner that gets the answer second receives no payout for their efforts.

90. Yaya J. Fanusie, “Iran faces a long road before using blockchain to evade US sanctions,” *The Hill*, February 15, 2019. (<https://thehill.com/opinion/technology/430276-iran-faces-a-long-road-before-using-blockchain-to-evade-us-sanctions>)

91. Maziar Motamedi, “Iran’s top banks launch blockchain platform to boost ailing banking system,” *Al-Monitor*, February 28, 2019. (<https://www.al-monitor.com/pulse/originals/2019/02/iran-banks-cryptocurrency-blockchain-kuknos-phoenix.html>)

the Iranian government has not formally endorsed the Peyman, Kuknos has signed multiple MOUs with various government technology and finance groups.⁹²

Unlike the Maduro regime in Venezuela, the Islamic Republic of Iran is not first creating a national coin and then pushing usage; instead, it is promoting pilot projects to determine how a blockchain-based system could work practically. These projects will likely inform the design and management of Iran's eventual sovereign cryptocurrency.

In January 2019, the Central Bank announced it would be the exclusive entity to operate the national cryptocurrency and future "regional cryptocurrencies."⁹³ Around the same time, the acting head of Iran's Trade Promotion Organization said, "Iran is negotiating the use of cryptocurrency in its financial transactions with eight countries" as part of its aim to "circumvent U.S.-led sanctions."⁹⁴ The eight were Austria, Bosnia, Britain, France, Germany, Russia, South Africa, and Switzerland, all of which had reportedly sent representatives to Iran to discuss the effort. However, there has been little corroboration of such talks and no additional details about Iran's plan.

China: A Potential Game-Changer for Sanctions Resistance

Of all U.S. adversaries, China is best positioned to develop blockchain-based digital currency infrastructure that could compete with the dollar-based financial system. China is the most technologically advanced of U.S. adversaries piloting blockchain technology. And it has the biggest economy with the largest influence on global trade.

China aims to displace the U.S. dollar as a global reserve currency,⁹⁵ but the renminbi's illiquidity currently makes it unattractive as a replacement.⁹⁶ A digitized renminbi – if it were more easily acquired, held, and spent across borders – would be useful to facilitate trade with Chinese companies involved in the multi-billion-dollar One Belt, One Road initiative.⁹⁷ Beijing is developing a digital currency and integrating blockchain technology infrastructure into its financial sector. Beijing's timeline is long, but its strategy is

92. "معاونت علمی و فناوری ریاست جمهوری و ققنوس تفاهنامه امضا کردند" (The Vice President of Science and Technology Presidential and Phoenix signed a memorandum of understanding)," *Way 2 Pay* (Iran), February 17, 1397. (<https://way2pay.ir/131569>); "Iranian Banks Lay Plans to Tokenize Gold, Real Estate, Assets on the Blockchain," *Trustnodes*, March 2, 2019. (<https://www.trustnodes.com/2019/03/01/iranian-banks-lay-plans-to-tokenize-gold-real-estate-assets-on-the-blockchain>)

93. Maziar Motamedi, "Iran's central bank issues draft rules on cryptocurrency," *Al-Jazeera* (Qatar), January 29, 2019. (<https://www.aljazeera.com/news/2019/01/iran-central-bank-issues-draft-rules-cryptocurrency-190129051653656.html>)

94. "Talks with 8 countries over using cryptocurrency in monetary transactions going on," *Tehran Times* (Iran), January 28, 2019. (<https://www.tehrantimes.com/news/432400/Talks-with-8-countries-over-using-cryptocurrency-in-monetary>)

95. For example, China is urging Saudi Arabia, Iran, and Angola to accept the renminbi for its oil purchases. Gal Luft, "The anti-dollar awakening could be ruder and sooner than most economists predict," *CNBC*, August 28, 2018. (www.cnbc.com/2018/08/27/the-anti-dollar-awakening-could-be-ruder-and-sooner-than-most-economists-predict.html). China also historically has argued that the International Monetary Fund's Special Drawing Rights (SDRs) be used to settle international trade transactions rather than the dollar. Jamil Anderlini, "China calls for new reserve currency," *Financial Times* (UK), March 23, 2009. (www.ft.com/content/7851925a-17a2-11de-8c9d-0000779fd2ac)

96. In 2018, Beijing also launched a renminbi-based oil futures contract on the Shanghai International Exchange; however, the so-called "petro-yuan" has been relatively unsuccessful. Craig Mellow, "China's Petro-Yuan Isn't Dislodging the Dollar Yet," *Barron's*, April 27, 2018. (www.barrons.com/articles/chinas-petro-yuan-isnt-dislodging-the-dollar-yet-1524843343); Gaurav Sharma, "Market Chatter About Rise Of 'Petro-Yuan' Misses Mark By Several Trillion Dollars," *Forbes*, November 30, 2018. (www.forbes.com/sites/gauravsharma/2018/11/30/market-chatter-about-rise-of-petro-yuan-misses-mark-by-several-trillion-dollars/#d5a095fd55bd)

97. Jennifer Zhu Scott, "Is China about to launch its own cryptocurrency?" *World Economic Forum*, October 15, 2018. (www.weforum.org/agenda/2018/10/is-china-about-to-launch-its-own-cryptocurrency/)

deliberate, concerted, and aligned with an economic and political vision mapped out through 2050.⁹⁸

With a large population already used to cashless payments,⁹⁹ China is well positioned to adapt as cryptocurrencies evolve. At the same time, the Chinese Communist Party is attempting to co-opt cryptocurrency as part of its campaign of domestic repression. In January 2019, China's internet regulation agency said that blockchain platforms in China would have to require personal identification of users, censor content, and store user data.¹⁰⁰

The People's Bank of China (PBOC) has been developing a digital currency strategy since at least 2014.¹⁰¹ China has no intention of using or duplicating independent cryptocurrencies like Bitcoin. Its aim has been to adopt blockchain technology more broadly, and to issue a digital currency that would be centrally controlled by the government.¹⁰² The central bank aims to ensure that digital currency serves its capital controls and broader monetary policy.

The PBOC governor declared in 2016 that a digital currency was inevitable for China and that, when unveiled, it would probably coexist with physical cash until hard currency could be taken out of circulation.¹⁰³ The central bank's vice governor argued in 2016 that a digital currency would "reduce operating costs, increase efficiency, and enable a wide range of new applications."¹⁰⁴ He publicly recommended that the central bank distribute digital currency to commercial banks, which would then circulate the tokens into the economy.¹⁰⁵ The next year, the bank created a Digital Currency Research Institute (DCRI),¹⁰⁶ with openings for cryptography experts with blockchain experience.¹⁰⁷ In October 2018, a PBOC research team published a report¹⁰⁸ analyzing the potential economic impact of the trend of cryptocurrency "stablecoins"¹⁰⁹ and offering recommendations should the United States circulate a dollar stablecoin.¹¹⁰

The DCRI is focused on building blockchain technology capacity at the province level first, as a foundation for digital currency connectivity in China's

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- 98.** Ting Shi, "Xi Plans to Turn China Into a Leading Global Power by 2050," *Bloomberg*, October 17, 2017. (www.bloomberg.com/news/articles/2017-10-17/xi-to-put-his-stamp-on-chinese-history-at-congress-party-opening)
- 99.** Alyssa Abkowitz, "The Cashless Society Has Arrived— Only It's in China," *The Wall Street Journal*, January 4, 2018. (<https://www.wsj.com/articles/chinas-mobile-payment-boom-changes-how-people-shop-borrow-even-panhandle-1515000570?ns=prod/accounts-wsj>)
- 100.** Josh Horwitz, "China imposes blockchain rules to enable 'orderly development,'" *Reuters*, January 10, 2019. (www.reuters.com/article/us-china-blockchain/china-imposes-blockchain-rules-to-enable-orderly-development-idUSKCN1P41FX)
- 101.** Fan Yifei, "On Digital Currencies, Central Banks Should Lead," *Bloomberg*, September 1, 2016. (www.bloomberg.com/opinion/articles/2016-09-01/on-digital-currencies-central-banks-should-lead)
- 102.** Zhou Xiaochuan, "Transcript of Governor Zhou Xiaochuan's Exclusive Interview with Caixin Weekly," *The People's Bank of China*, February 14, 2016. (www.pbc.gov.cn/english/130721/3017134/index.html)
- 103.** Ibid.
- 104.** Heng Xie, Yinan Zhao, and Jesse Hamilton, "Central Banks Should Lead on Digital Currency, PBOC's Fan Says," *Bloomberg*, September 1, 2016. (www.bloomberg.com/news/articles/2016-09-02/central-banks-should-lead-on-digital-currency-pboc-s-fan-says)
- 105.** Fan Yifei, "On Digital Currencies, Central Banks Should Lead," *Bloomberg*, September 1, 2016. (www.bloomberg.com/opinion/articles/2016-09-01/on-digital-currencies-central-banks-should-lead)
- 106.** Chuan Tian, "China's Central Bank Opens New Digital Currency Research Institute," *CoinDesk*, June 30, 2017. (<https://www.coindesk.com/chinas-central-bank-opens-new-digital-currency-research-institute>)
- 107.** Zheping Huang, "China's central bank recruiting cryptography experts to help develop its own digital money," *South China Morning Post* (China), October 11, 2018. (www.scmp.com/tech/blockchain/article/2168142/chinas-central-bank-recruiting-cryptography-experts-help-develop-its)
- 108.** Mary Kihoro, "People's Bank of China Recommends Yuan-Backed Stablecoin," *Cryptodigest*, October 12, 2018. (www.cryptodigest.com/news/44384/peoples-bank-of-china-recommends-yuan-backed-stablecoin-201810120454)
- 109.** A "stablecoin" is a cryptocurrency that is pegged to another stable asset, like gold or the U.S. dollar. It is a currency that is global, but is not tied to a central bank and has low volatility. This allows for practical usage of a cryptocurrency, like purchasing daily goods and services.
- 110.** Colin Harper, "In search of Stability: An Overview of the Budding Stablecoin Ecosystem," *Bitcoin Magazine*, October 3, 2018. (<https://bitcoinmagazine.com/articles/search-stability-overview-budding-stablecoin-ecosystem/>)

broader economy. By late 2018, the DCRI had established fintech centers in Shenzhen and Nanjing provinces to develop blockchain technology products and systems for banks, universities, and research institutions.¹¹¹ More broadly, the Chinese Communist Party is developing Shenzhen and Nanjing into tech innovation hubs to compete with Silicon Valley.¹¹²

The People’s Bank of China and various municipal authorities are running multiple blockchain pilots, particularly for credit, trade finance, and real estate projects. See Appendix 1 for prominent projects and Appendix 2 for the most influential institutions impacting blockchain development.

China also is piloting blockchain platforms for securities trading.¹¹³ China Securities and Depository Clearing Corporation partnered with Zheshang Bank in Shanghai to issue \$66 million worth of blockchain-based, asset-backed securities in 2018.¹¹⁴ In January 2019, the general manager of the China Securities and Depository Clearing Corporation, Yao Qian, penned a lengthy article about Bitcoin, the benefits of blockchain, and the likely future integration of cryptocurrency

technology in China.¹¹⁵ Yao is also the former head of the PBOC’s Digital Currency Research Initiative.¹¹⁶

Recommendations

While a viable and scalable blockchain-based financial infrastructure alternative is years, if not decades, away, the nations engaged now in research and development will shape future innovations. Blockchain technology is likely to enable significant cost savings and transparency in the long run. As U.S. Federal Reserve Governor Lael Brainard said, “Even if cryptocurrencies prove to have a very limited role in the future, the technology behind them is likely to live on and offer improvements in the way we transfer and record more traditional financial assets.”¹¹⁷

U.S. financial policymakers must now consider the risks to U.S. competitiveness if banks in adversarial nations gain an edge over the U.S. in blockchain development. As global regulatory standards expand to account for digital currencies,¹¹⁸ the banking sector is likely to become more comfortable with blockchain-based products.¹¹⁹ There is an opportunity now to integrate blockchain technology into the

111. Wolfie Zhao, “PBoC’s Digital Currency Lab Launches New Research Center,” *CoinDesk*, September 5, 2018. (www.coindesk.com/pbocs-digital-currency-lab-launches-new-research-center-outside-of-beijing)

112. Cheng Yu and Lu Haoting, “Shenzhen aims to be global technology innovation hub,” *China Daily* (China), May 21, 2018. (www.chinadaily.com.cn/a/201805/21/WS5b020132a3103f6866ee97db.html); Peter Elstrom, Yuan Gao, and Xiaoqing Pi, “China’s Technology Sector Takes On Silicon Valley,” *Bloomberg*, July 10, 2018. (www.bloomberg.com/news/articles/2018-07-10/china-s-technology-sector-takes-on-silicon-valley)

113. Wolfie Zhao, “PBoC’s Digital Currency Chief Departs to Lead Securities Clearing House,” *CoinDesk*, October 15, 2018. (www.coindesk.com/pbocs-digital-currency-chief-departs-to-lead-securities-clearing-house)

114. Wolfie Zhao, “Chinese Bank Issues Securities Worth \$66 Million on a Blockchain,” *CoinDesk*, August 21, 2018. (www.coindesk.com/china-zheshang-bank-issues-securities-worth-66-million-on-blockchain)

115. “Yao Qian: Central Bank Digital Currency Optimized Payment System Improves Effectiveness of Monetary Policy,” *BTC Trade* (China), March 13, 2019 (<https://www.btctrade.com/lives/84657.html?lang=en>)

116. Wolfie Zhao, “PBoC’s Digital Currency Chief Departs to Lead Securities Clearing House,” *CoinDesk*, October 15, 2018. (www.coindesk.com/pbocs-digital-currency-chief-departs-to-lead-securities-clearing-house)

117. U.S. Federal Reserve Governor Lael Brainard, “Cryptocurrencies, Digital Currencies, and Distributed Ledger Technologies: What Are We Learning?” *Speech at the Decoding Digital Currency Conference*, May 15, 2018. (<https://www.federalreserve.gov/newsevents/speech/brainard20180515a.htm>)

118. MarcHochstein, NikhileshDe, and AnnaBaydakova, “BeyondKYC:RegulatorsSettoAdoptToughNewRulesforCryptoExchanges,” *CoinDesk*, May 20, 2019. (<https://www.coindesk.com/beyond-kyc-global-regulators-appear-set-to-adopt-tough-new-rules-for-crypto-exchanges>)

119. Yaya J. Fanusie, “Crypto Is About To Look More Like Your Bank,” *Forbes*, March 22, 2019. (<https://www.forbes.com/sites/yayafanusie/2019/03/22/crypto-is-about-to-look-more-like-your-bank/#b22ce7556302>)

broader financial system, but a successful approach will only come through pilot projects, research, investment, and policy discussions.¹²⁰ It is quite possible that banks that are the most forward-leaning on cryptocurrencies and blockchain – those outside of the U.S. – could be best equipped to respond to changes in consumer and technological demands. Because these U.S. adversaries’ have strong political motivations to excel in blockchain technology development, the U.S. is at risk of being blindsided by seismic fintech shifts.

While some U.S. financial firms, and even SWIFT, are experimenting with blockchain applications, the American financial sector has fewer short-term incentives to build out new types of money transfer systems than countries looking to evade or displace U.S. financial power. If the American financial system is to stay competitive, U.S. financial stakeholders need to stay ahead of, and shape, the fintech curve. This requires more than watching blockchain innovations from afar. U.S. policymakers need to ensure that American businesses and brainpower are leaders as the global financial system evolves.

- The U.S. Treasury should conduct “red team” and financial threat scenarios that involve nation states deploying fintech alternatives to SWIFT to offset U.S. sanctions power. The U.S. Department of Defense and intelligence agencies often plan tabletop exercises to test the effectiveness of current agency policies and capabilities in a simulated scenario where adversaries deploy breakthrough technology. During the simulation, agencies identify policy or capability gaps and formulate recommendations for how to address them. Treasury should run similar financial threat exercises on low-probability/high-impact situations in which an adversary successfully deploys digital

currencies or new financial transfer mechanisms to circumvent or undermine U.S. financial power. In the exercises, Treasury should also consider the impact of these scenarios on U.S. debt financing and long-term financial strategy.

- The U.S. government should conduct studies on the potential impact of digital currencies on the U.S. banking system. Although the Federal Reserve is closely observing developments in the cryptocurrency and distributed ledger technology space,¹²¹ it has not published a study on how these new innovations may impact the U.S. financial system. The stewards of the nation’s monetary health should assess the possible impact of independent cryptocurrencies and foreign central bank digital currencies and determine the extent to which the U.S. should consider incorporating blockchain technology within its financial rails. Congress should task the Government Accountability Office with researching the potential impact of digital currencies on the U.S. banking system.

“The U.S. government should conduct studies on the potential impact of digital currencies on the U.S. banking system. Although the Federal Reserve is closely observing developments in the cryptocurrency and distributed ledger technology space, it has not published a study on how these new innovations may impact the U.S. financial system.”

- The White House should produce a National Strategy on Digital Assets. Although it is unclear if independent cryptocurrencies like Bitcoin will be relevant several years from now, the world’s

¹²⁰ U.S. Department of Homeland Security, “2018 Public-Private Analytic Exchange Program: Blockchain and Suitability for Government Applications,” 2018. (https://www.dhs.gov/sites/default/files/publications/2018_AEP_Blockchain_and_Suitability_for_Government_Applications.pdf)

¹²¹ U.S. Federal Reserve Governor Lael Brainard, “Cryptocurrencies, Digital Currencies, and Distributed Ledger Technologies: What Are We Learning?” *Speech at the Decoding Digital Currency Conference*, May 15, 2018. (<https://www.federalreserve.gov/newsevents/speech/brainard20180515a.htm>)

growing digitization suggests that digital assets of some form will be relevant in future global finance. The U.S. should identify how emerging and evolving technologies like blockchain will affect U.S. national security and also how to steer their development to ensure this evolution benefits American interests. This strategy should be informed by analysis from the Federal Reserve, Departments of the Treasury and Commerce, as well as the Department of Justice and the Office of the Director of National Intelligence. The relevant agencies should establish a task force to develop this strategy.

“U.S. regulators should establish formal definitions, terminology, and standards for blockchain technical operations, platform types, and business activities. Jurisdictions with clear regulations around blockchain technology products are likely to see more advances in their ecosystems than those with regulatory uncertainty.”

- U.S. regulators should establish formal definitions, terminology, and standards for blockchain technical operations, platform types, and business activities. Jurisdictions with clear regulations around blockchain technology products are likely to see more advances in their ecosystems than those with regulatory uncertainty. While the U.S. Treasury Department has pioneered anti-money laundering requirements for cryptocurrency exchanges,¹²² U.S. regulators have not provided firm guidance on a host of other issues relating to the new technology. Financial authorities should work to develop standards similar to Generally Accepted Accounting Principles to help guide blockchain-related retail and institutional business activity. Setting parameters will also help

organize research and assessments to identify best practices to protect consumers from fraud and market manipulation.

- U.S. financial authorities should strengthen their in-house blockchain intelligence expertise. Many federal agencies that combat illicit financing and enforce sanctions use blockchain analysis to aid their investigations, but greater technical blockchain expertise is needed. These agencies should cultivate deep, technical blockchain knowledge among their analysts and investigators. In addition to tracking blockchain transactions, more personnel should become familiar with the intricacies of writing blockchain code and evaluating blockchain applications. This will enable investigators to develop more fine-tuned tools. Financial authorities should recruit personnel with relevant computer science expertise to investigate the growing underground blockchain ecosystem, including mixers and privacy coins, and emerging tools like decentralized exchanges.
- The U.S. should target illicit actors, not open-source software development. The U.S. private sector is the global leader in open-source software development. Most blockchain projects in this report involve free, open-source protocols like Dash, Ethereum, Hyperledger, NEM, and Stellar. American ingenuity has helped develop many of these platforms. Countering blockchain sanctions resistance by trying to prohibit the proliferation of the software itself would be a quixotic undertaking. Blockchain software will proliferate wherever there is an internet connection. Regulators should make sure that their oversight does not push open-source software developers to leave the U.S. for havens with less stringent regulations overseas. In sanctions enforcement, the U.S. should make sure to distinguish between blockchain software code and the actors using blockchain platforms to circumvent sanctions.

122. U.S. Department of the Treasury, Financial Crimes Enforcement Network, Press Release, “FinCEN Issues Guidance on Virtual Currencies and Regulatory Responsibilities,” March 18, 2013. (<https://www.fincen.gov/news/news-releases/fincen-issues-guidance-virtual-currencies-and-regulatory-responsibilities>)

- The U.S. should work with international partners to identify blockchain projects that would undermine anti-money laundering and countering the financing of terrorism (AML/CFT) standards. Some nations friendly to the United States may be tempted to support the blockchain initiatives led by U.S. adversaries, but they should be warned of the illicit finance risks. The current global financial system has clear standards to combat money laundering and the financing of terrorism. Other nations should see blockchain sanctions resistance projects for what they really are: an effort to build a financial system with less accountability against crime, corruption, and other malicious and destabilizing activity. Groups like the Financial Action Task Force are working to incorporate virtual currencies into existing AML/CFT standards, but the U.S. will need to lead partners by example by codifying those recommendations into regulation and enforcement and sharing best practices.¹²³
- The U.S. should sponsor pilot programs to serve as business incubators for blockchain technology development. The private sector will drive innovation in the blockchain space. The U.S. can bolster this innovation by encouraging computer science talent to build blockchain solutions. The Commerce and Treasury Departments should develop criteria for companies to apply for business incubator projects that address key areas of blockchain development and challenges that federal, state, and local governments face.

Conclusion

Even as U.S. adversaries continue with traditional sanctions evasion schemes, they increasingly use new innovations like cryptocurrencies and blockchain technology to build sanctions resistant economies. Such efforts are unlikely in the short term to build big enough systems to offset U.S. sanctions. Increasing digitization, cashlessness, and peer-to-peer technology systems are creating different channels for transferring value.

These new financial pipelines are going to require innovative approaches to governance and compliance in order to maintain global financial integrity. The U.S. must do more than passively monitor adversaries' attempts to build new systems. U.S. policymakers and financial sector stakeholders will need to take the lead in this evolving international "crypto race." Washington must ensure that if blockchain technology ascends, it develops in a way that will expand the transparency, freedom, and prosperity of the last century. The way forward is not to just consider the threats emanating from various types of fintech, but to think more creatively how the global financial system should adapt to technological change.

123. Financial Action Task Force, Public Statement, "Mitigating Risks from Virtual Assets," February 22, 2019. ([http://www.fatf-gafi.org/fr/publications/recommandationsgafi/documents/regulation-virtual-assets-interpretive-note.html?hf=10&b=0&cs=desc\(fatf_releasedate\)](http://www.fatf-gafi.org/fr/publications/recommandationsgafi/documents/regulation-virtual-assets-interpretive-note.html?hf=10&b=0&cs=desc(fatf_releasedate))); Yaya Fanusie, "Crypto Is About To Look More Like Your Bank," *Forbes*, March 22, 2019. (<https://www.forbes.com/sites/yayafanusie/2019/03/22/crypto-is-about-to-look-more-like-your-bank/#1d8243d85630>)

Appendix 1: Blockchain Pilot Projects

| Country | Name of Institution | Ownership | Project Description | Blockchain Software Used |
|---------|--------------------------------------|-----------------|--|--------------------------|
| Russia | Alfa Bank JSC ¹²⁴ | Privately Owned | Platform designed to allow businesses to exchange data with the R3 Consortium as part of a Know Your Customer (KYC) identification system. ¹²⁵ | Corda |
| Russia | Bank VEB | State-Owned | Blockchain platform in the city of Grozny for housing and utilities services. ¹²⁶ | Hyperledger |
| Russia | Bank VTB | State-Owned | Patent for a blockchain-based payment system to facilitate cross-border payments, digital services, and loyalty programs. ¹²⁷ | Unknown |
| Russia | Bank of Russia | State-Owned | Central bank was reviewing Masterchain blockchain software for transmitting financial messages between Russian banks and the Eurasian Economic Union. (Ministry of Finance reported in December 2018 that it may end up not using a blockchain solution). ¹²⁸ | Ethereum |
| Russia | Gazprombank | State-Owned | Project designed to use quantum key distribution to secure data sets and smart contracts from hacking attempts. ¹²⁹ | Unknown |
| Russia | National Settlement Depository (NSD) | State-Owned | Blockchain platform called D3 Ledger, designed to hold digital assets and provide financial clearing services. ¹³⁰ | Hyperledger |
| Russia | Sberbank | State-Owned | Platform for issuing corporate bonds through smart contracts. As a pilot, the bank issued a bond worth \$12 million for a Russian telecommunication company. ¹³¹ | Hyperledger |

124. Tanya Chepkova, “Russian Alfa Bank Successfully Tests Blockchain-Based International KYC Solution,” *Cryptovest*, July 12, 2018. (<https://cryptovest.com/news/russian-alfa-bank-successfully-tests-blockchain-based-international-kyc-solution/>)

125. “Alfa-Bank has tested the international banking system for the exchange of customer data,” *Alfa Bank* (Russia), July 11, 2018. (<https://alfabank.ru/press/news/2018/7/11/46712.html>)

126. “Grozny Tests Blockchain Projects Backed By Development Bank (VEB) of Russia,” *Coin Idol*, July 28, 2018. (<https://coinidol.com/grozny-tests-blockchain-projects-backed-by-development-bank-veb-of-russia/>)

127. “VTB patents a multi-issuer blockchain system,” *VTB Group*, January 23, 2019. (<https://www.vtb.com/o-banke/press-centr/novosti-i-press-relizy/2019/01/2019-01-23-vtb-zapatentoval-multiehitentnuyu-sistemu-na-blokcheine/>)

128. Annaliese Milano, “Russia’s Central Bank Mulls Ethereum System for Pan-Eurasian Payments,” *CoinDesk*, April 4, 2018. (<https://www.coindesk.com/russias-central-bank-mulls-ethereum-system-for-pan-eurasian-payments>)

129. Gautham, “Russia’s Gazprombank Tests Quantum-Safe Blockchain,” *News BTC*, May 29, 2017. (<https://www.newsbtc.com/2017/05/29/russias-gazprombank-tests-quantum-proof-blockchain/>)

130. Michael del Castillo, “D3 Unveiled: Russian Platform Would Turn Legacy CSDs into Crypto Custodians,” *CoinDesk*, October 27, 2017. (<https://www.coindesk.com/d3-unveiled-russian-depository-seeks-big-money-investors-crypto-tokens>)

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Appendix 1 (cont.)

| Country | Name of Institution | Ownership | Project Description | Blockchain Software Used |
|---------|-------------------------------|-----------------|---|--------------------------|
| Russia | Sberbank | State-Owned | Blockchain project designed to increase the speed, reliability, and quality of interactions between Russian firms. ¹³² | Unknown |
| China | People's Bank of China (PBOC) | State-Owned | Trade finance system to facilitate trade in Hong Kong, Macau, and Guangdong province for small and medium-size businesses. ¹³³ | Unknown |
| China | Agricultural Bank of China | State-Owned | Program for agricultural mortgage applications, approvals, and registration in Guizhou province. Invested two million yuan (approximately \$300,000) to blockchain projects in mid-2018. ¹³⁴ | Unknown |
| China | China's Merchant Bank | State-Owned | Started using a blockchain system in 2017 for cash management, cross-border payments, and exchanging information. ¹³⁵ | Unknown |
| China | Zheshang Bank | Privately Owned | Platform called Lianrong developed in 2018 to settle \$66 million worth of peer-to-peer securities transactions. ¹³⁶ | Unknown |
| China | Bank of Communications | State-Owned | Issued \$1.9 billion worth of mortgage-backed securities in 2018 through a proprietary blockchain platform called Jucai Chain. ¹³⁷ | Jucai Chain |
| China | Citic Bank | State-Owned | A blockchain letter of credit system launched in 2017 and reportedly had one billion yuan (approximately \$147,722,000) after six months. ¹³⁸ | Unknown |

132. William Suberg, "First Government Blockchain Implementation for Russia," *Cointelegraph*, December 19, 2017. (<https://cointelegraph.com/news/first-government-blockchain-implementation-for-russia>)

133. "快讯：“粤港澳大湾区贸易金融区块链平台”4日在深圳试运行 (News: "Guangdong, Hong Kong and Macao Dawan District Trade Finance Blockchain Platform: trial run in Shenzhen on the 4th)," *21st Century Business Herald* (China), September 4, 2019. (<https://m.21jingji.com/article/20180904/herald/2d66ef9b438cab86aef580dcf177bdea.html>)

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136. Wolfie Zhao, "Chinese Bank Issues Securities Worth \$66 Million on a Blockchain," *CoinDesk*, August 21, 2018. (<https://www.coindesk.com/china-zheshang-bank-issues-securities-worth-66-million-on-blockchain>)

137. Wolfie Zhao, "Chinese Banking Giant Issues \$1.3 Billion in Securities on a Blockchain," *CoinDesk*, September 27, 2018. (<https://www.coindesk.com/chinese-banking-giant-issues-1-3-billion-in-securities-on-a-blockchain>)

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Appendix 1 (cont.)

| Country | Name of Institution | Ownership | Project Description | Blockchain Software Used |
|---------|---|-----------------|---|--------------------------|
| China | Bank of Shanghai | State-Owned | Agreement signed with China Construction Bank in 2018 to develop a blockchain letter of credit system. ¹³⁹ | Unknown |
| China | Bank of China Hong Kong | State-Owned | Bank was processing 85 percent of mortgage property valuations through a blockchain platform since 2018 and using a distributed ledger system for trade finance. ¹⁴⁰ | Unknown |
| China | China Banking Association (CBA) | State-Owned | Blockchain platform to facilitate inter-bank transfers to improve the security and efficiency of transactions. ¹⁴¹ | Unknown |
| China | China Securities Depository and Clearing Corporation (CSDC) | State-Owned | Agreement signed with the Russia National Security Depository in 2016 to cooperate on blockchain technology development. In 2018, Yao Qian, the former architect of the People’s Bank of China, joined the CSDC. ¹⁴² | Unknown |
| Iran | Kuknos | Privately Owned | Venture with four Iranian banks to use a blockchain system for tokenizing assets such as real estate and for inter-bank payments. ¹⁴³ | Stellar |
| Iran | Information Services Corporation & Aratek | Mixed | Project for identity verification and token management. ¹⁴⁴ | Hyperledger |

139. Chloe Jiang, “Bank of Shanghai and CCB launch China’s First Blockchain-based LC,” *8BTC* (China), May 24, 2018. (<https://news.8btc.com/bank-of-shanghai-and-ccb-launch-chinas-first-blockchain-based-lc>)

140. Chrisjan Pauw, “How Significant is Blockchain in the Mortgage Industry,” *Cointelegraph*, October 23, 2018. (<https://cointelegraph.com/news/how-significant-is-blockchain-in-the-mortgage-industry>)

141. Yogita Khatri, “Chinese Bank Giants Tap Blockchain in Trade Finance Efficiency Boost,” *CoinDesk*, January 4, 2019. (<https://www.coindesk.com/chinese-bank-giants-tap-blockchain-in-trade-finance-efficiency-boost>)

142. Samburaj Das, “After South Africa, the Russian Central Depository Partners China over Blockchain,” *CryptoCoinsNews*, October 25, 2016. (<https://www.ccn.com/south-africa-russian-central-depository-partners-china-blockchain>)

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Appendix 2: Influential Institutions in Blockchain Development

| Country | Name of Institution | Ownership | Sector | Role in Influencing Blockchain Development |
|---------|--|-------------|-----------------------------|--|
| China | People’s Bank of China (PBOC) ¹⁴⁵ | State-Owned | Banking/Finance | Development/Research; Investment |
| China | Digital Currency Research Initiative (DCRI) ¹⁴⁶ | State-Owned | Banking/Finance | Development/Research |
| China | Nanjing Financial Technology Research and Innovation Center ¹⁴⁷ | Mixed | Banking/Finance | Development/Research; Facilitator |
| China | Xiong’An Global Blockchain Innovation Fund ¹⁴⁸ | Mixed | Banking/Finance | Investment |
| China | China Securities Depository and Clearing Corporation (CSDC) ¹⁴⁹ | State-Owned | Banking/Finance | Investment |
| Russia | National Settlement Depository (NSD; a division of the Moscow Exchange Group) ¹⁵⁰ | Mixed | Banking/Finance | Investment |
| Russia | Association of FinTech (under governance of the Central Bank of Russia) ¹⁵¹ | Mixed | Technology; Banking/Finance | Development/ Research; Investment |
| Russia | Russian Presidential Academy of National Economy ¹⁵² | State-Owned | Education | Development/Research |
| Russia | Ministry of Telecom and Mass Communications ¹⁵³ | State-Owned | Technology | Regulation |

145. Chuan Tian, “China’s Central Bank Vows to Push for Blockchain in Five-Year Plan,” *CoinDesk*, June 27, 2017. (<https://www.coindesk.com/chinas-central-bank-vows-push-blockchain-five-year-plan>)

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Appendix 2 (cont.)

| Country | Name of Institution | Ownership | Sector | Role in Influencing Blockchain Development |
|---------|--|-------------|-----------------------------|--|
| Russia | Rosatom ¹⁵⁴ | State-Owned | Energy | Development/Research |
| Russia | Bank of Russia ¹⁵⁵ | State-Owned | Banking/Finance | Development/Research |
| Russia | Ministry of Defense ¹⁵⁶ | State-Owned | Defense/National Security | Development/Research |
| Russia | Russian Association of Cryptocurrencies and Blockchain (RACIB)/Accelerator ¹⁵⁷ | Mixed | Technology; Banking/Finance | Development/Research; Regulation |
| Russia | Gazpromneft-Aero (GPNA) ¹⁵⁸ | State-Owned | Energy | Development/Research |
| Russia | Rosseti ¹⁵⁹ | State-Owned | Energy | Development/Research |
| Russia | MGIMO (academic institution run by the Ministry of Foreign Affairs of Russia) ¹⁶⁰ | State-Owned | Education | Regulation |
| Iran | Shaparak Company ¹⁶¹ | State-Owned | Banking/Finance | Development/Research; Regulation |
| Iran | Iran Blockchain Labs ¹⁶² | Mixed | Education | Community; Development/Research |
| Iran | Ministry of Science, Research, and Technology ¹⁶³ | State-Owned | Technology | Development/Research; Regulation |

154. Ana Berman, “Russian State Nuclear Corporation to Develop Blockchain for ‘Increased Efficiency,’” *Cointelegraph*, October 1, 2018. (<https://cointelegraph.com/news/russian-state-nuclear-corporation-to-develop-blockchain-for-increased-efficiency>)

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Appendix 2 (cont.)

| Country | Name of Institution | Ownership | Sector | Role in Influencing Blockchain Development |
|-----------|---|-----------------|-----------------------------|--|
| Iran | Central Bank of Iran ¹⁶⁴ | State-Owned | Banking/Finance | Development/Research |
| Iran | Iran Blockchain Community ¹⁶⁵ | Privately Owned | Education | Community; Development/Research |
| Iran | Monetary and Banking Research Institute ¹⁶⁶ | State-Owned | Banking/Finance | Development/Research; Regulation |
| Iran | Informatics Services Corp ¹⁶⁷ | Privately Owned | Banking/Finance; Technology | Development/Research |
| Iran | Electronic Banking Conference ¹⁶⁸ | Privately Owned | Banking/Finance | Community; Development; Investment |
| Iran | Iran Fintech Association (also known as Fintech A) ¹⁶⁹ | Privately Owned | Banking/Finance | Development/ Research; Investment |
| Venezuela | Petróleos de Venezuela, S.A. (PDVSA) ¹⁷⁰ | State-Owned | Energy | Development/Research |
| Venezuela | Sunacrip ¹⁷¹ | State-Owned | Banking/Finance | Development/Research; Regulation |
| Venezuela | Superintendence of Cryptoassets and Related Activities ¹⁷² | State-Owned | Technology; Banking/Finance | Development/Research; Regulation |

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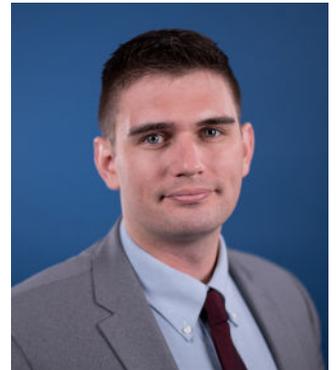
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