TEN

# How Digital Systems Will Transform the Future of Money and Development

Tomicah Tillemann

Open-source digital payment networks could not only revolutionize the financial sector, but also provide a foundation for whole-of-society digital transformation. The same technologies that enable frictionless, trusted financial transactions will unlock solutions to public corruption, digital identity verification, social benefits delivery, clean power markets, and even voting. Built correctly, these systems could reinvent the toolbox that government, the private sector, and civil society use to solve public problems.

The systems that societies use to carry out payments and financial transactions come with far-reaching consequences. In the same way a country's choice of transportation infrastructure affects traffic congestion, climate, public safety, and the ability to move people, a nation's choice of payments infrastructure influences economic growth, social mobility, and the ability to move assets.

If you are a member of the middle class in an advanced economy, you may

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think that the global financial system works reasonably well for you. You almost certainly have access to a government-insured bank account. You use financial products such as credit cards, mortgages, foreign currency exchanges, and loans to move funds, manage liquidity, and build a credit score. And you can transfer money digitally between the accounts of your family, friends, and businesses using services such as Zelle, Venmo, and PayPal.

Widespread reliance on this patchwork architecture to facilitate regular economic activity has led economists and development experts to focus on broadening access to cards, cash, and bank accounts as a means of increasing financial inclusion.[1] Policymakers and finance professionals have, in turn, pursued this goal based on the assumption that bringing more people into the existing financial system is the best way to expand access to the services it provides. However, the goal of universal financial inclusion has been stymied by inefficiencies embedded in legacy payments systems based on cards and cash.

A new generation of digital payment technology not only offers an opportunity to rethink how societies bring people into the financial system, but to reimagine the system itself. If digital payments solutions are deployed responsibly, they could catalyze a revolution in development. A growing variety of digital payment platforms are delivering groundbreaking progress in countries where they have been adopted. Many of these systems use existing technology such as mobile phones and text messaging to operate in low-capacity environments. Telecoms and government agencies are using mobile payments to leapfrog over card-based technologies and traditional financial institutions. Solutions such as M-Pesa in Kenya, BKash in Bangladesh, Bakong in Cambodia, and BHIM and NUUP in India are building a path for hundreds of millions of previously unbanked people to join the global economy. The pandemic accelerated the adoption of digital payment tools as physical banking centers closed and transactions conducted using cash increased the risk of contracting COVID-19.

Digital payment systems alone will not compensate for the effects of bad policy or revive dying industries, but they can significantly reduce levels of friction, corruption, and societal mistrust. As nations struggle to rebuild following the coronavirus pandemic, better payments architecture may prove indispensable to communities, companies, and households looking to deploy resources more efficiently. If these systems are built using open-source code and open standards, they will be able to scale quickly and at modest marginal cost to countries worldwide.[2]

The immediate upside for societies that embrace digital payments could be profound, from eliminating much of the US$30 billion spent each year on

1. World Bank.
2. Lerner.

remittance fees to recouping a portion of the US$3.1 trillion in government revenue lost to tax evasion.[3] In the long run, the benefits could go beyond providing hundreds of millions with access to more dynamic, equitable financial tools.[4]

Digital payment networks, particularly those based on open-source technology, could not only revolutionize the financial sector but also provide a foundation for whole-of-society digital transformation. The same technologies that enable frictionless, trusted financial transactions will unlock solutions to public corruption, digital identity verification, social benefits delivery, clean power markets, and even voting. Built correctly, these systems could reinvent the toolbox that government, the private sector, and civil society use to solve public problems.

This chapter provides an overview for policymakers, regulators, and development practitioners looking to harness the power and potential of these digital systems. It surveys the opportunities and challenges surrounding the use of payments solutions, including:

- The shortcomings of legacy systems;
- Promising cases where digital payment solutions have already been deployed at scale;
- Emerging technologies that could further alter the payments landscape;
- The risk that poor governance could undermine future progress in this space; and
- The ways digital payments infrastructure could enable societies to safely, securely validate and transact with a range of sensitive data and digital assets.

## Challenges of the Status Quo

The centrality of outdated payments architecture in daily life and commerce is part of what makes old systems difficult to uproot. In contrast to horse-drawn carriages and telegrams, which long ago assumed their place as quaint relics of centuries past, outmoded payments solutions continue to serve as the foundation of many advanced and emerging economies. Change is hard under the best of circumstances, and change that requires mustering political will to unseat entrenched incumbents, overcome regulatory hurdles, and roll out national technology platforms may seem almost unattainable. As a result of these and other challenges to deploying digital payment systems, many countries simply

3. Cecchetti and Schoenholtz; Werdigier.
4. Demirgüç-Kunt.

layer newer solutions, such as plastic cards, on top of older, analog infrastructure such as cash and paper-based checking accounts. The resulting amalgams of old and new often prove slow, expensive, insecure, and prone to reinforcing economic inequities. These dynamics also make payments systems vulnerable to regulatory capture and, in many cases, the sector suffers from a profound lack of competition.

A number of critiques can be leveled against existing payments infrastructure. Among them, it is:

- *Slow*. Only a quarter of the world's countries have deployed real-time payments systems.[5] Use of instant digital transactions accelerated during the COVID-19 pandemic, but in many regions, including in the United States, only a portion of financial institutions have been able to access and adopt faster systems.[6] The costs associated with slow payments infrastructure fall disproportionately on low-income populations who live paycheck to paycheck. In the United States, the long waits required to process and clear transactions are a prime reason for the US$35 billion spent each year on check cashing, payday lending, and bank overdraft services.[7] Low-income, marginalized populations use these services at disproportionately high rates to access liquidity more quickly.[8] This phenomenon was particularly pronounced during the pandemic, when millions faced financial ruin as they waited weeks to receive paper checks with social benefits and unemployment insurance.[9]

- *Expensive*. In many advanced economies, interchange fees are approximately 2 percent of each transaction.[10] For the United States, that translates to over US$40 billion annually.[11] Like the costs of long delays in settling payments, the burdens associated with these fees fall regressively on low-income consumers.[12] These challenges can be far more acute in cash-based economies. Withdrawals from automated teller machines (ATMs) are often capped at low levels, and each transaction comes with fees equivalent to several dollars. Pulling out enough cash to accomplish even a simple task such as filling up an automobile gas tank may require multiple withdrawals

5. FIS.
6. Ibid.
7. Wilson and Wolkowitz.
8. Brown, Eftekthari, and Kurban.
9. Marbella and Miller; Iacurci.
10. Kansas City Fed.
11. *Motley Fool*.
12. Schuh, Shy, and Stavins.

from multiple ATMs, each with its own transaction costs. Similar dynamics pervade cross-border remittances, a crucial development tool used to transfer over US$500 billion per year to families worldwide.[13] Moving money internationally through financial institutions requires banks to establish trusted relationships with a series of intermediaries in order to convey funds to their intended recipient. The transfer fees charged by each intermediary total US$30 billion per year, money that never reaches the individuals and communities that remittances are intended to benefit.[14]

- *Insecure.* Cash, credit cards, and checks are vulnerable to exploitation on two fronts. First, to varying degrees these systems cannot guarantee that payee and payer make and receive payments as intended. Second, legacy systems can be co-opted and exploited by bad actors. Harvard economist Ken Rogoff has estimated that one-third of all U.S. currency in circulation is used for crimes and tax evasion.[15] Cash is so insecure that responsible regulators would likely never approve it for use today if it were suggested as a new medium of exchange.[16] Credit card fraud costs the global economy over US$27 billion annually, a number that is expected to reach US$35 billion by 2023.[17] Tens of millions of credit card users have also been subject to data breaches that increase their vulnerability to identity theft. Check fraud is an old problem, but it surged back into headlines in 2020, as governments distributed fiscal stimulus in the form of physical checks. When a final accounting is done, criminals may have stolen over US$100 billion in assistance funds intended for needy families following passage of the CARES Act.[18]

- *Prone to reinforcing existing economic inequities.* One-third of the world's population has no access to the formal financial institutions that serve as an on-ramp to the global economy.[19] Unbanked individuals often find it difficult or impossible to secure their assets and may be forced to stockpile cash at home—a risky, sometimes dangerous proposition—if they want to maintain a financial reserve. Alternatives, such as entering expensive or potentially exploitative relationships with rent-seeking middlemen, add to the already high costs of being poor. Surveys of unbanked individuals find

13. De and others.
14. Cecchetti and Schoenholtz.
15. Rogoff.
16. Polemitis.
17. *Nilson Report*.
18. Murphy and Rainey.
19. World Bank Development Research Group.

that the most frequent impediment to accessing bank accounts is cost.[20] In order to combat the fraud and abuse challenges mentioned above, cash- and card-based financial institutions are subject to regulatory requirements to "know your customer" (KYC). The accompanying compliance costs are often too high to serve poor populations profitably. Other barriers to financial access include physical distance to financial institutions, a lack of documentation to validate one's identity, and a lack of trust in available banking options.[21]

## What's Working

Technologies to mitigate each of the challenges outlined above already exist. Governments, firms, and civil society organizations have deployed digital solutions that are significantly faster, more efficient, more secure, and more equitable than the systems they replace. The scope and ambition of some of these projects is sufficiently breathtaking to convince even jaded observers that change is possible.

Successful digital payment platforms come in a variety of shapes and sizes. Some are centralized systems deployed by governments. In other cases, a company with broad reach, such as a mobile carrier, may operate national payments infrastructure. As outlined below, these solutions are changing the lives of hundreds of millions of users that rely on them. In Kenya, digital payments have already lifted 2 percent of the country's population out of poverty.[22] However, even the best digital payments systems in use today come with tradeoffs.

Government-backed platforms require ongoing public investment and political support in order to function effectively. Private-sector solutions can easily morph into monopolies with attendant opportunities for rent-seeking. Centralized systems provide bad actors with a vantage point from which to conduct malevolent surveillance. And any digital platform can prove an attractive target for cybercriminals. The solutions highlighted in this section do not follow a specific formula. Rather, they reflect the expanding universe of approaches by countries adopting payment solutions that are fit for purpose in a digital age.

20. Demirgüç-Kunt.
21. Ibid
22. Jack and Suri.

### *Financial Inclusion in India*

Aadhaar, the digital identity platform of the government of India, created the groundwork for a series of payment innovations that are providing financial access to hundreds of millions of the country's citizens. The biometric identity architecture made possible by Aadhaar serves as the foundation for the Aadhaar-Enabled Payment System (AEPS), a cash transfer mechanism that allows government agencies to utilize an electronic Know Your Customer (eKYC) services to deliver payments, along with basic banking services, to millions of Indians. The Unified Payment Interface (UPI), an open payment software that standardizes bank transfer processes, enables apps like the Bharat Interface for Money (BHIM) and BharatQR to facilitate almost 1.5 billion monthly transactions between smartphone users, customers, and businesses.[23] Even those without internet-enabled mobile phones can transfer up to ₹5,000 (approximately US$65) by entering *99#* on a regular, non-smartphone to access a protocol similar to an SMS. By supplying this core technology to a wide range of payment providers, UPI has grown rapidly to power more than half of all digital transactions in India.[24]

### *Accountable Public Administration in Estonia*

Estonia prioritized interoperability to build a whole-of-government approach to digital payments and services. The country's digital platforms allow agencies and banks to offer a range of advanced services. Utility payments, pension contributions, and taxes all rely on common digital infrastructure to channel information between government agencies and citizens' bank accounts. At the core of the system is a digital identity and data exchange platform called X-Road, which securely moves information and assets between individuals, companies, and government agencies. The availability of a trusted digital identity solution streamlines KYC compliance for banks, and enables financial institutions to process mortgages, loans, and even requests to open new accounts entirely online. The system has powerful implications for public administration. By simply confirming the accuracy of information already stored in the system, citizens can file their taxes in under three minutes.[25] Estonia's X-Road framework also takes extensive precautions to safeguard personal data. Users see exactly who is accessing their information and what information has been accessed in order to help identify and deter any illicit use of the platform.

23. *Economic Times BFSI*.
24. Sharma.
25. Enterprise Estonia.

### *Universal QR Code Payments in Singapore*

Singapore embarked on a transition from a card-and-cash-based society to a mobile-first digital economy by centering its payments infrastructure on QR (Quick Response) codes. Singapore's PayNow application uses mobile phone numbers and QR codes to facilitate peer-to-peer digital payments. The country's Government Technology Agency launched the world's first unified standard for using QR codes in digital payments between banks, merchants, consumers, and government agencies, a protocol known as Singapore Quick Response (SGQR). Customers of different banks can easily, instantly exchange funds with each other, pay bills, taxes, and purchase goods and services using just QR codes. Singaporeans rely on a variety of digital payment channels, including credit cards, Google and Apple Pay, and other QR-based payment apps, but half of all adults in Singapore have downloaded the PayNow and PayNow Corporate apps since 2017.[26] Government agencies and banks have also implemented national programs to boost adoption of the SGQR system in the wake of the COVID-19 pandemic, particularly in the food and healthcare industries.[27]

### *Repurposing Existing Networks in Kenya*

Kenyan mobile phone providers leapfrogged the legacy banking system to create SMS-enabled mobile money services for their citizens. Instead of relying on formal financial institutions to serve as on-ramps and off-ramps for Kenyans looking to deposit and withdraw cash, the M-Pesa mobile phone–based money transfer service leverages a network of human agents located in cell phone kiosks across rural and urban areas to exchange cash for digital credits tracked by mobile network giants Vodafone and Safaricom. These agents act like independent ATMs, allowing M-Pesa users to move cash in and out of the M-Pesa system independent of banks. Many transactions traditionally completed using cash or bank payment services, like buying groceries or paying bills, can be accomplished solely with cell phones. Since its launch in 2007, nearly 96 percent of households in Kenya have gained access to mobile money services, lifting over a million people out of poverty thanks to the increased access to financial services.[28] M-Pesa does lock users into a specific mobile vendor, but it has successfully expanded to Tanzania, Mozambique, DRC, Lesotho, Ghana, Egypt, Afghanistan, and South Africa. Other mobile money services, including BKash in Bangladesh and Tigo

26. Monetary Authority of Singapore.
27. Sharwood.
28. Jack and Suri.

in Bolivia, now emulate M-Pesa's SMS-based model, taking advantage of its simplified infrastructure requirements and growing cellular network coverage.

### *Blockchain-Based Payments in Cambodia*

Cambodia boasts a vibrant mobile money provider market, but the highly fragmented digital payment ecosystem elevates prices for financial services and restricts payments between users on different platforms. Bakong, a project by the National Bank of Cambodia, uses blockchain[29] technology to bridge banking systems so that interbank loans and retail banking transactions all occur on a unified settlement system.[30] Consumers and merchants that rely on different banks and payment apps can process transactions in real time, fostering greater adoption of mobile financial services for the unbanked and lowering the cost for new digital payment competitors. By linking payment apps and standardizing QR codes, Bakong will also enable migrant workers to securely and instantly transmit money across borders and submit payments for medical costs or utility bills for family members back home.[31]

## Benefits of Digital Payment Platforms

Despite the broad range of approaches, architectures, and technologies outlined in the examples above, the benefits from successful digital payment solutions are remarkably similar across different geographies and contexts. In addition to technical advances such as reduced transaction times and lower costs, digital systems also demonstrate an impressive ability to reach and serve groups that were previously on the margins of an economy or society.

### *Broader Access*

Over the last decade, mobile and digital payments have driven a meteoric rise in financial inclusion. An estimated 1.2 billion people have gained access to basic financial services, which helped many start-up businesses to purchase critical goods and services and build savings.[32] These benefits particularly affect rural communities previously unable to utilize financial services due to limited internet connectivity and the long distances between many rural brick and mortar banking

29. Tillemann.
30. Vireak.
31. Chea.
32. World Bank (2018b).

locations.[33] The gains from digital payment platforms have also aided women and migrant workers. In regions where legal and societal barriers prevented women from independently managing their finances and building wealth, digital payments have afforded women greater control of their income and assets. A study in Kenya showed that mobile money services increased savings by over 20 percent, allowed 185,000 women to transition from agricultural to business occupations, and led to a 22 percent decline in the share of women-led households living in extreme poverty.[34] Migrant workers have gained the ability to manage family finances from abroad and send digital remittances instantly, securely, and at lower cost.[35]

As with any digital solution, there is always a risk that new systems could exacerbate existing inequities. In fields such as digital identity, organizations, including ID2020, have worked to ensure that solutions work for those who lack internet connectivity. It is important for digital payments providers to take similar precautions and design their systems with marginalized individuals in mind. Governments may need to embrace a variety of different payments systems. No society should be entirely dependent on a single solution. Low competition in payment service markets enables operators to charge high prices for products that underserve their users. Whenever possible, digital platforms should give communities new options rather than restrict their freedom of choice.

### *Enhanced Efficiency*

Digital payments are slowly eradicating the antiquated process of reconciling and settling transactions across disconnected financial institutions. Individuals who receive digital government cash transfers spend less time waiting in lines and traveling to collect benefits. Research in Niger concluded that the country's decision to administer its cash transfer program through mobile payments saved enough working hours to enable each participant in the program to feed a family of five for a day.[36] Time savings occur in more advanced economies as well. Estonia's efficiency gains from its X-Road system are equivalent to 2 percent of the country's GDP[37] and give citizens back the equivalent of an extra 844 working years[38] annually. Individuals' ability to repurpose time that was previously wasted visiting banks, government offices, and ATMs to engage in more productive economic and family activity is one of the most powerful benefits in countries where digital payments have been adopted.

33. Bughin and others.
34. Suri and Jack.
35. World Bank Development Research Group.
36. Boumnijel and others.
37. See www.ipinst.org/2016/05/information-technology-and-governance-estonia#3.
38. See https://e-estonia.com/solutions/interoperability-services/x-road/.

### *Reduced Transaction Costs*

Mobile payments largely eliminate the need for expensive point-of-sale terminals and interchange fees paid to financial intermediaries. Just as telecom companies can transmit text messages at the marginal cost of 1/1000th of a cent, mobile payment networks drive the cost of facilitating a transaction close to zero.[39] Lower transaction costs are encouraging many countries that lack legacy payment systems to opt for digital solutions instead of card-based infrastructure. Decentralized digital interbank settlement systems such as Ripple and Corda also reduce the cost of existing financial infrastructure. In principle, the interoperability and lower transaction fees available through use of these platforms should allow banks to reduce compliance budgets and lower the cost of services for consumers. Low transaction costs can also open the door to micropayments, and the multitude of potentially revolutionary new business models they create for everyone from street vendors to journalists. An economy in which moving assets is as easy as moving information via text or e-mail could develop new market mechanisms and incentives that more accurately reward the creation of value across society.

### *Increased Accountability*

Interoperable payments and identity verification systems can reduce waste, fraud, and abuse in public and private finance. Estonia's digital payments system allows its government to transfer funds to citizens with a high degree of confidence that the money will reach eligible, intended beneficiaries. India's digital identity and payments platforms eliminated an estimated 47 percent of leakage after it was introduced, amounting to US$9 billion of savings each year.[40] The better data that comes with the use of digital payments systems can also help governments deploy data-driven economic and social policies.

## Ensuring Responsible Governance of Payments Architecture

The remarkable benefits afforded by digital payment platforms come with a caveat: their utility depends on ensuring that systems are used responsibly and safeguarded from bad actors. Along with electrical power and computer code, digital payment networks run on trust. People need to have confidence that the platforms they trust with their hard-earned funds will operate as intended. Government efforts to illicitly manipulate or surveil networks are a clear and present danger to the long-term efficacy of digital payment systems. The potential for

39. Barker.
40. *Business Today*.

cyberattacks that compromise platform availability or integrity represent another significant concern. Either risk could quickly undermine users' confidence—and the otherwise positive outcomes associated with the use of digital payments.

Effective, responsible platform governance is the best insurance against the challenges posed by bad actors. Its importance will escalate as authoritarian governments continue to develop and export payments solutions that are both highly innovative and extremely compromised.

Alipay and Tencent's WeChat Pay, the two dominant Chinese payment platforms, include tightly integrated access to everything from bill payment and bank account management to food delivery, social media, ride shares, transit tickets, insurance, digital ID, and document storage. These platforms are among the most ambitious, successful payments solutions available anywhere in the world, and the Chinese Communist Party (CCP) is encouraging their global adoption through its Digital Silk Road and Belt and Road Initiative.[41] The CCP is also piloting a Digital Yuan, which could allow party officials to surveil the transaction history of anyone who uses their digital currency and offer similar capabilities to friendly regimes across the world. Though the CCP claims to have introduced privacy protections as a feature of the Digital Yuan, party officials reserve the right to monitor for transactions they deem illegal or a threat to national security. These measures could assist efforts to limit the economic freedom of ethnic minorities or political dissidents. In societies dependent on digital payments, a government's ability to "de-platform" users by denying them access to funds or the ability to engage in transactions could provide a penalty almost as devastating as physical incarceration.

These trends should be deeply concerning to democratic governments. The United States, in particular, has exercised significant influence over the global financial system through SWIFT—the Society for Worldwide Interbank Financial Telecommunication—an international settlement mechanism that facilitates dollar-denominated payments between countries via U.S. banks. The United States has used SWIFT to freeze international payments by individuals and organizations that finance terrorism, engage in criminal behavior, and violate international laws. SWIFT maintains strict privacy policies and is designed to extend democratic values of transparency, accountability, and the rule of law through international financial markets.[42] If innovative systems developed by authoritarian governments outcompete aging, vulnerable financial structures like SWIFT, it could have profound implications for the global system. Going forward, a country's choice of digital payment systems and digital infrastructure

41. Olsen.
42. SWIFT.

may be as important to shaping its geopolitical orientation as membership in NATO or the Warsaw Pact was a generation earlier.

The responsible governance of digital payment architecture is too important to be left to governments alone. Ideally, multi-stakeholder models with oversight from civil society, academia, the private sector, and other independent institutions could help safeguard the privacy and security of platform users. Under any circumstance, citizens and democratic governments should be wary of the serious dangers posed by digital payment systems that lack adequate oversight, privacy protections, and accountability mechanisms.

## The Frontiers of Digital Payment Architecture

Despite real governance concerns, existing digital payment technologies are delivering immense benefits. The potential reach and impact of the revolution in payments technology is poised to accelerate as new technologies nearing deployment begin to come online. These innovations could empower consumers to design their own financial tools, redefine the concept of money with programmable currency, and allow payments to cross borders seamlessly. As these technologies begin to take hold, they will reshape the concept of the global financial system along with initiatives aimed at financial inclusion.

### *Mojaloop: A Digital Payment System as a Digital Public Good*

Virtually all payment systems are designed and controlled by governments, companies, or consortia. Thanks to a powerful new category of technology solution—digital public goods—that could soon change. Digital public goods are open-source software platforms with the potential to transform the "walled gardens" of proprietary payment systems into open ecosystems that are created and maintained for societal benefit. Mojaloop is an open-source software platform that bridges divides between siloed digital payment providers. Mobile networks such as Orange and MTN are using Mojaloop to connect 100 million registered mobile money accounts into an interoperable network. The government of Tanzania is leveraging Mojaloop to break down data silos between financial providers and reduce transaction costs among businesses and individuals.[43] Open-source development can improve transparency and security of critical systems while providing organizations of all sizes with access to high-quality, interoperable digital payment systems at extremely low cost.[44]

43. Dominguez; Hunter.
44. Lerner and others.

### *Direct Cross-Border Payments with Stablecoins*

Historically, national borders have presented an exceptionally expensive barrier to financial transactions. Stablecoins, digital currencies that provide the benefits of instant processing and finality of transactions while ensuring the stability of a government-backed currency, may erode the costs of international transfers to the point of irrelevance. Instead of relying on expensive networks of intermediary banks, stablecoins take advantage of blockchain technology to create decentralized digital accounting systems. Stablecoins are pegged to fiat currencies and designed to avoid the price fluctuations that affect cryptocurrencies with market-based valuations, such as Bitcoin. The result is a stable currency that can be transmitted across continents without intermediaries and associated costs. Numerous stablecoins are preparing for launch or already in circulation. For development actors, two of the most significant are USDC (US Dollar Coin) and Diem.[45] Several other blockchains are being used to anchor stablecoins, including Stellar, Solana, and Celo.

USDC is a stablecoin developed by Circle, a fintech company based in Boston, and administered through the Centre consortium. As of mid-year 2021, there is over US$25 billion of USDC in circulation, and it is rapidly gaining traction as a regulated solution for applications that rely on a stable digital currency. Facebook incubated Diem, previously called Libra, before spinning out the project as a nominally independent social impact organization with multi-stakeholder governance. The engineering heft and global reach of the project's progenitor organization provides Diem with a big head start as it works to become the default digital currency for low-cost, instantaneous cross-border exchange. However, the platform has faced significant regulatory scrutiny along the way, largely as a consequence of its Facebook roots. Stellar is a multipurpose blockchain that allows users and institutions with different stablecoins (such as a digital dollar or a digital euro) to seamlessly transact without intermediaries, creating a global network of interoperable financial systems.[46] Celo and Solana are high performance open-source networks that allow users to buy and sell stablecoins by equipping developers with tools to build decentralized financial applications.[47] Solutions on the Celo platform include lending tools for refugees, integration with M-Pesa, and universal basic income systems for vulnerable communities.[48]

45. This chapter was originally drafted while the author was an employee at New America, a nonprofit organization. As of July 2021, the author became a partner at Andreessen Horowitz, which invests actively in this domain, including in Diem, Celo, and Solana, all of which are mentioned in this chapter.

46. Stellar Development Foundation.

47. Slavich.

48. See examples at Celo DApp Library (https://docs.celo.org/developer-guide/celo-dapp-gallery).

### *Empowering Government Economic Policy with Central Bank Digital Currencies*

The advent of blockchain technology has pushed central banks to reimagine how they manage national currencies in the digital era. Central bank digital currencies (CBDCs) could equip national currencies with new properties and improve how central banks, policymakers, and financial regulators manage money supplies and economic policy. Programmable digital currency could give governments more control over how consumers use social benefits or stimulus payments. Policymakers could program expiration dates for using cash transfers to help spur growth during slowdowns or limit the use of funds to small businesses or vulnerable industries.[49] Nearly 80 percent of the world's central banks are exploring CBDCs at either the retail or wholesale levels, with Sweden's Riksbank, the People's Bank of China, and the European Central Bank among the growing number already pursuing efforts to operationalize CBDCs.[50] Multilateral institutions such as the IMF, World Bank, and G20 are actively assessing how CBDCs could transform governments' role in finance.[51] CBDCs will need to be managed responsibly in order to realize their potential. In the absence of effective governance, they could merely port the problems of analog currencies to the digital realm.

## Digital Payment Platforms and Data Stewardship

In the same way nuclear energy can power a city or destroy it, and steel can be used to build hospitals or machetes, digital payments can advance human dignity or oppress and surveil entire populations. On their own, digital payment platforms are neutral. Against this backdrop, a new opportunity is emerging for societies to adopt data models that grant users more control over their payments data.

The world's governments currently rely on two models that govern financial data. Both are vulnerable to abuse and fail to ensure individuals have control over their information. Payments systems in India and China centralize control of transaction data in government agencies that are vulnerable to privacy breaches and manipulation for political purposes. Western democracies allow private firms to package and sell payment data to advertisers who then try to influence individual behavior. In a 2015 study, MIT researchers were able to identify individuals using credit card metadata with a 90 percent success rate if they knew

49. Yu.
50. Press Trust of India; Bharathan; European Central Bank.
51. Financial Stability Board.

the details of just four individual purchases.[52] As governments begin to leverage digital platforms to power their institutions, they should rethink data ownership and data protection rules to help citizens own and control their personal data.

Placing users at the center of public data architecture could give individuals more autonomy over how private firms, governments, and researchers use their transaction history. User-centered data models could also help individuals control and monetize the value of their financial data, maintain higher degrees of privacy, and prevent government overreach and use of personal data without individuals' consent.

## From Digital Payments to Digital Assets

Estonia, India, and a growing list of other countries are demonstrating the vast potential that exists when societies link digital payment platforms and digital identity verification. These two foundational pieces of digital infrastructure, along with mechanisms for responsible data management, can unlock a multitude of next-generation tools to power more productive societies and effective institutions.

The technologies that support digital payments and digital identity allow users to securely verify and transfer not only currency, but any unique, valuable data. The digital payments systems that provide data rails for secure, online financial transactions could be repurposed to exchange digital votes, licenses, educational credentials, carbon credits, and public benefit vouchers, all while maintaining a high degree of confidence that these assets could not be duplicated, stolen, or altered.

Societies with the capacity to move digital assets easily between trusted actors will have massive advantages in solving some of the greatest challenges of the twenty-first century. Interoperable digital payments and identity infrastructure could:

- *Help public officials and civil society organizations reduce waste and combat corruption.* Digital infrastructure can help manage procurement processes, prevent misappropriation of public funds, and provide new, more efficient methods to collect taxes. Bringing accountability to public revenue management could help governments recover trillions of dollars in public assets currently lost to waste, tax evasion, and corruption.[53]
- *Support a new class of secure public registries.* Governments use registries to establish ownership of property and companies. Creating digital land titles

52. De Montjoye, Radaelli, Singh, and Pentland.
53. UN News.

could unlock the economic potential of the US$9.3 trillion in global land assets that are currently unsecured due to stolen or missing titles.[54] They could also facilitate digital credentials to verify vaccination records, educational credentials, and other licenses.

- *Create trusted digital voting systems.* Digital voter registration and voting systems could mitigate threats to election integrity and support more efficient, secure democratic processes. Voting applications could verify that votes are cast by the intended citizen and transmit votes securely for tabulation.
- *Issue public benefits.* Next-generation benefits distribution could remove cumbersome identification barriers that prevent otherwise eligible recipients from accessing public benefits. New systems could also include features that target assistance to better aid specific communities and businesses while ensuring that public assistance is not stolen or diverted to ineligible recipients.

## A Digital Decade for the Sustainable Development Goals

As researchers map ongoing efforts to achieve the Global Goals, one point has become clear: deploying more effective digital platforms may be the only path to achieving the Sustainable Development Goals by 2030. Particularly in light of the COVID-19 pandemic, access to trusted digital systems will be essential to helping societies and institutions rebuild. Among governments responding effectively to the pandemic, virtually all rely on world-class digital systems that enable the frictionless movement of resources and data.

In September 2020, on the margins of the UN General Assembly, a group of key development stakeholders from around the world came together to launch a #DigitalDecade focused on developing open-source solutions to power more effective public institutions.[55] The prime minister of Norway, a president of the Bill & Melinda Gates Foundation, and leaders from across government, civil society, and the private sector all committed to working together to develop a new generation of digital infrastructure. New America's Digital Impact and Governance Initiative has been fortunate to be at the forefront of this work.

From Mesopotamian canals and Roman roads to transcontinental highways and the internet, infrastructure has long provided a catalyst for transforming the landscape of human development. Digital platforms, including digital payment platforms, are the transformational infrastructure of our time. As with any piece

54. Arsenault.
55. New America Foundation.

of monumental infrastructure, these platforms come with risks and the danger that they could be misused. But given the stakes for society and humanity, it is time to start building. For countries that do so responsibly and judiciously, the benefits will be immeasurable.

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