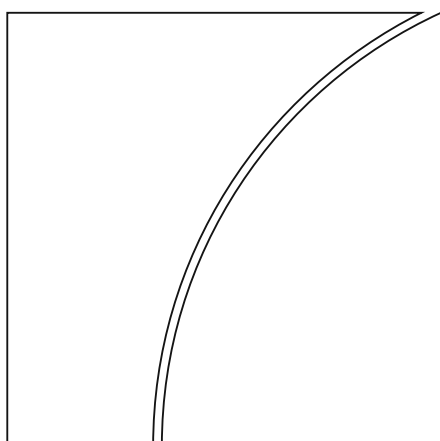




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by Derryl D'Silva, Zuzana Filková, Frank Packer and  
Siddharth Tiwari

Monetary and Economic Department

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# The design of digital financial infrastructure: lessons from India

Derryl D'Silva, Zuzana Filková, Frank Packer and Siddharth Tiwari\*

## Abstract

Digital finance has the potential to transform emerging market and advanced economies alike. India's approach rests on the principle of providing digital financial infrastructure as a public good. It offers an important case study where the results are relevant and applicable for all economies, irrespective of their stage of development. The provision of a national digital biometric identity to all residents has effectively granted them broad access to the banking system. The development of a real-time payment system platform has brought efficiencies to retail customers and small-scale transactions. By providing cheap and instantaneous payment services to ordinary citizens, the design of the Indian payment system challenges the business case for standalone private payment systems. The establishment of a legal framework for data fiduciaries promises to ensure that individuals can readily access the data generated by their online activity and dictate the circumstances for sharing those data.

Keywords: digital finance, financial inclusion, payment system, interoperability, data privacy, India Stack.

JEL classification: G28, H41, L15, L17, O33.

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## 1. Introduction

Access to finance for individuals is critical for tapping the full potential of an economy. There have traditionally been significant barriers to financial inclusion in most economies emanating from societal attitudes, legal frameworks and prohibitively high transaction costs. Recent evidence has shown that digital technologies offer a powerful way to overcome these barriers and boost access to the banking and financial system.

Key features of digital finance include the ability to use mobile devices, quickly authenticate identity, and real-time payment services. Their scalability means that they can be applied to hundreds of millions of customers, even for low-value transactions. Such low-cost, high-volume, low-value digital financial transactions were unimaginable just a decade ago. Much has already been achieved: in India alone, nearly half a billion adults opened bank accounts between 2011 and 2017.

In spite of these advances in digital technologies, some 1.7 billion people today still remain unbanked, with virtually all unbanked individuals living in developing economies. Women remain overrepresented amongst the unbanked globally at about 1 billion, as well as individually in each economy. Globally, about half of unbanked individuals come from the poorest 40% of households and the unbanked are disproportionately young.<sup>2</sup> The current system penalises those who can afford it the least. Doing nothing is not an option.

Increasing access to finance first involves the challenge of bringing the population into the country's formal financial system. Entrepreneurship, investment and economic growth suffer when savings are held, credit granted and payments settled outside the formal system to the benefit of usurious middlemen. But another challenge is to retain individuals in the formal financial system through constant innovation and satisfactory performance. In both cases, the digital financial infrastructure can be designed and implemented so that the large gaps in financial inclusion narrow between genders, as well as between income levels, education and degrees of urbanisation.

India offers an example of how various policy reforms related to digital finance – including transformation of the traditional banking system with the central bank playing a pivotal role – can solve many of the challenges of inclusive financial development that once seemed out of reach. It also offers insights into how the regulator (eg the central bank) and the regulated (eg commercial banks) can together run a payment system that operates around the clock throughout the year, is open to the participation of firms ranging from boutique fintechs to big techs and provides all the network benefits that big tech systems usually provide, but settles instantly in fiat money inside the central bank.<sup>3</sup> India's approach is built upon four pillars: (i) providing digital financial infrastructure as a public good; (ii) encouraging private innovation by providing open access to this infrastructure; (iii) creating a level playing

<sup>2</sup> The four largest developing economies with unbanked individuals are: China (224 million), India (191 million), Pakistan (99 million) and Indonesia (97 million). There are 980 million women globally without a bank account, of whom 132 million are in China, 109 million in India, 56 million in Pakistan and 47 million in Indonesia. 30% of unbanked adults are between 15 and 24 years old. See Demirgüç-Kunt et al (2018) and World Bank (2018).

<sup>3</sup> By fiat money, we mean state-issued money, declared by the sovereign government to be legal tender.

field through the regulatory framework; and (iv) empowering individuals through a data-sharing framework that requires their consent. India offers important lessons that are equally relevant for both advanced economies and emerging market and developing economies.

In the 10 years since 2009 – when the Aadhaar programme, the world’s first initiative to provide biometric identity, was launched for all Indians – India has created several innovative digital platforms, built as public goods. Each platform, designed within the regulatory system, solves a single need such as identity, payments or data sharing. But when put together, these platforms, which we sometimes refer to as “rails” in this paper due to their ability to connect different parties, create a powerful “stack” of applications. The stack reinforces private sector innovation in fintech by supporting open, free and contestable markets in digital finance. By embracing the stack approach, the official sector, in turn, has created a payment system characterised first and foremost by interoperability.<sup>4</sup>

For instance, the *identity rail* has not only greatly increased financial inclusion, but Aadhaar-based KYC procedures also offer more robust anti-money laundering (AML) / combating the financing of terrorism (CFT) checks to the banking system than before. The *payment rails* handle instantaneous and seamless financial service transactions for more citizens than before, in fiat money and settling within the banking system. They also route some government payments and can be accessed by private fintech firms.

Similar to other forms of digital infrastructure, the “India Stack” is also making Indians data rich. *Data-sharing rails* are designed to prevent data capture by the state or the private sector, instead empowering consumers and businesses to benefit from their own data. In this digital financial infrastructure, consumers – by controlling the access to and management of their own data – can transact in the marketplace without compromising privacy. At the same time, convenient means of sharing data where necessary are incorporated in the infrastructure. Easier access to data, granted with consumer consent, ultimately means that it is cheaper for consumers to find alternative products and services by fostering more competition to provide them.

A key feature of this framework is that it dramatically changes the dynamic between regulators and innovators. It enables a type of collaboration between the public and private sectors that harnesses the rapid force of private innovation while protecting the economy (and consumers) through the traditional guardrails of regulation. Notably, the Indian example has established that central banks can be proactive and equal partners with private sector counterparts when it comes to fostering technological innovation in the financial sphere.

The strengths of the framework aside, the cyber security risks of any system of digital financial platforms are immense. These include identity and data theft, scope for unlawful violations of privacy and so on. In particular, the risks that identification schemes and system integrity face from hackers must be monitored vigilantly. Likewise, the state’s ability to access identification for profiling and access to private details should be carefully circumscribed.

<sup>4</sup> Interoperability – the technical or legal compatibility that enables a system or mechanism to be used in conjunction with other systems or mechanisms – allows participants in different systems to conduct, clear and settle payments or financial transactions across systems without participating in multiple systems. The ability to use one bank’s mobile app to access and make payments from accounts in another bank is an example.



The rest of this paper is structured as follows. In Part II, we outline the main challenges faced by Indian policymakers a decade ago, currently and in the future. Part III outlines the concept of a technology stack and Part IV presents the Indian version of the stack approach. Part V provides more details on India's digital financial infrastructure, including the establishment of a digital identity, the enhancement of the payment system to bring efficiencies to retail customers and the development of a data-sharing framework that mandates customer consent. Conclusions are presented in Part VI.

## 2. The challenges

### a. The challenge then: inclusion through identity

In 2008, only one in 25 people in India had formal identification and around one in four Indian adults had a bank account.<sup>5</sup> The financial exclusion of marginalised groups – women, the poor, those out of the labour force or with less formal education – was extreme.<sup>6</sup>

It is a well established regularity that financial deepening – often measured as the growth of financial assets as a share of GDP – goes hand in hand with economic development.<sup>7</sup> A similarly strong positive relationship between economic development (as proxied by GDP per capita) and financial inclusion (as proxied by the share of adults with a bank account) has been suggested by the first available cross-country data on financial inclusion, taken from the World Bank's Global Findex database. According to the estimates across 121 national jurisdictions in 2011, the first year for which the inclusion data are available, a rise in GDP per capita from \$5,000 to \$20,000 was associated with an increase in the share of adults holding bank accounts from 30% to almost 80% (see fitted black line, Graph 1, left-hand panel).

<sup>5</sup> In 2008, 40 million Indians, or around one in 25 of the population, had a passport, which was the only unique, multi-purpose form of identity at the time (GSMA (2017)). Data on the adult population with bank accounts in 2008 are not available. The total is estimated by approximating the size of the adult population with bank accounts in 2011 from the World Bank's Global Findex database (the first year of the database) and discounting the 2011 figure by the growth rate of standard commercial ("scheduled") bank accounts, as published by the Reserve Bank of India, between 2008 and 2011. We then arrive at 27% – or around one in four – by dividing the estimated number for 2008 by the adult population of India in 2008.

<sup>6</sup> The evidence for 2011 of outsize financial exclusion of marginalised groups, presumably less than in 2008, is presented in Table 1 on page 15. A description of the inefficiencies of earlier cash transactions to transfer government benefits can be found on the website of the Indian government's Direct Benefit Transfer programme (<https://dbtbharat.gov.in/>).

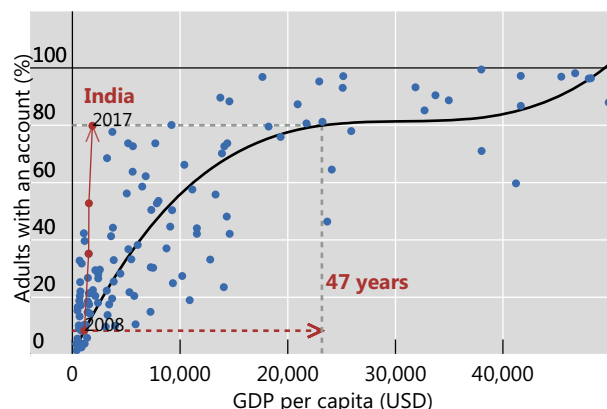
<sup>7</sup> A large literature dating at least as far back as Bagehot (1873) and Schumpeter (1911) emphasises the positive influence of the development of a country's financial sector on the level and the rate of growth of its income per capita. Theoretical papers on this topic in the 1980s and 1990s established, in particular, that development in the financial system: (i) reduce the cost of acquiring and processing information and thereby improve resource allocation (Diamond (1984), Boyd and Prescott (1986)); (ii) help monitoring investments and exerting corporate governance after providing finance (Stiglitz and Weiss (1983), Jensen and Meckling (1976), Jensen (1993)); (iii) facilitate the trading, diversification, management of risk and pooling of saving (Acemoglu and Zilibotti (1997)); and (iv) ease the exchange of good and services (Greenwood and Smith (1996)). Empirical studies confirm these mechanisms. For a review, see Levine (2005).

At the same time, it is increasingly recognised that identification is one of the key elements of financial inclusion.<sup>8</sup> According to the Global Findex database, there is also a strongly positive relationship between the proportion of population with an ID and those having bank accounts (Graph 1, right-hand panel). As people obtain such verifiable identities, they also have an easier time opening bank accounts, obtaining credit and enrolling in social welfare programmes. Transactions become more efficient, with less leakage of value along the path to the payee.

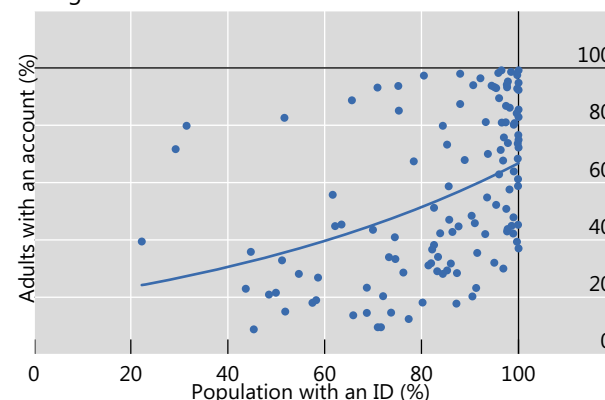
## Leapfrogging traditional development processes

Graph 1

Positive relation between GDP per capita and adults with a bank account<sup>1</sup> in 2011



Positive relation between having a bank account<sup>1</sup> and having an ID in 2017<sup>2</sup>



<sup>1</sup> Bank account held by people aged 15 and older. Data on adults with an account in 2008 were not available, therefore the graph assumes India to be on the fitted line. GDP per capita restricted to \$50,000 to remove outliers and expressed in 2011 USD values. <sup>2</sup> Due to data constraints, data in the right-hand panel are displayed for 2017 instead of 2011.

Sources: A Demirgüç-Kunt, L Klapper, D Singer, S Ansar and J Hess, "The Global Findex Database 2017: measuring financial inclusion and the fintech revolution", World Bank Group, 2018; IMF, *World Economic Outlook*, October 2019; World Bank Group, *Global Findex Database*; World Bank Group, *Identification For Development (ID4D) Global Dataset*.

Given the low levels of both financial inclusion and formal identification in 2008, the magnitude of the challenges facing India a little more than a decade ago was clearly immense. Based on the bank account data and the relationship with GDP per capita discussed above, one rough estimate is that it would have taken 47 years to achieve 80% of adults with a bank account had India solely relied on traditional growth processes.<sup>9</sup>

<sup>8</sup> The role of digital finance in promoting financial inclusion is reviewed in Ardic et al (2019), Deloitte and Confederation of Indian Industry (2016), Gates Foundation and G7 French Presidency (2019) and Riley and Kulathunga (2019). The role of central bank and government policies in advancing financial inclusion is discussed in Carstens (2019a). That enabling digital identification results in higher levels of inclusive economic growth is argued in McKinsey Global Institute (2019b). An analysis of the payment aspects of financial inclusion is discussed in CPMI and World Bank Group (2016).

<sup>9</sup> Assuming the level of GDP per capita subsequent to 2008 grew in accordance with medium-term projections at that time for Indian GDP from IMF, *World Economic Outlook*, April 2008, and for population from the World Bank, then based on the relationship of GDP per capita and financial inclusion estimated with 2011 data (Graph 1, left-hand panel, data cover 121 countries), it would have taken until 2055 for India to achieve 80% of adults with an account.

## b. The challenge now: improving payment services within the formal financial system

Just as important as increasing financial inclusion is the challenge, in the face of emerging competition, of keeping consumers within the banking system after they have entered it. For many years, consumers have been seeking instant, 24/7 and cost-free ways to transfer money to other consumers and businesses using mobile applications. Yet transfers remain costly, involve processes that are cumbersome to navigate and slow to execute, are generally available only during limited times of the day and can take days to clear. While payment systems have become more efficient in many jurisdictions, progress has been uneven, with considerable scope to upgrade further.

Many central banks and sovereigns have yet to provide an app-based payment system that meets consumer needs as outlined above and settles in fiat money inside the central bank. This failure has given rise to private schemes from non-banks. Spurred by fintech innovation, privately provided payment products and services are increasingly filling the gap outside the formal financial system. If the increased consumer use of these services is not incorporated and linked to the formal system in some fashion, it has the potential to disintermediate both banks and central bank payment platforms/systems, as well as create financial stability and AML/CFT risks.<sup>10</sup>

Cross-border payments pose a distinct challenge. Inefficiencies abound, and the costs of overseas remittances are often exorbitant.<sup>11</sup> Improving cross-border payment services involves more than technological solutions; standards and practices across jurisdictions must be coordinated to find efficient ways to connect payment systems. Enabling such solutions requires that domestic payment networks address AML/CFT concerns.

## c. The challenge going forward: data empowerment with consent

The challenge of empowering consumers with the data generated from their online activity will be of increasing importance going forward. As in many jurisdictions, the Indian population, at over 1 billion, is becoming data-rich with increasing penetration of internet connectivity and mobile phones. But in the absence of public initiatives, newly created digital data will tend to be gathered and retained in proprietary silos. The challenge is to create a structure allowing customers to readily access and share their personal data to overcome information asymmetries and lack of trust, and in so doing obtain financial services. With such an approach, consumers are likely to benefit from more personalised products linked to their individual needs. More open access

<sup>10</sup> See Carstens (2019c), G7 Working Group on Stablecoins (2019) and Duffie (2019). The government's role more generally in managing payment systems is discussed in Boel (2019) and Raman and Staschen (2017).

<sup>11</sup> See World Bank, "Remittance Prices Worldwide", September 2019. In Q3 2019, the global average cost for sending remittances was 6.84%, compared with the G8 (2010) and the G20 (2011, 2014) commitment to reduce the global average cost to 5% and the United Nations Sustainable Development Goal target of 3% by 2030.

to data can also lower switching costs for customers and foster competition and financial inclusion.<sup>12</sup>

At the same time, while ensuring wider access to data is beneficial, care should be taken that rights to privacy are protected. In jurisdictions with dominant big techs, firms have considerable autonomy over the customer data they acquire and relatively limited fiduciary responsibilities to the customers whose activities generate the data.<sup>13</sup> While data have often been used by institutions to market to customers without their informed knowledge or consent, one key issue is how can usage be disciplined so that individuals can readily access their own data and determine the conditions under which their data are shared.

### 3. What is a technology stack?

The term “technology stack” usually refers to a set of interconnected yet independent single-purpose technologies – called “platforms” – that work together towards general purpose tasks. This set is called a “stack” because it is modular in construction and its component platforms can be flexibly stacked upon each other to build a digital infrastructure. Platforms, in turn, are complex systems that connect, directly or indirectly, many users and are able to adapt to evolving user needs.<sup>14</sup> Platforms involve the exchange of information (eg social media), the exchange of goods (eg eBay) and the transmission of some form of money (eg credit cards, PayPal). In many cases, service delivery is allowed outside the platform (Uber and Airbnb), but the transmission of money takes place within the platform. In this manner, interactions on a platform resemble any economic or social exchange, whether in the real world or virtually. Moreover, it is possible for all firms – irrespective of size – to have equal access to platforms, creating network effects that lower costs and improve processes.

As an example (Graph 2), consider the combination of technologies that enables a person to hail a ride using a smartphone or book a stranger’s house instead of a hotel. Various technologies (publicly and privately) developed independently of each other have been combined to enhance the services without the end user being aware of them. In a typical taxi transaction, the consumer uses a personal smartphone to connect via publicly provided internet to a satellite-based navigation system (also developed by the public sector) to locate a driver. In this case, the service is delivered outside the platform, but payment takes place on the platform through commercially available methods (credit cards etc).

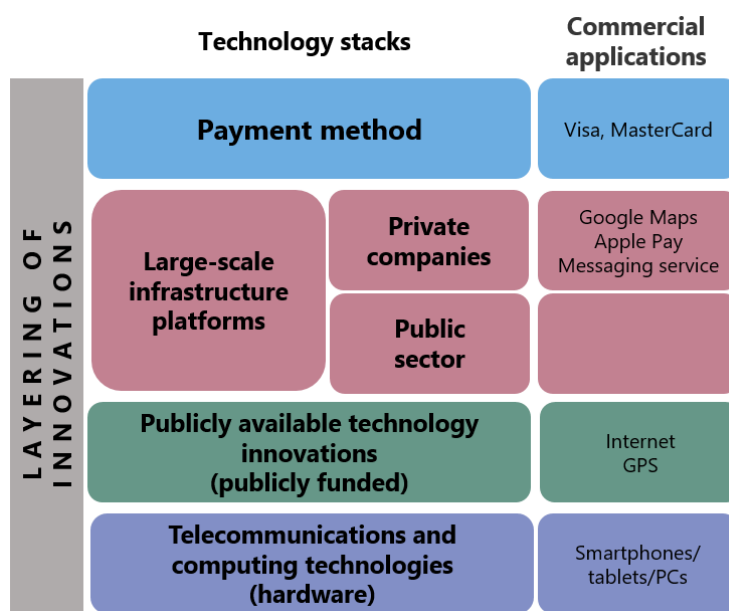
The public sector can buttress the technology stack. Historically there are already a number of important examples where digital infrastructure has been created as a

<sup>12</sup> For a discussion on the role of personal data in digital financial innovation, see Carstens (2019b).

<sup>13</sup> For a general discussion of data-opolies, see Stucke (2018). For a debate on the legal responsibilities of big tech firms, see Dobkin (2018) and Khan and Pozen (2019).

<sup>14</sup> See Parker et al (2016). There is an important distinction between platforms and products. Platforms are used to build content. For example, YouTube is a platform because it allows users to build content on it. By contrast, Netflix is a product because, while content is seen on it, it does not let third parties build on it.

public good. The internet and the GPS stand out as examples of two foundational digital infrastructures that were initially developed by the US government, and subsequently made available to the private sector to build upon further, forming the base for public-private partnerships.<sup>15</sup>



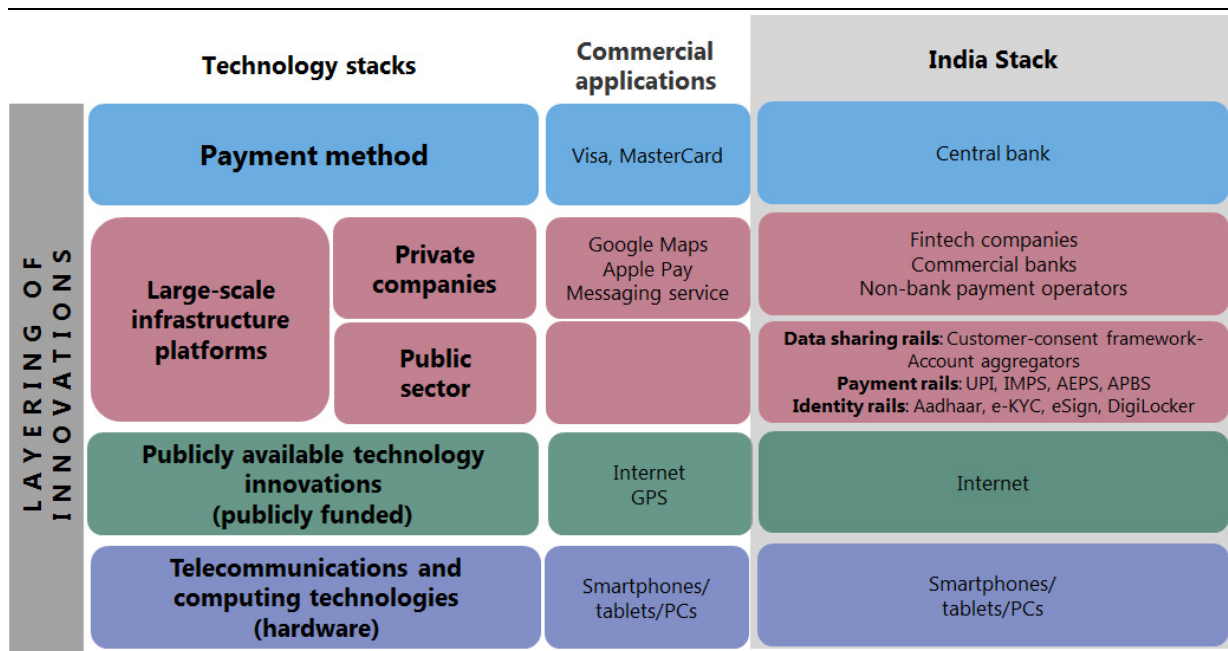
## 4. India Stack

India has addressed the challenges outlined in Part II by developing a version of a technology stack known as the India Stack (Graph 3). Instead of simply undertaking multiple technology projects in isolation, India created a state-of-the-art digital foundational infrastructure based on two principles: (i) building digital platforms as public goods so both public and private sector participants are able to develop technological innovations; and (ii) incorporating data privacy and security in the design of digital public goods.<sup>16</sup> In this paper, the India Stack concept is developed for transactions in the payment systems, although it is also applicable to other industries (eg health care, insurance).

India's digital infrastructure is designed to support both public and private sector innovators, including big tech companies, to create products that operate within the regulatory framework. Therefore, a big tech firm and a traditional commercial bank can both operate on the same digital platform. Further, these platforms, when built and operated by public institutions, provide regulators with the means to ensure that financial stability concerns are adequately addressed.

<sup>15</sup> See Nilekani (2018).

<sup>16</sup> See iSPIRT (Indian Software Product Industry Roundtable, <https://ispirt.in/>), including the discussion in Ruhela (2019). For a helpful guide to India Stack, see also India Stack (2016).



A verifiable identity is the bedrock of a modern economy. Launched in 2010, India's unique digital identity system, Aadhaar, was the first digital public good designed for the specific purpose of authenticating individual identity. More than 1.2 billion Indians now have a unique digital identity.

Various platforms – verification, digital signature and payments – have been developed over Aadhaar, built as public goods, each solving for a single purpose, each enabling another and all capable of scaling up. Using the payment systems terminology, we call these platforms “rails”, as they serve as an infrastructure for other applications to run on top of. Public and private sector innovators can use these publicly provided rails to create and exchange value, doing away with the need to build their own digital infrastructure, thereby significantly lowering transaction costs.

The e-KYC rail – digitalisation of the manual KYC process – was launched in 2012, soon after Aadhaar. This drastically reduced transaction costs for businesses and also enabled greater access to bank accounts (see discussion of e-KYC in Part V). The government could now also directly transfer subsidies to bank accounts rather than conduct these transactions in cash. Already more than \$100 billion has been transferred directly to the beneficiaries over seven years (equivalent to 5% of average period GDP), thereby reducing fraud and leakage.<sup>17</sup> Subsequently, other rails such as digital signature, digital repository and Unified Payments Interface (UPI) were launched, each tackling a specific need. The UPI payments rail has been remarkably

<sup>17</sup> See Direct Benefit Transfers, Government of India, <https://www.dbtbharat.gov.in/>. The total cumulative direct benefit transfer up to the 2019/20 financial year is scaled by average annual GDP between 2013 and 2019 taken from IMF, *World Economic Outlook*, October 2019. For an earlier overview of government transfer payments in India, see Breloff and Rotman Parker (2011). For a more general overview of how digital payments can transform public finance, see Cangiano et al (2019) and Gupta et al (2017).

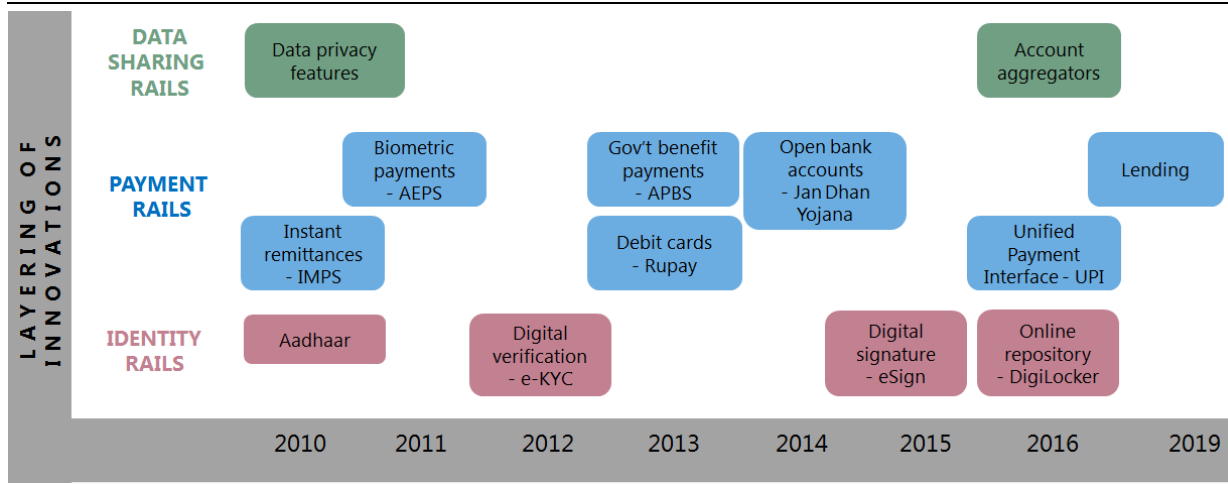
popular: in three years since 2016, it has handled a total of more than 12 billion transactions compared with 5 billion credit card transactions over the same period.<sup>18</sup>

Critically, the rails handle a high volume of data flows, raising issues of data security and privacy. In addition, as more people use the rails, they generate their own data. In the present system, citizens will have control over their own data and who they can share the data with, for how long, and whether the information can be shared further.<sup>19</sup>

Over time, this collection of rails, all offered as digital public goods, has come to be known as India Stack (Graph 4). These rails, when connected, allow many different and competing solutions to emerge for technological problems, all capable of scaling up. India Stack promotes a host of new services, from lending to insurance and wealth management.

Development of India Stack – a collection of rails

Graph 4



- **Identity rail**, where Aadhaar allows the authentication of identity on demand without the need for a physical presence, as well as e-KYC (verification), eSign (digital signature) and DigiLocker (online document depository).
- **Payment rail**, where the UPI is a single interoperable interface to bank accounts effectively granting everyone mobile access to the payment system and allowing financial transactions to take place instantly, on demand, and in fiat money inside the formal financial system.
- **Data-sharing rail**, where data privacy is ensured and customer data facilitate financial transactions, while moving efficiently and securely based on customer consent.

India Stack is an example of how a unified, multi-layered set of digital platforms, provided by the public sector, gives businesses, startups and developers significantly improved access to financial services. At the same time, it also promotes financial

<sup>18</sup> See National Payments Corporation of India, <https://www.npci.org.in/statistics>; and Reserve Bank of India, [https://www.rbi.org.in/Scripts/BS\\_ViewBulletin.aspx?Id=18573](https://www.rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=18573).

<sup>19</sup> See iSPIRT (Indian Software Product Industry Roundtable; <https://ispirt.in/>), "Data Empowerment and Protection Architecture Explained", June 2019.

inclusion, efficient conduct of specific fiscal policies, increased efficiency, financial stability and easier access to data granted with consumer consent.

## 5. Digital financial infrastructure

As noted above, India’s digital financial infrastructure consists of modular, open source architectures and standards covering three rails – identity, payments and data-sharing – that need to work concurrently.

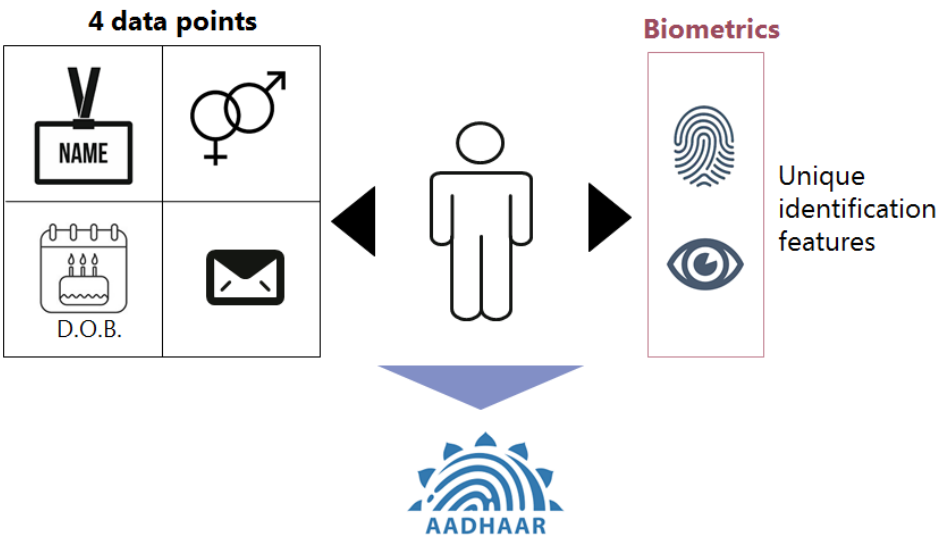
### Rail 1: Identity

#### a. Unique identity

The first rail of India’s digital financial infrastructure is used to access a unique, verifiable identity for each of its residents, available as a public good. Aadhaar is a biometric identity that requires minimal information and has a low marginal cost per identification.<sup>20</sup> It consists of a 12-digit random number that corresponds to certain demographic and biometric information of an individual. The mandatory information to be provided to receive the Aadhaar number comprises four data points: name, date of birth, gender and residential address (Graph 5). In addition to that, the user provides a photograph of the face and biometrics (fingerprints and iris scans) that can authenticate the user’s identity when the number is used.<sup>21</sup>

Components of digital identity

Graph 5



<sup>20</sup> See Zelazny (2012), where the cost per identification is estimated at approximately \$0.79, based on 200 million people enrolled at the time.

<sup>21</sup> See UIDAI (2019a). For other comprehensive guides to Aadhaar, see also GSMA (2017), IDinsight (2017) and UIDAI (2019b).



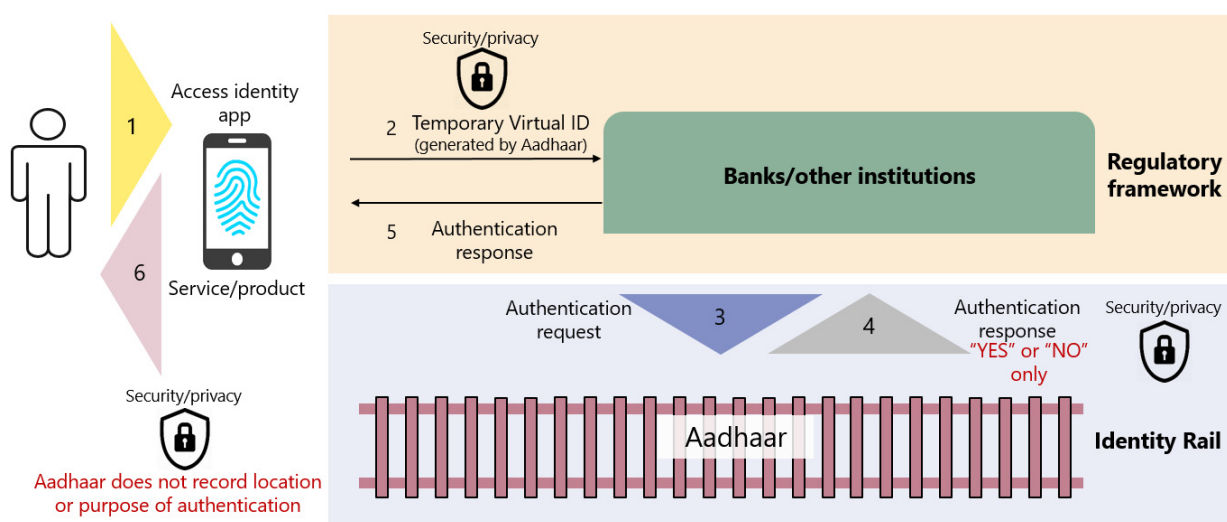
As a general purpose identity, it is usable across various functions which has increased consumer convenience and lowered transaction costs. The use of biometrics unique to the individual also significantly reduces the possibility of misuse.

The workings of the Aadhaar identity rail, by which individuals identify themselves to obtain services and products, are depicted in Graph 6. This includes a number of privacy protection features. When the individual accesses the Aadhaar identity app, the app generates a temporary “virtual ID” that connects to the original Aadhaar number and can be used to verify the identity.<sup>22</sup> By virtue of not being permanent, it does not allow financial institutions or data brokers the institutions may transact with to put together a detailed profile combining transactions across databases.

Furthermore, when the bank or other institutions send an authentication to Aadhaar, the application does not record the location or purpose of authentication. Similarly, the authentication response to the providing institution is “Yes” or “No” only; no other information about the individual is conveyed.

Aadhaar – the identity rail

Graph 6



This overview of the structure by no means implies that the workings of Aadhaar are flawless. There have been some publicised data breaches, and a number of critics worry about the threat to individual privacy from a single identification number,<sup>23</sup> although these people argue less for scaling back Aadhaar than for enhanced cyber security, as well as legislation that protects the privacy of its citizens and efforts to educate the population about their data rights.

<sup>22</sup> The virtual ID is valid for a minimum of a calendar day, although the individual can continue to use it up to the point that he or she voluntarily decides to generate a new one. See UIDAI (2019b).

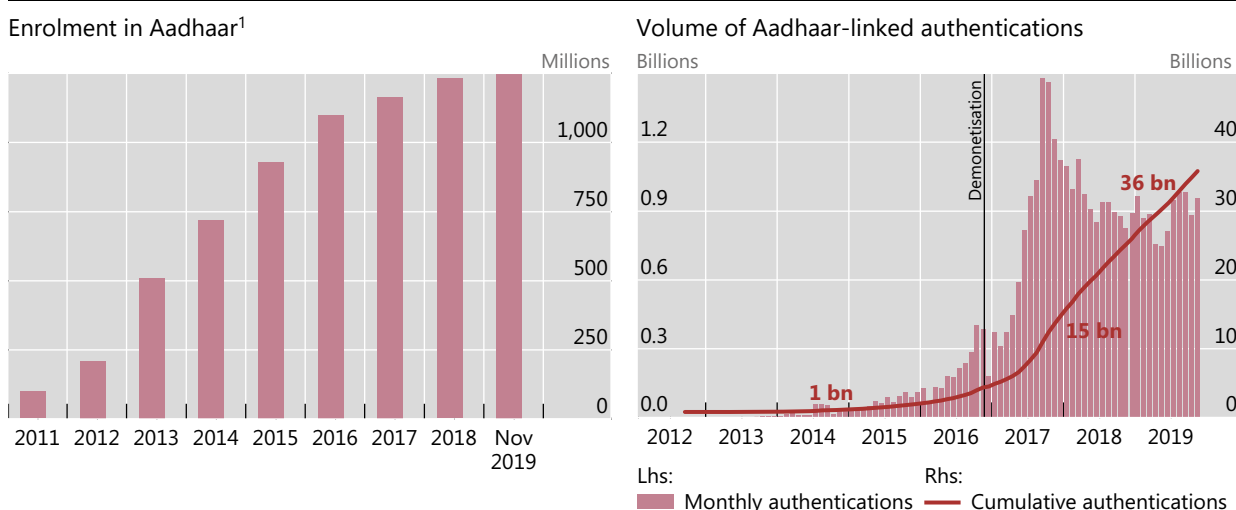
<sup>23</sup> See the discussion in Khaira (2018). Agrawal et al (2017) argue for stronger legal and policy frameworks to ensure the privacy and security of Aadhaar.

## b. Expansion and impact on financial inclusion

Aadhaar has been adopted at an extremely rapid pace. Today, over 1.2 billion Indians have an Aadhaar number, and the system is used to authenticate identity some 900 million times a month (Graph 7). Aadhaar has also served as the basis for other significant policy initiatives – most notably, the Pradhan Mantri Jan Dhan Yojana (PMJDY) initiative launched in 2014. Under this financial inclusion programme, the government allowed simple, no-frills bank accounts to be provided to individuals if they could supply their identity details. By December 2019, almost 380 million bank accounts had been opened under PMJDY.<sup>24</sup> The Direct Benefit Transfer programme, another government initiative launched in 2013 that has benefited from Aadhaar authentication, permits the government to place subsidies directly into bank accounts. In the 2018/19 financial year, about one third of transfers under the programme, amounting to nearly \$12.3 billion<sup>25</sup> or 0.4% of GDP,<sup>26</sup> were paid by the government into an Aadhaar-linked bank account.

Aadhaar: speed of adoption

Graph 7



<sup>1</sup> For data during the period from 2011 to 2016, see State of Aadhaar Report, Figure 2.1. For 2018 and current data, see UIDAI dashboard, [https://uidai.gov.in/aadhaar\\_dashboard/](https://uidai.gov.in/aadhaar_dashboard/). The value for 2017 is linearly interpolated.

Source: IDinsight, *State of Aadhaar Report 2016–17*, May 2017; UIDAI; iSPIRT.

In sum, the speed of adoption of Aadhaar – together with the other government initiatives mentioned above – has also led to a sharp increase in bank accounts. Between 2011 and 2017, some 470 million Indian adults opened a bank account in a financial institution. As mentioned earlier, the share of the population with bank

<sup>24</sup> See Pradhan Mantri Jan Dhan Yojana, <https://pmjdy.gov.in/account>.

<sup>25</sup> The 2018/19 financial year runs from April 2018 to March 2019. See Direct Benefit transfers, Government of India, <https://dbtbharat.gov.in/>; and National Payments Corporation of India, <https://www.npci.org.in/>.

<sup>26</sup> GDP data from IMF, *World Economic Outlook*, October 2019.

accounts soared to 80% – the largest increase (45 percentage points) recorded for any of the 121 countries in our sample during this period.<sup>27</sup>

The increase in financial inclusion was also accompanied by a sharp reduction in the exclusion of marginalised groups more generally (Table 1). The gender gap – the difference between the shares of men and women with a bank account – diminished from 17% in 2011 to 6% in 2017.<sup>28</sup> Similarly, the inclusion difference between those in and out of the labour force fell from 18% to 9%; between those with secondary education and those without from 29% to 10%; and between rich and poor from 14% to 5%. The gaps are now all less than world levels.

Closing inclusion gaps				Table 1
	2011	2014	2017	
	India	India	India	World
<b>Percent with bank account<sup>1</sup></b>	<b>35%</b>	<b>53%</b>	<b>80%</b>	<b>67%</b>
<b>Gender gap</b>	<b>17%</b>	<b>20%</b>	<b>6%</b>	<b>7%</b>
Men	44%	62%	83%	71%
Women	26%	43%	77%	64%
<b>Employment gap</b>	<b>18%</b>	<b>23%</b>	<b>9%</b>	<b>14%</b>
In-labour force	44%	63%	84%	72%
Out-of-labour force	26%	41%	75%	58%
<b>Education gap</b>	<b>29%</b>	<b>21%</b>	<b>10%</b>	<b>23%</b>
Secondary education or more	59%	64%	85%	77%
Primary education or less	31%	43%	75%	54%
<b>Income gap</b>	<b>14%</b>	<b>15%</b>	<b>5%</b>	<b>13%</b>
Richest 60%	41%	59%	82%	72%
Poorest 40%	27%	43%	77%	59%

<sup>1</sup> All data in this table reflect bank accounts held by people aged 15 and older.

Sources: A Demirgüç-Kunt, L Klapper, D Singer, S Ansar, and J Hess, "The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution", *World Bank Group*, 2018; World Bank, *Global Findex Database*.

### c. Electronic KYC (e-KYC)

In addition to the PMJDY financial inclusion and Direct Benefit Transfer programmes mentioned above, Aadhaar has also paved the way for making it much easier for individuals to navigate the know-your-customer (KYC) processes used by regulated entities – such as banks, other financial institutions and telecommunications

<sup>27</sup> The sample consists of countries which reported data on bank accounts held by people aged 15 and older in the World Bank's Global Findex database both, in 2011 and in 2017. The country set is then matched with GDP per capita using the IMF's World Economic Outlook database and further restricted to GDP below \$50,000 to remove outliers.

<sup>28</sup> That innovation which enhances access to digital financial services can increase the financial inclusion of women in particular is a point emphasised by Melinda Gates (2019).

companies – to evaluate new customers and satisfy regulatory requirements.<sup>29</sup> In 2012, the government launched electronic KYC (e-KYC), which allows banks and other companies to handle the KYC processes paper-free, reducing the costs of engaging new customers while complying with bank and anti-money laundering regulations. Aadhaar qualifies as an officially valid identity as part of the package for e-KYC requirements.<sup>30</sup>

Many countries, including India, prefer a conservative approach to KYC to prevent fraud in financial transactions, requiring in-person verification of identity by a trusted agent at the first instance. The cost of procuring and verifying this identity from every customer can be a major hurdle to innovative financial products and financial inclusion.

Aadhaar-based e-KYC is fast and cheap and it simplifies the process for accessing a range of financial services.<sup>31</sup> Instead of providing multiple paper identity documents, customers can use biometrics to allow their service provider to access their demographic information and photograph for verification. E-KYC can verify instantly and at significantly less cost than conventional KYC that the details on the ID are true and that the person with the ID is who they claim to be. As a paperless system, e-KYC also reduces the risk of document forgery. At the same time, India's regulators remain prudent in enforcing compliance requirements, since e-KYC still requires in-person verification for the initial opening of fully fledged bank accounts, in the presence of an approved agent. But with a network of local shops adopted as an agent, e-KYC is still less cumbersome than regular KYC practice.

The strictness of e-KYC for opening bank accounts makes it a reference point – “foundational e-KYC” – for the e-KYC performed for other purposes. For example, the e-KYC requirements for opening a brokerage or investment account are fulfilled with a one-time password for the second-factor authentication over the phone, as long as the customer already has a bank account that has undergone e-KYC as described above.

The impact of e-KYC has been substantial. A total of 8 billion e-KYC requests have been received since 2012; an average of 3 million Aadhaar-based e-KYC requests have been processed per day over the last 12 months. According to one estimate, banks that use e-KYC could lower their cost of compliance with mandatory KYC processes for setting up accounts from \$15 to around \$0.07.<sup>32</sup> Thus, Aadhaar has not only made a digital KYC process possible but has also dramatically reduced its costs.

#### d. Other applications

The ability to use Aadhaar to authenticate and verify identity on demand, at significantly lower transaction costs, has significant scope to enable access to many

<sup>29</sup> KYC is the process of verifying identity and assessing if the customer is suitable for a business relationship. Before opening a basic bank account, banks are required to conduct a KYC check for regulatory compliance requirements, to prevent fraud, money laundering and terrorist financing.

<sup>30</sup> India's Supreme Court has ruled that the use of Aadhaar is mandatory for the distribution of government subsidies and benefits, but not for opening bank accounts. See UIDAI Circular “Hon. Supreme Court's Aadhaar judgement”, October 2018, <https://uidai.gov.in/about-uidai/legal-framework/circulars.html>.

<sup>31</sup> Turnaround time for retail customer onboarding for a large bank is down from six days to one hour (India Stack (2016)).

<sup>32</sup> See Hariharan (2016).

more products and services in a range of industries. For this, a suite of applications linked to Aadhaar have been developed:

- ESign allows any individual with Aadhaar to sign documents digitally on their phones. The signature is issued only after biometrics have been confirmed or a one-time password has been used. So far, it has been heavily used for income tax returns, which are all digitally signed, and is anticipated to make it simpler for small and medium-sized enterprises to sign invoices, which, in turn, could support invoice financing for these enterprises.
- DigiLocker is an online repository (cloud-based) of digital documents. Government organisations registered with DigiLocker can deposit digital copies of documents issued by them directly into citizens' lockers. Since documents are already verified by the issuer, individuals can use the documents to access various services, from banking to telecommunications, and potentially also the health care sector. A person can also upload other documents, such as land records and insurance policies, and share them using the eSign capability. So far, about 30 million people have been using this service.<sup>33</sup>

## Rail 2: Payment systems

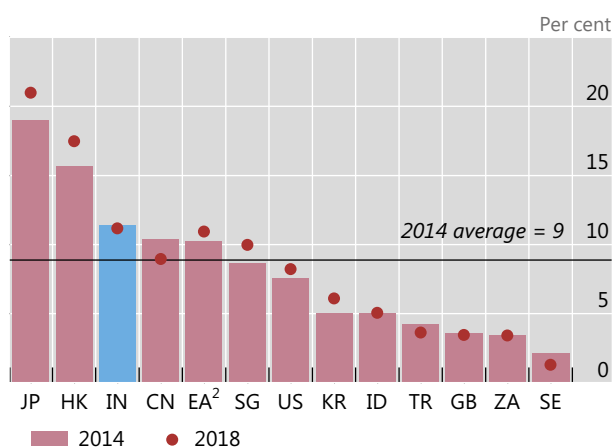
### a. Initial conditions

India has traditionally had a high level of cash usage. Cash in circulation was 11.2% of GDP in 2018, which while not as high as Japan and Hong Kong SAR, was well above the average of countries covered in the Red Book statistics of the Committee on

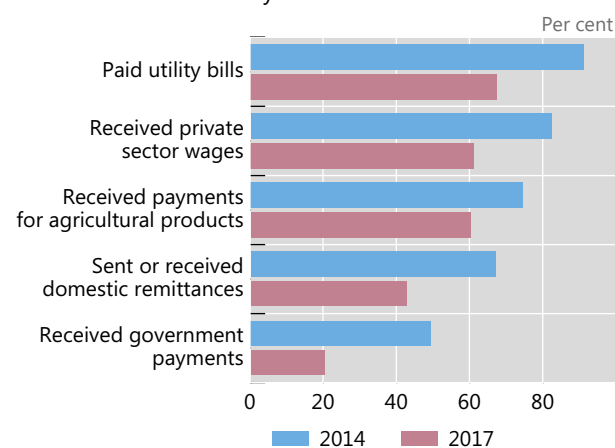
### Dominance of cash

Graph 8

Cash in circulation as a share of GDP<sup>1</sup>



Transactions in cash only<sup>3</sup>



<sup>1</sup> Cash in circulation from the CPI Red Book statistics. The weighted average of 2014 is calculated using GDP from the IMF World Economic Outlook. <sup>2</sup> Euro area. <sup>3</sup> Cash transactions as a percentage of the respective population involved in such transactions and older than 15 years. See World Bank, Global Findex Database.

Sources: A Demirgüç-Kunt, L Klapper, D Singer, S Ansar and J Hess, "The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution", World Bank Group, 2018; IMF, *World Economic Outlook*, October 2019; World Bank, *Global Findex Database*; CPI, Red Book statistics.

<sup>33</sup> See DigiLocker, Government of India, <https://digilocker.gov.in/>.

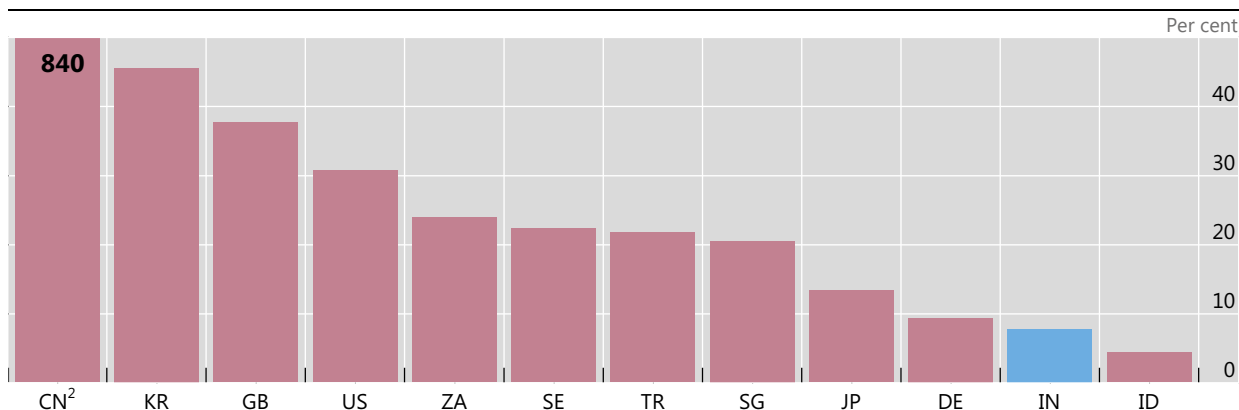
Payments and Market Infrastructure (CPMI), as well as above the ratios of comparable emerging market economies such as China, Indonesia, South Africa and Turkey (Graph 8, left-hand panel). In India, cash has been used for a significant proportion of all transactions, including the payments of wages and utility bills, domestic remittances and some government payments (Graph 8, right-hand panel).<sup>34</sup>

In a society where many consumers have been reluctant to take on debt, payment card usage has been relatively low. In fact, the share of all payment card transactions – which includes debit cards, credit cards and prepaid instruments – in India is below 8% of GDP, well below not only advanced economies such as the United States and the United Kingdom, but also the comparable emerging market economies mentioned earlier, with the exception of Indonesia (Graph 9). This meant that there was the absence of an entrenched legacy framework devoted to card-related payments that could have slowed efforts to modernise the payments framework.

### Payment cards have not gained popularity

Value of payment card transactions<sup>1</sup> as a share of GDP in 2018

Graph 9



<sup>1</sup> Debit cards, credit cards and prepaid instruments, which CPMI defines as “e-money”. <sup>2</sup> The value for China (CN), at 840%, is off this scale.

Source: IMF, *World Economic Outlook*, October 2019; CPMI, Red Book statistics.

At the same time, the domestic banking system employed an array of payment options that were not interoperable; furthermore, users could not integrate their payments across different payment systems. For example, sending money from an account at one bank to an account at another bank could take up to two calendar days, if sent after a cut-off time, and even longer over weekends or holidays. In addition, non-bank wallet providers were outside of the system, making it impossible to make a direct transaction from, for example, a Google Pay account to another account on WhatsApp. The system was ripe for change.

#### b. Unified Payments Interface (UPI)

UPI is an instant real-time payment system developed by the National Payments Corporation of India (NPCI) – a non-profit owned by the Reserve Bank of India (RBI)

<sup>34</sup> For further evidence that the Indian economy has been relatively cash-heavy and estimates of the costs of the phenomenon, see Bech et al (2018), Bapat et al (2019) and Visa (2016). For benchmarking of India's payment system to other economies, see Reserve Bank of India (2019a).

and 56 commercial banks. In operation since 2016, it is regulated by the RBI. Primarily intended to bring payment efficiencies to low value transactions, UPI unified multiple legacy payment systems via an open API architecture.<sup>35</sup>

The UPI system works by virtualising accounts, with uniform addresses along the lines of email addresses. It allows a wide range of methods for customers and operators to transfer funds within the system, using any of the following: a virtual payment address (VPA) or UPI ID, a mobile number, a bank code and account number, an Aadhaar number, or even a QR code which has captured any of the above information. The system operates 24/7, is frictionless/straight-through (ie requires no manual intervention) and enables access to funds instantly. It covers all types of consumer-to-consumer (C2C) and consumer-to-business (C2B) payments, as well as many business-to-business (B2B) payments.

The mechanics of the UPI payment rail and how it connects payment system participants together are illustrated in Graph 10. In addition to the security and efficiency attributes mentioned earlier, the following features are worth noting:

- **Interoperability:** The open API architecture enables individuals to use a single bank or payment service application to manage their money residing in multiple banks, as well as to execute and receive payments through UPI. As an example, retail customers can conduct transactions on their accounts at Bank A from inside the mobile banking app of Bank B. The greater ease of transferring funds between banks offered by UPI ensures greater competition on bank interest rates and services. Likewise, as long as the interfaces are linked to a UPI member bank, users can use fintech or big tech interfaces that they are familiar with to execute payments.<sup>36</sup>
- **Open/contestable entry (including big techs):** Any regulated payment service provider can directly use UPI to transfer funds between individuals, bank branches/correspondents, ATMs, POS machines and mobile subscribers. Fintech and big tech firms can also ride on the UPI rail, through regulated payment service providers, to offer services: WhatsApp has a pilot under way for its peer-to-peer payment service in India, which, when approved, will offer over 400 million<sup>37</sup> users in India another means of payment via a trusted interface, and within the regulated system. Smaller domestic payment service providers such as Paytm, PhonePe and OlaMoney also connect with UPI through regulated payment service providers.<sup>38</sup>
- **Within the regulatory framework:** As mentioned above, the UPI platform itself is regulated by the RBI. While all payment system players have access to the system, with the exception of some prepaid instruments (eg prepaid cards), only regulated banks can transfer money along the UPI payment rail. The

<sup>35</sup> As of December 2019, the upper limit of fund transfers using UPI is ₹100,000 (roughly \$1,500); see <https://www.npci.org.in/what-limit-fund-transfer-using-upi>. For a comprehensive overview of UPI, see Desai et al (2017). Further information can be found in National Payments Corporation of India (2016, 2018a, 2019). For a guide to NPCI activities and their evolution more generally, see Cook and Raman (2019).

<sup>36</sup> For discussions of wallet interoperability, see Gupta (2018).

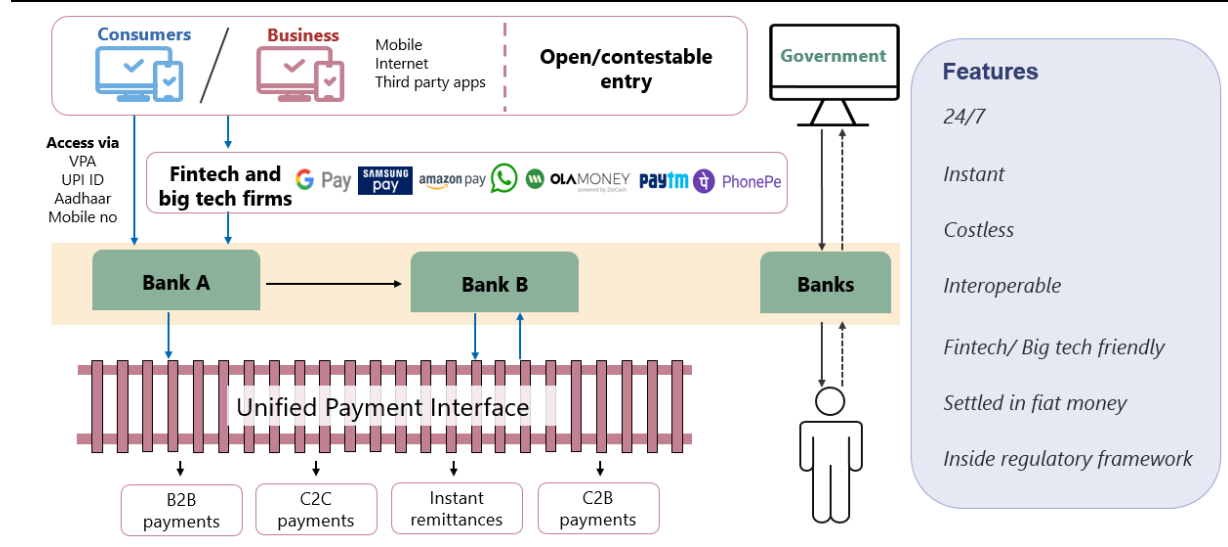
<sup>37</sup> See techcrunch, July 2019, <https://techcrunch.com/2019/07/26/whatsapp-india-users-400-million/>.

<sup>38</sup> "NPCI statement pertaining to WhatsApp BHIM UPI beta launch", [www.npci.org.in/press-releases](http://www.npci.org.in/press-releases), 16 February 2018.

establishment of payment banks<sup>39</sup> has enabled telecom providers as well as the postal system to join the banking network. These digital payments are also settled within the banking system, in fiat currency. As of December 2019, 143<sup>40</sup> banks were on UPI, representing more than 90%<sup>41</sup> of the Indian banking industry's total assets.

UPI – a payments rail

Graph 10



### c. Expansion and impact

With almost all of the Indian banking industry's customers and fintech companies able to access UPI and offer instant payment services on it as well, the use of UPI has expanded quite rapidly since its inception (Graph 11, left-hand panel). The monthly volume of UPI digital retail transactions has risen seven-fold since the beginning of 2018; in November 2019, there were more than a billion transactions, totalling around \$27 billion in value. For the six months through September 2019, payments via UPI accounted for 25% of the volume of all digital retail payments, compared with much smaller numbers for other forms of payment (Graph 11, right-hand panel). In value terms, UPI remains much smaller, though this is as expected since it has primarily brought efficiencies to low-value retail transactions.<sup>42</sup>

<sup>39</sup> Payment banks provide (i) small savings accounts and (ii) payment/remittance services to migrant labourers, low income households, small businesses, other unorganised sector entities and other users; see [https://www.rbi.org.in/scripts/BS\\_PressReleaseDisplay.aspx?prid=32615](https://www.rbi.org.in/scripts/BS_PressReleaseDisplay.aspx?prid=32615).

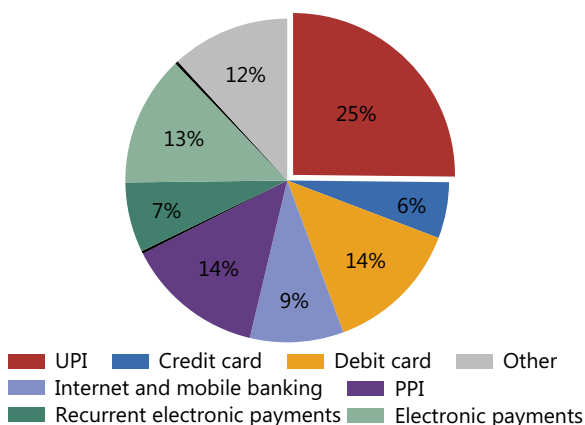
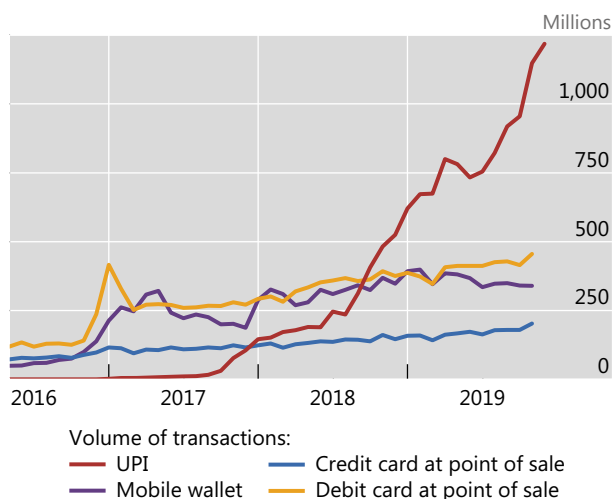
<sup>40</sup> See <https://www.npci.org.in/upi-live/members>.

<sup>41</sup> At end-March 2019, see ProwessIQ database.

<sup>42</sup> The value of retail transactions on UPI represents only 0.3% of total payments in India in the 2018/19 financial year. Total payments include digital transactions and cheque clearing and excludes cash transactions. See Reserve Bank of India, <https://www.rbi.org.in/scripts/PublicationsView.aspx?id=19057>. For an in-depth discussion of the transition for cash to non-cash and cheque to digital payments in India, see Reserve Bank of India (Maiti (2017)).



Monthly UPI transactions grow at dizzying rate

Share of digital payments by volume from April to Sept 2019<sup>1</sup>

<sup>1</sup> Credit card = credit card payments at point of sale and online. Debit card = debit card payments at point of sale and online. PPI = prepaid payment instruments, comprising mobile wallets and prepaid cards. Recurrent electronic payments = payments through the National Automated Clearing House (NACH). Electronic payments = payments through the Immediate Payment Service (IMPS), National Electronic Funds Transfer (NEFT) and Real Time Gross Settlement (RTGS). Other = other digital payments as defined by DigiDhan Dashboard: BHIM Aadhaar, closed loop wallets and other. Digital payments such as Unstructured Supplementary Service Data (USSD) and National Electronic Toll Collection (NETC) are excluded due to the possible impact of double-counting. Aadhaar-enabled payment services (AePS) system is also excluded as it includes cash withdrawal and cash deposit transactions that are not considered payment transactions.

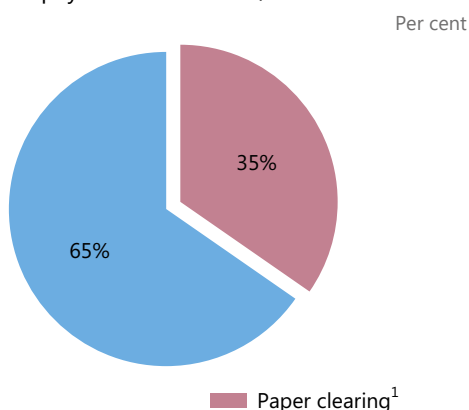
Sources: Reserve Bank of India; DigiDhan Dashboard; NPCI.

UPI has thus facilitated the large-scale adoption of digital retail payments in India, increasing from 65% in 2013/14 to 95% in 2018/19 (Graph 12). Aided by a young population,<sup>43</sup> mobile penetration increased connectivity and led to a significant reduction in the costs of mobile data consumption, which means that digital payments in India are bound to increase further. At the same time, the fact that the increase in digital retail payments is occurring through UPI ensures that the increasing transition to instant, round-the-clock payment services is in fiat money that settles within the banking system.<sup>44</sup>

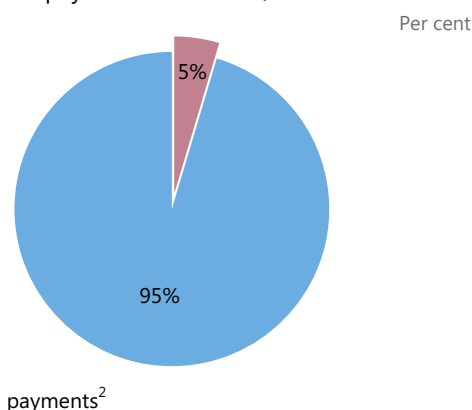
<sup>43</sup> Over two thirds of the population is under 35 years of age. See Office of the Registrar General and Census Commissioner India, <https://censusindia.gov.in>. That the leveraging of mobile phone technology was the key trigger to sizeable increases in financial inclusion is a point emphasised by Bank of Kenya Governor Patrick Njoroge (2017).

<sup>44</sup> For further discussion of the digital payments outlook in India and elsewhere more generally, see Bank of England (2019), Das (2019), Deloitte and Internet and Mobile Association of India (2017), McKinsey & Company (2018, 2019), Reserve Bank of India (2019b, 2019c) and Visa (2016). For articles paying particular attention to the development of mobile technology for digital finance in India, see Deloitte and Associated Chambers of Commerce and Industry of India (2016), Deloitte and Confederation of Indian Industry (2016), Ernst & Young LLP and Associated Chambers of Commerce and Industry of India (2018) and McKinsey Global Institute (2019a).

Volume of retail payments in FY 2013/14



Volume of retail payments in FY 2018/19



<sup>1</sup> Cheque clearing. This takes place mainly through CTS (Cheque Truncation System) and Express Cheque Clearing System (non-MICR). MICR clearing was present in 2013/14 and discontinued subsequently. Ideally, the volume of cash transactions would be included, but the data are not readily available in the RBI's payment system statistics. <sup>2</sup> As defined by the RBI: ECS, NEFT, IMPS, UPI, NACH, credit card payments at the point of sale and online, debit card payments at the point of sale and online, and prepaid payment instruments.

Source: Reserve Bank of India.

#### d. Challenges from the private sector

In the last decade, private sector operators have increasingly moved into the payments space, citing advantages over publicly provided systems such as inclusion, cost and convenience.<sup>45</sup> Private sector schemes – whose memberships often transcend national boundaries – also promise improved payment services, even on a cross-border basis. Previous work has distinguished between two types of private payment platform.<sup>46</sup> First, *standalone systems* are “closed loop” payment systems which do not interact with, or depend on, other existing payment systems. In these systems, payments are processed, cleared and settled by the platform provider independently of any other system. Alipay is a good example of this. Stablecoins issued by a big tech firm could also represent a type of standalone payment system, albeit it should be noted that no stablecoin arrangement is currently in operation. Second, *overlay systems* use existing payment infrastructure, such as correspondent banking and credit card networks or retail payment systems, to process and settle payments. Such systems build an innovative consumer interface that makes it easier for consumers to instruct and receive payments. Apple Pay is one example in this category. Notably, public fast payment systems such as UPI have been built from the

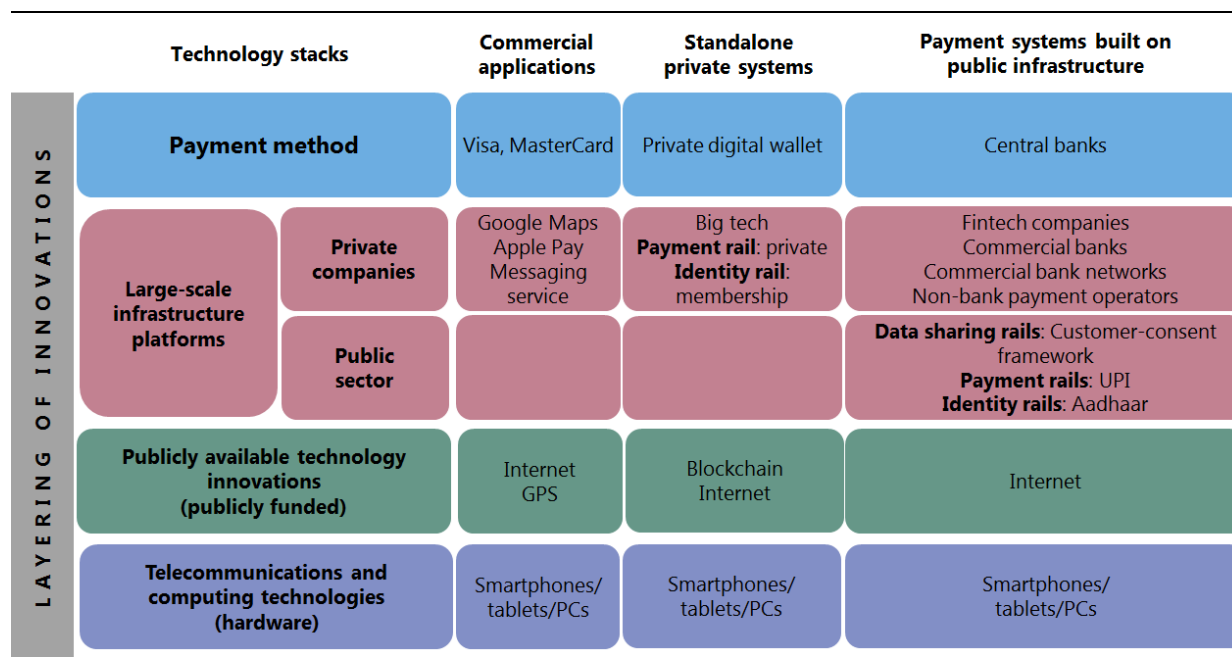
<sup>45</sup> Big tech firms can leverage their global network of existing customers, drawing on big data spanning a range of diversified activity. The big tech firms already have enormous reach: Facebook and Tencent have over 2.5 billion and 1.5 billion users, respectively (BIS (2019)). Meanwhile, while consumers want a 24/7, instant, cost-free payment system, this is not yet the norm in public payment systems worldwide, in spite of significant technological advances. Convenience is especially lacking in the context of cross-border payments. Recorded remittances today exceed foreign direct investment flows and official development assistance. The cost of these remittances – on average about 7% – is prohibitive and falls on migrant workers who can afford it the least.

<sup>46</sup> This description draws on BIS (2019), G7 Working Group on Stablecoins (2019) and Petralia et al (2019).

ground up to support interbank transactions, allowing for *overlay systems* to connect with them for payment purposes (Graph 13).

Private and central bank payment systems

Graph 13



It is often argued that standalone systems do not face the delays, costs and frictions associated with overlay systems that rely on existing relationships (including correspondent banking networks to complete the transaction). India's payment system, which is characterised by interoperability, shows how fast payment systems, built on public infrastructure, that connect with overlay systems can provide the same level of convenience for domestic transactions as a standalone system, but with the added advantage that they settle in fiat money within the regulated financial system perimeter. By contrast, standalone systems such as stablecoins – which are managed by big tech firms and others – pose risks that have yet to be dealt with comprehensively.<sup>47</sup>

There is certainly considerable scope to upgrade domestic payment systems along the line of India's digital financial infrastructure in many jurisdictions. At the same time, there is also the need globally to upgrade and reduce frictions in cross-border payments services, which is arguably the greater challenge.<sup>48</sup> Improving cross-border payment services is not only a matter of technology, but also one of coordination of practices and consistency in standards (such as ISO 20022) across

<sup>47</sup> There are at least three major challenges worth highlighting. First, unlike central bank real-time gross settlement payment systems, stablecoins are not naturally positioned to provide settlement liquidity. Second, the governance of stablecoins can be problematic, if payment arrangements involve entities outside the regulatory perimeter, and given the potential incentives for managers to serve private backers. Third, at the international level, there is the risk of global stablecoins becoming a vehicle to dodge KYC processes, as well as to evade AML/CFT compliance requirements. For detailed discussions of these issues, see G7 Working Group on Stablecoins (2019). See also Carney (2019).

<sup>48</sup> For an overview of the policy issues regarding cross-border payments, see Committee on Payments and Market Infrastructure (2018); discussions can also found in McKinsey & Company (2018) and Reserve Bank of India (2019c).

jurisdictions. Greater harmonisation in compliance and regulatory requirements across jurisdictions, as well as reducing the number of times a customer needs to complete a KYC process, would help lower the costs incurred in cross-border payments. Since a payment system is only as good as its weakest link, which usually is KYC, having low cost and instant e-KYC is critical for improving any system, whether public or private.

Fast national payment systems can also work globally. Two existing payment rails in two different jurisdictions could be configured to connect with each other simply by translating payment instructions to the common payment language. This would make the two payment rails interoperable with each other. Once technological barriers have been overcome, enabling such bilateral cross-border solutions is then a matter of having mutual confidence that each domestic network's KYC and AML/CFT is sufficient. For example, the recent pilot where a payment system (India's UPI) was connected with Singapore's network for electronic transfers (NETS) suggests significant advances could be made to cross-border payments within the existing environment.<sup>49</sup> This arrangement can provide the same level of convenience as any standalone system (eg Alipay, global stablecoins) that might enable payments between two jurisdictions, albeit with the added advantage that it would settle in fiat money within the regulated financial system perimeter.

### Rail 3: Data-sharing

As more citizens go online with their everyday activities, increasingly large amounts of data are being produced and the population is becoming data-rich. One of the guiding principles of India's approach to financial innovation is that citizens should be empowered by the wealth that their data generates. While the identity rail has brought large sections of the population into the formal financial system, and the payment rail has successfully retained them there by facilitating convenient transactions, a third rail completes the stack by allowing individuals to access and share their personal data to overcome lack of trust and information asymmetries in financial services provision.

In principle, ensuring wider access to the data generated by online activity could be beneficial. Digital data are often obtained at zero marginal cost as a by-product of digital services and are a non-rival good – ie they can be used by many without loss of content. Open access to data could also lower switching costs for customers and generally foster competition and financial inclusion.<sup>50</sup>

Major jurisdictions take different approaches to data regulation. The United States, for example, has opted for a market-oriented approach with little to no regulation of the internet. Big tech firms have generally free control over the customer data they acquire and relatively little responsibility regarding how they, or third parties, use the data. In China, while the internet is tightly controlled for national

<sup>49</sup> See High Commission of India in Singapore, <https://www.hcisingapore.gov.in/pressarch>. See the press release on the pilot launch of BHIM QR in Singapore (13 November 2019).

<sup>50</sup> See Carrière-Swallow and Haksar (2019) for a recent discussion of data's role in the modern economy and characteristics of data that justify intervention. Jones and Tonetti (2019) provide a theoretical model showing how incentives for firms to hoard data can lead to their inefficient use and that giving data property rights to consumers may be (close to) optimal. Research by FinRegLab, a non-profit innovation centre, makes the point that data can help the unbanked/underbanked in advanced economies (FinRegLab (2019)).

security reasons, and certain data must remain inside the country's borders, China's big tech firms have considerable autonomy in their use of customer data for commercial purposes. Europe has taken a more activist approach and opted for strong data protection laws, exemplified by its General Data Protection Regulation (GDPR). The burden for privacy and security is shifted to service providers, with strict rules on their ability to collect and handle data and heavy penalties for violations. But the focus is on the prevention of harm rather than user empowerment through data.

In India, the focus of data policy is to ensure that citizens reap the benefits of the data they generate. Up until now, newly created data have often been gathered and retained in proprietary silos, and stored at various institutions in incompatible formats. Data isolated in silos represent a significant opportunity cost to consumers. Digital data trails can help consumers show evidence of income, businesses attest to revenues and earning potential, thus improving access to credit and other financial services. Yet, prospective consumers of financial services in India can find it difficult to get their data to financial service providers, as they have only limited options to combine data requests across institutions. But now, India is in the midst of a major shift that disciplines the usage of data: rather than their data generally being used by institutions without their knowledge or informed consent, customers can now readily access their data to obtain services that were previously inaccessible and dictate the circumstance for sharing those data.<sup>51</sup>

For this purpose, in 2016 the RBI established the legal framework for a class of regulated data fiduciary entities, called account aggregators, which enable customer data to be shared within the regulated financial system with the customer's knowledge and consent. Data to be shared under this framework cover 18 classes of financial information that have been defined across the banking, investment, insurance and pension fund sectors. Access to data will be granted to regulated entities for a limited time for a specific purpose, but only with customer consent, which will effectively give customers control over the distribution of their own data (Graph 14). As of October 2019, seven entities had received in-principle approval from the RBI, although not all have yet been approved for operations.

Account aggregators will facilitate the transfer of financial data between various regulated financial institutions (banks, securities firms, insurance companies, pension funds etc). To deter free-riding, all participating institutions that can request data must also agree to provide data in response to requests. This will help a credit provider, personal finance adviser or vendor of other financial services (any regulated entity under the RBI, SEBI, IRDA and PFRDA)<sup>52</sup> that needs data about a potential customer (such as their credit balance, payments history or asset holdings) in order to assess the desirability of a transaction, rather than requesting information from the customer on a bilateral basis or through a variety of specialised institutions such as credit bureaus, they will submit the request for information together with the customer's virtual ID to the account aggregator. Before passing on the request to the financial institutions that hold the requested data, the account aggregator will notify

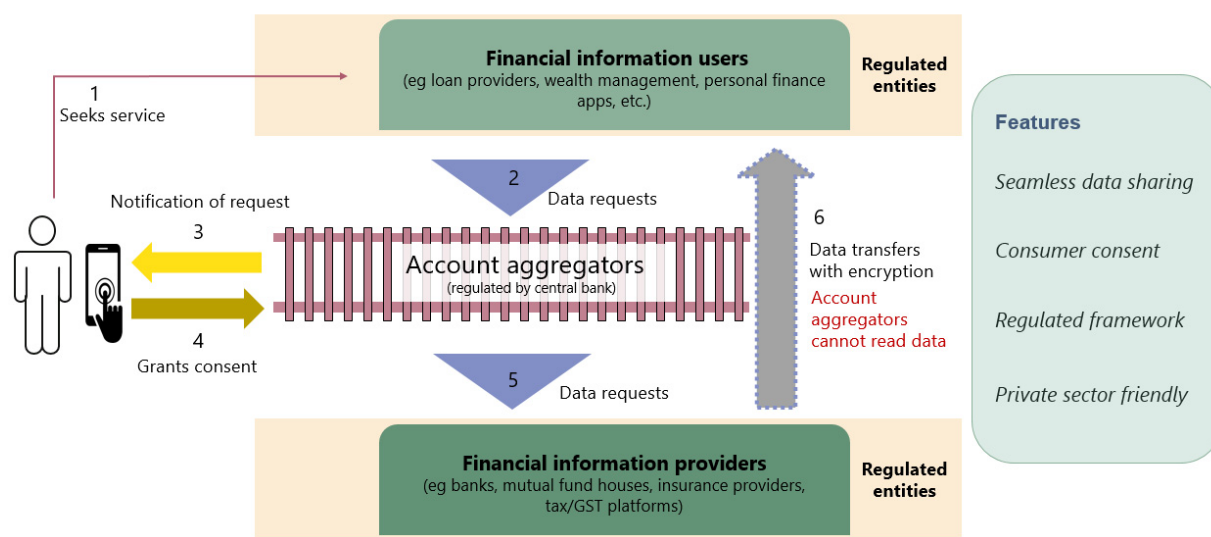
<sup>51</sup> For a review of how India Stack deals with consumer consent and data privacy issues, see Nilekani (2018), Ruhela (2019) and Kanaujia (2018). See also Republic of India (2018).

<sup>52</sup> The RBI, the Securities and Exchange Board of India (SEBI), the Insurance Regulatory and Development Authority (IRDA) and the Pension Fund Regulatory and Development Authority (PFRDA).

the customer of the entity's request via the app and ask for consent to share the data (Graph 14).

## Account aggregators – a data-sharing rail

Graph 14



Thus, the account aggregator's principle role is to serve as a consent manager, ensuring that the requested data are shared only after consent has been obtained from the registered customer on the app. The customer can restrict consent in terms of time and data categories, as well as revoke it at any time. The aggregator will also maintain a log of consents given and revoked, which will be available to its customers via the app. With regard to the actual data, the aggregators themselves are blind. Once approved, data flows on an encrypted basis directly between the source and the user; the aggregators have no ability to read the data, much less sell or store them for future use (Graph 14). Accounts are intended to be portable, meaning that individuals can change their account aggregator whenever they choose.

The key initial application of this new generation of data fiduciaries is anticipated to be in the lending space. With account aggregators, individuals and small business owners in need of credit can themselves ensure that relevant information is made available for their loan applications. For instance, an entrepreneur seeking a loan can demand that a range of information such as her tax returns, bank account data and home loan repayments be shared with the loan provider. Tedious paperwork that could take weeks and increase the cost of processing the loan is eliminated. Furthermore, the feasibility of cash flow-based lending as an alternative to asset-backed lending will be greatly enhanced, increasing access to credit and lowering the cost of existing credit lines. Loan products can be personalised and created in real-time to suit the needs of the customer based on the data provided.<sup>53</sup> After the loan has been disbursed, data-sharing can help monitor the loan on an ongoing basis.

<sup>53</sup> For example, a farmer with seasonal cash flows would be better off with seasonal repayment than monthly repayment.

Lending is an important application, albeit not the only one. Data fiduciaries will add considerable value in the insurance and wealth management fields as well.<sup>54</sup> Broadly speaking, account aggregators in financial services have the same intended outcome as “open banking”. The difference is that account aggregators are not limited to banking activities alone; they cover all regulated entities under the RBI, SEBI, IRDA and PFRDA, and could therefore promote banking, insurance and investment activities. Account aggregators will facilitate: (i) access and extension of services to unserved and underserved segments; (ii) real-time personalised and customised financial solutions based on the unique needs of individuals; (iii) quicker, affordable and convenient access; and (iv) innovation by new players that had been hampered due to data being siloed by incumbents.

The rollout of account aggregators started in the financial sector, but the individual-centric approach for digital data-sharing is also being planned for other sectors such as health care (to allow patients to access and control their own health records) and the labour market (to allow potential employees to validate their employment history or credentials). India’s approach to data-sharing, as in payments, is intended to increase competition, by ensuring both that multiple account aggregators compete on service and that exclusive access to customer data by financial firms will not be a source of competitive advantage.

The account aggregator approach to data-sharing notwithstanding, more recently India’s personal data protection bill (Republic of India (2018)) has generated considerable discussion and debate. Proponents of the bill note the increased restrictions on the collection by corporations of data generated by citizens. That said, a key concern for many Indians is that the bill might enable government authorities to exercise greater control over their data. The view expressed in this paper is that a prudent approach to data treatment is one where citizens can share their data based on their consent, and those data should not be automatically captured by either the private or the public sector.

## 6. Conclusions

In spite of the remarkable progress made on financial inclusion over the last decade – notably in India and China – today some 1.7 billion individuals remain unbanked, with virtually all of them living in developing economies. Women, the poor and young people are disproportionately represented amongst the unbanked. The current system penalises those who can afford it the least.

Increasing access to finance comprises two distinct elements. First, it entails bringing every citizen into the country’s formal financial system. Increasing access to finance also means that the digital financial infrastructure be designed and implemented such that the large gaps in financial inclusion among the disadvantaged continue to narrow. Second, it requires constant innovation so as to discourage consumers from leaving the formal financial system for privately provided payment products and services, in part by facilitating their use within the system.

<sup>54</sup> That digital financial services can greatly lower the cost and increase access to health care is a point made by Her Majesty Queen Máxima of the Netherlands (2019).

India has embraced a public sector “stack-type” architecture that encourages and internalises the benefits of disruption within the regulatory framework. India also offers an example of how various policy reforms related to digital finance – including transformation of the traditional banking system with the central bank (regulator) playing a pivotal role – can solve many of the challenges of financial development and inclusion that once seemed out of reach. The rails that create the stack can be designed in parallel or in sequence, and have powerful combinatorial effects not just in financial inclusion, but also in social protection and better access to government programmes.

All this is built around the application of digital technology to provide individuals – including those who cannot read or write – with a trustworthy identity independently of income, location, gender and ethnicity. By doing so, previously excluded groups were brought into the formal banking system with a rapidity that was well beyond what otherwise might have been expected.<sup>55</sup>

India’s approach rests on the principle of providing digital financial infrastructure as a public good, encouraging private innovation by providing open access to this infrastructure and creating a level playing field through the regulatory framework. The upgrading of the payment system along these lines – covering all types of consumer-to-consumer and consumer-to-business payments, debit cards and many business-to-business payments – enables the system to operate 24/7, in a frictionless/straight-through fashion (ie requiring no manual intervention), with instant settlement, in fiat money and inside the formal financial system. The payment system is interoperable – individuals and firms can execute and receive payments by using a single bank or payment service application to manage their money residing in multiple banks. The system has open and contestable entry, and fintech and big tech companies alike can handle payments using the payment rail through regulated banks.

In addition to bringing the population into the formal financial system and keeping them there, the Indian authorities have also developed an architecture that allows individuals to access and share their personal data to overcome information asymmetries without compromising their privacy. A legal framework for data fiduciary entities, known as account aggregators and regulated by the central bank, enables the sharing of user data, but only with the user’s full knowledge and consent. The account aggregators serve as both consent managers and pass-through vehicles for data requests and transfers, but are not allowed to read or store the data themselves. Once again, the government regulates the platforms and entry. In this fashion, the Indian authorities are proactively establishing institutional checks to empower citizens rather than allowing big techs to control customer data for their own ends.

The rapid development of India’s financial infrastructure also offers some cautionary lessons, which it has not been possible to fully cover in this report. Given the importance of customer uptake to the success of any digital financial platform, using third-party agents – as was the case with Aadhaar – is common. This can increase the risk of fraudulent behaviour, and the potential for fraud is exacerbated when consumers are less educated and technologically illiterate. A focus on both pre-

<sup>55</sup> The importance of digital ID as a foundation for digital finance has been recognised by other jurisdictions such as Singapore and the United Arab Emirates, in the MyInfo and UAE Pass schemes, respectively. An important element of PSD2, the European Union’s payment service directive of 2015 which promotes open banking, is the requirement for strong customer authentication for most electronic payments.



emptive fraud detection and consumer education is therefore necessary. Consumers need to be educated on an ongoing basis not only in the use and the features of digital financial platforms, but also in how they can protect their personal information.

It should also be acknowledged that India's digital financial infrastructure development does not necessarily transpose well to all jurisdictions. Different countries may wish to adopt different models, in part due to different starting points. For instance, big tech firms have rapidly grown to dominate digital platforms in both China and the United States, which might make mandated sharing of data at this point more difficult. Social preferences will also affect the choices made on data-sharing issues, setting national security against the privacy of personal information. Neither do all countries have equally favourable conditions: digital payment platforms have developed more rapidly where the provision of payments is limited and mobile phone penetration high. At the same time, jurisdictions with relatively inefficient and competitive banking systems tend to have larger total fintech development.<sup>56</sup> In spite of these caveats, aspects of the Indian approach, not least the promotion of digital platform interoperability, would appear ripe for study, and possibly adaptation, by developing and advanced economies alike.

The unfinished agenda concerns cross-border payments. Recorded remittances today exceed foreign direct investment flows and official development assistance. Yet, the cost of these remittances – averaging some 7% – is prohibitive and falls on migrant workers who can afford it the least. In much the same way that the domestic payment system has been transformed in recent years in India, the official sector must lead the way to provide 24/7, cost-free, instant cross-border transactions that are settled in fiat money inside the formal financial system. In its absence, private schemes will flourish, together with the attendant financial and other security risks. Instead, as we have noted earlier, the solution lies in providing public digital infrastructure upon which the private sector would operate.

If jurisdictions were to adopt a UPI-like payment solution, it would not be so much of a technical challenge to set up instant cross-border payments schemes. The challenge would be to build international consensus over policy architecture for cross-border payments. Whatever the particulars of the adopted payment solution might be, the principles underlying the design of the domestic payments system in India remain relevant: the infrastructure should be open and interoperable, and the public sector should play the key role in creating a level playing field through platforms that are open to all (commercial banks and big techs) and settle in fiat money, inside the formal financial system. In this manner, citizens will enjoy inclusive development, remain in the system and be empowered by their own data.

<sup>56</sup> See Claessens et al (2018).

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